

## 2 . DIVISIONS & FACILITIES

## 2.1 DIVISION OF AGRONOMY AND HORTICULTURAL SCIENCE

The Division offers educational and research programs to study ecological, physiological characteristics of crops in harmony with environment, useful genetic variations and gene manipulation and also management of productive and sustainable arable ecosystems and quality control of agricultural products, focusing on establishment of the theory and technology for efficient and sustainable crop productions and improvement of crop quality. These programs are provided by nine laboratories; Crop Science, Plant Breeding, Vegetative and Ornamental Horticulture, Pomology, Weed Science, Plant Production Systems, Food Quality Design and Development, Quality Analysis and Assessment and Plant Production Control in cooperation with University Experimental Farm and Kii-Oshima Research Station of Field Science Education and Research Center.

Seventy three and thirty one graduate students, including twelve foreign graduate students, are enrolled in Master's and Doctor's Programs, respectively. Four postdoctoral fellows, three research students, and one special research student have also worked in the Division in 2008.

# Chair of Crop Science

## 2.1.1 Laboratory of Crop Science

*Staff*      *Professor*                      : Shiraiwa, Tatsuhiko, Dr. Agric. Sci.  
                 *Associate Professor*: Katsube-Tanaka, Tomoyuki, Dr. Agric. Sci.  
                 *Assistant Professor* : Homma, Koki, Dr. Agric. Sci.  
                 *Secretary*                         : Otaka, Toyoko

### *Students and research fellows*

*Doctor's Program*    : (3)  
*Master's Program*    : (7)  
*Undergraduate*       : (3)  
*Guest scholar*        : (1)  
*Special Research Student* : (1)  
*Research Student*    : (1)

## A. Research Activities (2008.4-2009.3)

### A-1. Main subjects

#### a) Mechanisms for high productivity of soybean and its adaptability to changing environments

The yield potential of soybean remains low and unstable as compared to the major cereal crops. This study aims at identification of major factors that limit yield potential of current genotypes and environmental factors that vary seed productivity in soybean. Field experiments demonstrated that a close and consistent correlation exists between seed yield and CGR during the initial seed filling stage across diverse genotypes. A remarkable difference in leaf photosynthetic ability was observed among cultivars and the mechanisms are being investigated. The phenomenon of “delayed stem senescence (DSS)” has broadly been observed in the soybean farms and reduces seed quality and even yield. Based on field experiments and field surveys, we found that the occurrence of delayed stem maturation may be promoted by unstable soil moisture condition especially during reproductive growth periods. The crop physiological mechanism for DSS are being established. In the soybean production area, a large field-to-field variability exists in the yield. The factors for this are being investigated with reference to moisture and fertility conditions. Also the methodology for evaluation of field condition also employing the remote sensing technique and the model for the water budget.

#### b) Identification, genotypic evaluation and simulation-modelling of major traits determining yield potential of rice under field conditions

Stagnation of yield potential of rice cultivars has been recognized since the Green Revolution. The objectives of this study are to identify the processes that limit rice yield potential under field conditions and to evaluate genotypes in the processes. So far, we have conducted field experiment using Rice Diversity Research Set of germplasm (RDRS) selected by NIAS and have reported several traits associated with yield potential. Analysis of genetic variability in leaf photosynthetic ability (Pn) and associated factors revealed that some local varieties were promising for breeding.

and that stomatal conductance and leaf nitrogen concentration was significantly different among genotypic groups which were classified by DNA markers. We also developed a rice crop simulator to interface gene functions to field performances based on the results in a multi-site experiment conducted under diverse environments in Asia. The processes of dry matter and spikelet production, and leaf area development have been modeled.

c) Quality improvement of rice seeds and analysis of mechanisms for high-temperature injury

Rice grain is one of the most important cereals since around half of the world's population consumes rice as a staple food. Rice seed is, however, deficient in the essential amino acid, lysine. Therefore, nutritional improvement in the amino acid composition of rice protein is needed especially for developing countries. We have focused on compositional change of the most major seed protein, glutelin by genotype- and/or environment/management- oriented improvement techniques. So far we demonstrated the possibility that the lysine content is increased by ~10% using glutelin mutants which are deficient in a subunit with less amount of lysine and that the composition is altered by adjustment of plant nitrogen and/or sulfur nutrition. Screening and analysis of wild rice species is also carried out to isolate novel superior glutelin gene. On the other hand, analysis on the quality loss of rice seeds caused by global warming, etc. has shown that some plant hormones and transcription factors are involved in the high-temperature injury, by using unique experimental system of detached ear culture.

d) Improving productivity and sustainability of rain-fed rice culture in the world

More than half of rice cropping lands in the world is still under rain-fed condition. We have conducted the field surveys on constraints of rice production in rain-fed paddy culture and upland culture in North-east Thailand, North Laos and Madagascar. The surveys in Thailand and Laos demonstrated that inappropriate land and soil managements have caused serious degradation of soil fertility and decline of productivity. In order to improve the productivity, introduction of legume manure crops during fallow seasons and return of clay-accumulated soil to the clay-eloded soil were the two major putative technologies. In North Laos, soil respiration and biomass production of plant community of cropped and fallow plots have been monitored at a shifting agriculture area to estimate CO<sub>2</sub> balance of the ecosystem. The survey in Madagascar revealed that application of organic materials with deep tillage is the key technology to improve rice productivity under insufficient resource input condition.

## A-2. Publications and presentations

a) Publications

***Books***

Homma, K., Horie, T. (2008) The present situation and the future improvement of fertilizer applications by farmers in rainfed rice culture in Northeast Thailand. In: L.R. Elsworth, W.O. Paley (Eds.) *Fertilizers: Properties, Applications and Effects*. Nova Science Publishers, N.Y. 147-180.

Shiraiwa, T. (2008) Constraints to crop growth. In H. Daimon (Ed.) *Introduction to Crop Science*. Asakura-Shoten, Tokyo. 64-74.

Shiraiwa, T. (2008) The past, present and future of crop yield. In Y. Yamasue (Ed.) *Agriculture in The 21st Century (1) Exploring Future Crop Production*. Kyoto University Press, Kyoto. 61-90.

***Original papers***

- Homma, K., Mochizuki, A., Watatsu, E., Horie, T., Shiraiwa, T., Supapoj, N., Thongthai, C. (2008) Relay-intercropping of *Stylosanthes guianensis* in rainfed lowland rice ecosystem in Northeast Thailand. *Plant Prod. Sci.* 11, 385-392.
- Homma, K., Mikoshiba, H., Mori, H., Okai, H., Shiraiwa, T., Sudo, K., Inamura, T. (2008) Analysis of production variability of soybean 'Tanbaguro'. I. Investigation of 'Tanbaguro' production in Oyugo village in Yakuno, Fukuchiyama in 2006. *J. Crop Res.* 53, 25-31.
- Homma, K. (2008) Present situation of wheat production for bread in Japan. *Japan. J. Agric. Educ.* 39, 25-32.
- Inoue, Y., Qi, J., Olioso, A., Kiyono, Y., Ochiai, Y., Saito, S., Asai, H., Horie, T., Shiraiwa, T., Dounagsavanh, L. (2008) Reflectance characteristics of major land surfaces in slash-and-burn ecosystems in Laos. *International Journal of Remote Sensing* 29: 2011-2019.
- Katsura, K., Maeda, S., Lubis, I., Horie, T., Cao, W., Shiraiwa, T. (2008) The high yield of irrigated rice in Yunnan, China -a cross-location analysis- *Field Crops Res.* 107, 1-11.
- Khan, N., Katsube-Tanaka, T., Iida, S., Yamaguchi, T., Nakano, J., Tsujimoto, H. (2008) Diversity of rice glutelin polypeptides in wild species assessed by the higher-temperature sodium dodecyl sulfate-polyacrylamide gel electrophoresis and subunit-specific antibodies. *Electrophoresis* 29: 1308-1316.
- Khan, N., Katsube-Tanaka, T., Iida, S., Yamaguchi, T., Nakano, J., Tsujimoto, H. (2008) Identification and variation of glutelin  $\alpha$  polypeptides in the genus *Oryza* assessed by two-dimensional electrophoresis and step-by-step immuno detection. *J. Agric. Food Chem.* 56, 4955-4961.
- Ohsumi, A., Hamasaki, A., Nakagawa, H., Homma, K., Horie, T., Shiraiwa, T., (2008) Response of leaf photosynthesis to vapour pressure difference in rice (*Oryza sativa* L.) varieties in relation to stomatal and leaf internal conductance. *Plant Prod. Sci* 11: 184-191.
- Saito, K., Linquist, B., Johnson, D.E., Phengchanh, S., Shiraiwa T., Horie, T. (2008) Planted legume fallows reduce weeds and increase soil N and P contents but not upland rice yields *Agroforestry Systems* 74, 63-72.
- Tanaka, Y., Shiraiwa, T., Nakajima, A., Sato, J., Nakazaki, T. (2008) Leaf gas exchange activity in soybean as related to leaf traits and stem growth habit. *Crop Sci.* 48, 1925-1932.
- Yoshida, H., Horie, T., Shiraiwa, T. (2008) A model for explaining genotypic and environmental variation in vegetative biomass growth in rice based on observed LAI and leaf nitrogen content. *Field Crops Res.* 108, 222-230.

### **Reports**

- Ishimaru, T., Sato, J., Kadowaki, M., Masumoto, C., Ikenaga, S. (2008) Report of the 4<sup>th</sup> mini-session by young members in the Crop Science Society of Japan. *Jpn. J. Crop Sci.* 77: 518.
- Sone, C., Ishioh, T., Ohsumi, A., Kano, M., Tsutsumi, K., Hayashi, S., Homma, K. (2008) Report of the 3<sup>rd</sup> mini-session by young members in the Crop Science Society of Japan. *Jpn. J. Crop Sci.* 77: 210.

Tanaka, T. (2008) Analysis on the chalky grains of rice using the detached ear culture method in long term period. Report to the Ministry of Education, Science, Sports and Culture for 2006-2007 Grant-in-Aid for Scientific Research (no. 18580013) pp1-58.

b) Conference and seminar papers presented

The 225th Ann. Meeting of Crop Sci. Soc. of Japan : 5 presentations

The 226th Ann. Meeting of Crop Sci. Soc. of Japan : 5 presentations

The 165<sup>th</sup> Ann. Meeting of the Society of Crop Science and Breeding in Kinki, Japan: 1 presentation

The 166<sup>th</sup> Ann. Meeting of the Society of Crop Science and Breeding in Kinki, Japan: 1 presentation

The 2008 Ann. Meeting of the Hokkaido Branch of the Japanese Society of Breeding and the Hokkaido Branch of the Crop Science Society of Japan: 1 presentation

The 2008 Ann. Kinki Branch Meeting of The Society of Agricultural Meteorology of Japan: 1 presentation

5th International Crop Science Congress & Exhibition, Jeju, Korea: 4 presentations

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Shiraiwa, T.: Crop Science Society of Japan (Councilor, Editorial board member of Japanese journal, Chair of reviewing committee, Member of symposium committee), The Society of Crop Science and Breeding in Kinki, Japan (Councilor)

Katsube-Tanaka, T.: Crop Science Society of Japan (Reviewing committee member, Regional editorial board member of Japanese journal)

Homma, K.: Crop Science Society of Japan (Member of strategy committee for young members, Member of strategy committee for men and women cooperative), The Society of Crop Science and Breeding in Kinki, Japan (Chairperson of symposium organizing committee)

#### ***Research grants***

Monbusho Research Grant: Scientific Research (B) Mechanisms for delayed stem senescence in soybean: evaluation of gene by environment interaction and identification of major genetic regions (Leader; Shiraiwa). Research Grant: Scientific Research (B) Contribution of environmental, genotypic and agronomic factors to increasing gap of soybean yield between Japan and USA (Leader; Shiraiwa), Scientific Research (C) Study on milky white rice kernel by long-term detached ear culture method (Leader; Katsube-Tanaka).

The Ministry of the Environment Grant: Development of Greenhouse-gas Sink/Source Control Technologies through Conservation and Efficient Management of Terrestrial Ecosystems -Intermediate and long-term strategies for the stabilization of atmospheric GHG concentration (Collaborator; Shiraiwa)

Agriculture, Forestry and Fisheries Research Council: Research Project for Utilizing Advanced Technologies for Agriculture, Forestry and Fisheries 'Production Technologies for Stable Production of "Black Soybean" in The Cropping System in Kinki Region.

Nara City: The Effect of Irrigating The Treated Wastewater on Rice Growth (Leader; Shiraiwa).

#### **A-4. International cooperations and overseas activities**

##### ***Membership in international academic societies***

Shiraiwa, T.: Plant Production (Editorial board member)

##### ***International joint researches, overseas research surveys***

Shiraiwa, T.: Contribution of environmental, genotypic and agronomic factors to increasing gap of soybean yield between Japan and USA (USA: University of Arkansas, University of Illinois)

Homma, K.: Study on the actual conditions and the high yielding factors of System of Rice Intensification (SRI) in Madagascar (Madagascar)

#### **B. Educational Activities (2008.4-2009.3)**

##### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Outline of Bioresource Science I (Shiraiwa), Crop Science I (Shiraiwa), Crop Science II (Shiraiwa, Tanaka), Laboratory Course in Biological and Environmental Science I, (Tanaka, Homma), Seminar in Crop Science (Shiraiwa)

Graduate level: Crop Production Ecology (Shiraiwa), Crop Science-Seminar (Shiraiwa, Tanaka), Special Laboratory Work in Crop Science (Shiraiwa, Tanaka)

##### **B-2. Off-campus teaching, etc.**

###### ***Part-time lecturer***

Shiraiwa, T.: Fukui Prefectural University (Crop Science)

Tanaka, T.: Gifu University (Crop Environmental Physiology)

###### ***Doctrinal thesis examiner***

###### ***Open seminar***

##### **B-3. Overseas teaching**

###### ***Students and research fellows from abroad***

Students from abroad: Master's Program Student 1 (Mozambique)

Special Research Student 1 (Pakistan)

#### **C. Other remarks**

Shiraiwa, T.: "Agriculture, Forestry and Fisheries Research Council" - Outsider's evaluation member for research grant, "Kyoto University"- Board member of university experimental farm, Member of advisory committee for Agriculture, Forestry and Fishery in Shiga Prefecture for coping with climate change.

## 2.1.2 Laboratory of Plant Breeding

*Staff*      *Professor*                      : Tanisaka, Takatoshi, Dr. Agric. Sci.  
                 *Associate Professor*: Okumoto, Yutaka, Dr. Agric. Sci.  
                 *Lecturer*                         : Nakazaki, Tetsuya, Dr. Agric. Sci. (~2008.9.30)  
                 *Assistant Professor* : Teraishi, Masayoshi, Dr. Agric. Sci. (2008.12.1-)  
                 *Assistant Professor* : Tsukiyama, Takuji, M. Agric. Sci.  
                 *Secretary*                        : Furushima, Kimiko

### *Students and research fellows*

*Postdoctoral fellow* : (1)  
*Doctor's Program*    : (9)  
*Research fellow*     : (1)  
*Master's Program*    : (12)  
*Undergraduate*       : (4)

## A. Research Activities (2008.4-2009.3)

### A-1. Main subjects

#### a) First discovery of an active transposon in rice

A mutant slender glume gene *slg* was induced with gamma-ray irradiation to seeds of the rice variety Gimbozu. But this slender glume gene occasionally reverts to its wild type allele *slg*<sup>+</sup>. We considered that such mutability of *slg* results from precise excision by a transposon inserted in it. As a result of analyzing the molecular structure of *slg*, we could demonstrate that a transposon *mPing* (belonging to one of the non-autonomous transposon family called MITEs) was inserted in the fourth exon of *slg*, the same gene as *Rurm1<sup>m</sup>* (*Rice ubiquitin related modifier-1*), and that reversion from *Rurm1<sup>m</sup>* to its wild type allele resulted from precise excision of the *mPing*. Thus we successfully identified an active rice transposon by analyzing the mutability of a slender mutation of glume. No active transposons have so far been reported in intact rice plants, and there have been no reports on active MITEs mobile both in intact higher plants and in animals. Mobile transposons used as gene tags in intact plants are powerful tools for function analysis because transposon insertions often inactivate genes. Therefore, this discovery is a milestone for function analysis of rice genes.

#### b) Genetic analysis of major agronomic characters in rice

A number of *japonica*- and *indica*-rice varieties and a large number of mutant lines induced and preserved in our laboratory were analyzed for genetic factors controlling important agronomic characters, such as heading time, plant height and resistance to blast. These genes were subjected to the RFLP or SSR analysis to determine their locations on chromosomes. Some of these genes were also examined for the effects on phenotypic expression including pleiotropy and gene-gene interaction, and evaluated for their agronomic values.

#### c) Molecular-genetic analysis of chitinase gene family in rice.

We had identified that there are twelve independent loci of chitinase gene (*Cht1* to *Cht12*) in rice genome. These genes were analyzed for the primary structure and function of enzyme protein in relation to disease - resistance after isolation and purification using *E. coli* expression system.

#### d) Analysis of genetic variation in wheat seed storage protein, glutenin.



Asian hexaploid wheat (*Triticum aestivum* L.) cultivars were investigated for the genotype of high molecular weight glutenin subunits (HMGS). HMGS is the most important factor determining the bread-baking quality and noodle quality. We are investigating the genetic diversity of HMGS among East Asian wheat cultivar to identify the valuable genotypes for the improvement of wheat quality in Japanese varieties. Then, we found the new HMGS in one variety which showed a specific dough quality comparing to other varieties. It is important to disclose effects of this new HMGS on the characteristics of dough and bread-baking quality.

e) Genetic analysis of major agronomic characters in soybean

A number of varieties and 96 recombinant inbred lines (RILs) derived from the F<sub>2</sub> population of 'Peking' and 'Tama-homare' which was developed in our laboratory were analyzed for genetic factors controlling major agronomic characters such as filling duration, stress resistance, seed quality. The genetic map consisting 342 SSR markers loci, three phenotypic gene loci (*I*, *T* and *W1* locus) was constructed using above RILs. Based on this map, we found several QTLs (Quantitative Trait Loci) for pre-germination flood tolerance and isoflavone accumulation in seeds (cotyledon).

## A-2. Publications and presentations

a) Publications

**Book**

Nakazaki, T., K. Naito, Y. Okumoto and T. Tanisaka: Active transposons in rice. In Rice Biology in Genomics Era. H.-Y. Hirano et al. (eds.) Springer-Verlag Berlin Heidelberg pp.69-79, 2008

**Original papers**

Fujita, M., M. Seki, H. Matsunaka, C. Kiribuchi-Otobe, A. Hiwatashi, J. Kitano, Y. Kanda, K. Miyamoto and Y. Okumoto: Relationship between yellow alkaline noodle quality and flour properties in hard wheat varieties in the central region of Japan. Jpn. J.Crop Sci. 77;449-456, 2008

Xayphakatsa, K., T. Tsukiyama, K. Inouye, Y. Okumoto, T. Nakazaki and T. Tanisaka: Gene cloning, expression, purification and characterization of rice (*Oryza sativa* L.) class II chitinase CHT11. Enzyme and Microbial Technology 43; 19–24, 2008

Ochiai, K., S. Uemura, A. Shimizu, Y. Okumoto, T. Matoh: Boron toxicity in rice (*Oryza sativa* L.). I. Quantitative trait locus (QTL) analysis of tolerance to boron toxicity. Theor Appl Genet 117;125–133, 2008

Oki, N., K. Yano, Y. Okumoto, T. Tsukiyama, M. Teraishi, and T. Tanisaka: A genome-wide view of miniature inverted-repeat transposable elements (MITEs) in rice, *Oryza sativa* ssp.japonica. Genes Genet. Syst. 83;311-329,2008

Tsukiyama, T., K. Xayphakatsa, Y. Okumoto, D. Kageyama, T. Nakazaki, C. Tanaka, T. Nakazaki, M. Teraishi, and T. Tanisaka: Analysis of rice blast-induced expression of PR-3 chitinase genes and their signal pathway in rice (*Oryza sativa* L.). J.Crop Res. 53;55-60, 2008

Tanaka Y., T. Shiraiwa, A. Nakajima, J. Sato, and T. Nakazaki; Leaf Gas Exchange Activity in Soybean as Related to Leaf Traits and Stem Growth Habit Crop Sci. 48;1925–1932, 2008

Hirota, N., T. Yoshikawa, T. Nakazaki, T. Sayama, T. Tsukiyama, Y. Okumoto, M. Teraishi, K.

Hirata, and T. Tanisaka: Seed-flooding tolerance genes of the yellow seed coat soybean variety 'Enrei'. J.Crop Res. 53;61-66, 2008

Sayama, T., T. Nakazaki, G. Ishikawa, K. Yagasaki, N. Yamada, N. Hirota, K. Hirata, T. Yoshikawa, H. Saito, M. Teraishi, Y. Okumoto, T. Tsukiyama, T. Tanisaka: QTL analysis of seed-flooding tolerance in soybean (*Glycine max* [L.] Merr.) Plant Science 176 ;514–521, 2009 (On line)

Monden Y., K. Naito, Y. Okumoto, H. Saito, N. Oki, T. Tsukiyama, O. Ideta, T. Nakazaki, S.R. Wessler, and T. Tanisaka: High Potential of a Transposon *mPing* as a Marker System in *japonica* × *japonica* Cross in Rice. DNA RESEARCH 16;131–140, 2009 (On line)

b) Conference and seminar papers presented

Congress of Japanese Society of Breeding: 12 presentations

Congress of the Society of Crop Science and Breeding in Kinki: 11 presentation

Workshop on Rice Genetics and Molecular Biology: 3 presentations

### **A-3. Off-campus activities**

#### ***Roles in academic societies***

Tanisaka, T.: Association of Japanese Agricultural Scientific Societies (Council member), The Society for the Advancement of Breeding Researches in Asia Oceania (Board member), The Society of Crop Science and Breeding in Kinki (Council member)

Okumoto, Y.: Japanese Society of Breeding (Accounting auditor), The Society of Crop Science and Breeding in Kinki (Council member)

Tsukiyama, T.: Japanese Society of Breeding (Council member), The Society of Crop Science and Breeding in Kinki (Council member)

Teraishi, M.: Japanese Society of Breeding (Council member),

#### ***Membership in Science Council of Japan, etc.***

Tanisaka, T.: Member of the Committee of Gamma-Field-Symposia (Institute of Radiation Breeding, The Ministry of Agriculture, Forestry and Fisheries)

#### ***Research grants***

Independent Administrative Institute (National Institute of Agrobiological Sciences): Genetic and molecular dissection of quantitative traits in rice (Tanisaka)

Independent Administrative Institute (National Agriculture and Food Research Organization): Construction of linkage-map, physical-map and genome sequence dataset of soybean genome "Identification of soybean seed-flooding tolerance gene" (Tanisaka)

The Wakayama Prefecture Collaboration of Regional Entities for the Advancement of Technological Excellence: Development of the Technologies of Analyzing Gene Expression Information by Utilizing Genomic Information (Tanisaka)

Momofuku International Co. Ltd.: Collaboration "Exploitation of high-yielding production techniques in soybean" (Tanisaka)

Fujikko Co. Ltd.: Collaboration "Breeding of soybean varieties with high quality" (Tanisaka)

Fuji Foundation for protein research (Tanisaka)

### **A-4. International cooperations and overseas activities**

#### ***International joint researches, oversea research surveys***

Functional analysis for a erect panicle gene in rice (China, Shenyang Agriculture University)  
Exploitation of the resistance genes for leaf-blast diseases in rice (China, South China Agricultural University)  
Studies on improvement of fatty acid composition in oil crops (Germany, Justus-Leibig University)  
Exploitation of genetic factors contributing to the mobilization of *mPing* in rice (U.S.A., The University of Georgia)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Plant Breeding I, II (Tanisaka), Basic Bioresource Science II (Tanisaka), Outline of Bioresource Science I (Tanisaka), Biometrics (Okumoto), Introduction to Foreign Literature in Bioresource Science I (Nakazaki), Seminar in Crop Science (Tanisaka), Laboratory in Bioresource Science I (Tanisaka, Okumoto, Nakazaki, Tsukiyama), Introduction to Research (Tanisaka, Okumoto, Nakazaki, Tsukiyama), Food Safety II (Tanisaka)  
Graduate level: Progress in Mutation Breeding (Tanisaka), Plant Breeding Seminar (Tanisaka), Special Laboratory Work in Plant Breeding (Tanisaka, Okumoto, Nakazaki, Tsukiyama)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Tanisaka, T.: Takii College of Horticulture (Plant Breeding),  
Okumoto, Y.: School of Environmental Science, The University of Shiga Prefecture (Biometrics)  
Nakazaki, T.: Faculty of Engineering, Kyoto Sangyo University (Fundamentals of Biological Experiments I, Fundamentals of Biological Experiments II)

### **B-3. Overseas teaching**

#### ***Students and research fellows from abroad***

Graduate course: 1 student (Bangladesh)

Doctor course: 6 students ( Egypt 1, Buhtan 1, Nepal 1, China 2, Bangladesh 1)

## **C. Other remarks**

Tanisaka, T.: Japanese Society of Breeding Awards 2008, “The Ministry of Education, Science and Culture”, Member of textbook authorization committee, Member of fact-finding committee for crop breeding. Committee member of National bio-resources project (Chairman of rice subdivision committee), Member of the Gamma-field symposium committee, Member of authorization committee for NARO (National agriculture and food research organization)

# Chair of Horticultural Science

## 2.1.3 Laboratory of Vegetable and Ornamental Horticulture

*Staff      Professor                      : Yazawa, Susumu, Dr. Agric.Sci.*  
*Associate Professor: Hayashi, Takahiro, Dr. Agric.Sci.*  
*Assistant Professor : Mizuta, Youichi, Dr. Agric.Sci.*  
*Assistant Professor : Hosokawa, Munetaka, Dr. Agric.Sci.*

*Students and research fellows*

*Doctor's Program : (3)*

*Master's Program : (8)*

*Undergraduate     : (4)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

- a) Formation of novel capsaicinoid-like substances (CLSs) in chilli fruit

CLSs contained in a fruit of 'CH-19 Sweet' are identified as 4-hydroxy-3-methoxybenzyl (E)-8-methyl-6-nonenoate (capsiate) and 6,7-dihydro derivative of capsiate. These substances have no pungent for human. Now we conduct the experiment on formation of these substances in a fruit of 'CH-19 Sweet' and production of the fruit in grower's fields.

- b) Isolation and transplant culture of undifferentiated shoot apical meristems by micro surgery

Tissue culture is a useful technique for producing virus-free plants. Viroid may be hardly removed by the ordinary tissue culture methods using shoot tips with one or two leaf primordia. Shoot apical meristem without leaf primordia is suitable for an explant to remove viroid which exist even in the young leaf primordia just after differentiation but difficult to be cultured without nurse culture. We are developing an exclusive device for picking up shoot apical meristems and the nurse culture system by transferring them to cultured roots.

- c) Clarification of anthocyanin biosynthesis mechanism regulated by phosphorus in petals

Phosphorus deficiency in fertilizer or nutrient solution causes the decrease of anthocyanin biosynthesis and consequently makes red petals turn white in some petunia cultivars. We are trying to clarify the mechanism how phosphorus regulates the anthocyanin biosynthesis in petunia.

- d) Color appearance in flower petals

We are trying to clarify the mechanism generating diverse colors depended on the pigments and spectral characteristics of flower petals by spectrophotometry. By analyzing the spectral reflectance from a flower petal irradiated with a tungsten halogen lamp, it can be revealed how the petal color is determined by the pigments, the cell inclusions such as starch grains and structure of the petal which decide spectral characteristics. Informations about the relationship between the petal color and the petal structure e.g., the shape of epidermal cells will be useful for flower color breeding.

- e) Development of new plant production system

(1) We developed new tissue culture method of the plant without using the sterility equipment by adding chlorine to the medium with sterile containers. And the enlargement method and the liquid culture method are being developed now. (2) We developed sucrose supplying method to plant by microbe-static conditions established by phosphate elimination using aluminum hydroxide and root split. By sucrose supply, potted plants had more flower and ornamental leaves while suppressing increase of the microorganism for about three months. (3) We facilitated the transplant and the control of the rhizosphere by making rhizosphere plane. (4) We are developing the system that consistently does the tissue culture, the raising seedling, and the harvest by combining these three methods.

## A-2. Publications and presentations

### a) Publications

#### *Original papers*

- Kobata, K., H. Tate, Y. Iwasaki, Y. Tanaka, K. Ohtsu, S. Yazawa and T. Watanabe. Isolation of coniferyl esters from *Capsicum baccatum* L., and their enzymatic preparation and agonist activity for TRPV1. *Phytochem.* 69; 1179-1184, 2008
- Fudano, T. and T. Hayashi. Differences of inflorescence architecture among varieties of *Gypsophila paniculata* L.. *Bulletin Exp. Farm, Kyoto University* 17; 1-5, 2008
- Nishikawa, K., H. Ito, T. Awano, M. Hosokawa and S. Yazawa: Characteristic thickened cell walls of the bracts of the 'eternal flower' *Helichrysum bracteatum*. *Ann.Bot.* 102; 31-37, 2008
- Hosokawa, M. Leaf primordia-free shoot apical meristem culture: A new method for production of viroid-free plants. *J. Japan. Soc. Hort. Sci.* 77; 341-349. 2008
- Kitamura, Y., M. Hosokawa, C. Tanaka and S. Yazawa. Identification and sterilization of epiphytic bacteria flora near hydrangea shoot apical meristems. *J. Japan. Soc. Hort. Sci.* 77; 418-425. 2008
- Tanaka, Y., K. Ohtsu, T. Nakamura, M. Hosokawa, K. Yamaguchi, K. Kanazawa and S. Yazawa. Inhibitors of nitric oxide radical (NO) generation in young pepper plants as a newly developed leafy vegetables. *Hort. Res.* 7; 491-497, 2008

### b) Conference and seminar papers presented

2007 Spring Meeting of the Japanese Society for Horticultural Science (5 presentations)  
 2007 Autumn Meeting of the Japanese Society for Horticultural Science (6 presentations)  
 The First Asian Horticultural Congress, Jeju, Korea (2 presentations)

## A-3. Off-campus activities

#### *Membership in academic societies (roles)*

Yazawa, S.: The Japanese Society for Horticultural Science, International Society for Horticultural Science  
 Hayashi, T.: The Japanese Society for Horticultural Science  
 Mizuta, Y.: The Japanese Society for Horticultural Science  
 Hosokawa, M.: The Japanese Society for Horticultural Science

#### *Research grants*

Monbusho Research Grant: Scientific Research (B) Screening of functional sequences in viroid

(Leader; Hosokawa), Japan-Korea Joint Research Project Molecular study for the dramatic growth changes of *capsicum* plants near 25°C (Leader; Hosokawa)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### a) Courses given

Undergraduate level: Ornamental Horticulture (Yazawa, Hayashi), Vegetable Science (Yazawa), Seminar in Horticultural Science (Yazawa), Laboratory in Bioresource Science I, II (Hayashi, Mizuta, Hosokawa)

Graduate level: Vegetable and Ornamental Horticulture (Advanced course) (Yazawa), Vegetable and Ornamental Horticulture-Seminar (Yazawa), Special Laboratory Work in Vegetable and Ornamental Horticulture (Yazawa, Hayashi), Environmental Control for Horticultural Production (Hayashi)

### **B-2. Off-campus teaching**

#### *Part-time lecturer*

Hayashi, T.: Faculty of Bioresources, Mie University (Special lecture on floriculture)

### **B-3. Overseas teaching**

#### *Students and research fellows from abroad*

## **C. Other remarks**

Yazawa, S.: Member of a selection committee of the science and technology foundation of Japan, Japan prize, Expert committee of the Ministry of Agriculture, Forestry and Fishery. 21th member of Science Council of Japan, Chairman of the awards committee of K. Matsushita foundation of EXPO '90

## 2.1.4 Laboratory of Pomology

*Staff Professor : Yonemori, Keizo, Dr. Agric. Sci.*  
*Associate Professor: Tao, Ryutaro, Dr. Agric. Sci..*  
*Assistant Professor : Yamane, Hisayo, Dr. Agric. Sci.*

*Students and research fellows*

*Research fellow : (2)*

*Doctor's Program: (4)*

*Master's Program: (9)*

*Undergraduate : (4)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

- a) Molecular markers for selecting pollination-constant and non-astringent (PCNA) type persimmon in breeding populations

The PCNA-type fruit is the most desirable persimmon for fresh consumption. The breeding program is going on to obtain new promising PCNA cultivars. However, the trait of natural loss of astringency in PCNA-type is qualitatively inherited and the PCNA-type is recessive to the other three non-PCNA types (PVNA, PVA, and PCA). Thus, F<sub>1</sub> offspring of the PCNA- x non-PCNA-type must be backcrossed to the PCNA type to obtain diverse PCNA offspring. This backcross yields PCNA offspring at a low rate. We are now seeking the molecular makers for selecting PCNA offspring in the breeding populations at an early seedling stage using leaf DNA, in order to make greater efficiency for persimmon breeding program, and are examining two promising RFLP markers found from breeding populations.

- b) Molecular basis of gametophytic self-incompatibility in *Prunus*

Many fruit tree species in *Prunus* exhibit the monofactorial gametophytic self-incompatibility. As they are unable to bear fruits parthenocarpically, fertilization is a very important factor in fruit production in self-incompatible fruit species in *Prunus*. We attempt to elucidate the physiological and molecular mechanisms of gametophytic self-incompatibility of four fruit tree species of *Prunus*: almond, Japanese apricot, Japanese plum, and sweet cherry. We have identified both the pistil determinant (S-RNase gene) and the pollen determinant (S haplotype-specific F-box protein gene) of the self-incompatibility reaction. We are now on the way to elucidate the molecular basis of the self and nonself recognition system in *Prunus*.

- c) Tissue culture for propagation and breeding of Japanese persimmon

Breeding of Japanese persimmon has been hindered by the long juvenile period, large plant size, and polyploidy. Furthermore, breeding of clonal rootstocks is virtually impossible because of rooting difficulties in this species. We attempt to overcome these problems by using tissue culture techniques. So far, efficient systems have been developed for plant regeneration from shoot tip, anther, endosperm, callus, and protoplast cultures. Further development of tissue culture systems for producing somatic hybrids and genetic transformation is now under way.

- d) Phylogenetic and reproductive studies on the genus *Diospyros* and some tropical fruits

Persimmon is a member of the genus *Diospyros* which includes more than 400 species. Many of them exist in tropical and subtropical regions, and a few of them, including persimmon

(*Diospyros kaki*), are distributed in temperate regions. We are now attempting to survey and collect *Diospyros* species distributed in tropical regions with the cooperation of researchers in Thailand. Phylogenetic studies are going on by the analyses of a specific region of cpDNA and genomic hybridization of the chromosomes. Apomixis in the genus *Diospyros* is also investigated. In addition, the phylogenetic study is being done to the genus *Mangifera* and some tropical fruit genera, with the cooperation of researchers in Thailand, Malaysia, and Indonesia. The study on reproduction in tropical fruit is also planned under the cooperation of these researchers.

e) Dormancy in temperate fruit tree

Bud dormancy in deciduous fruit tree species is a complex process necessary for plant survival in the unfavorable environment. Once formed in summer, buds enter an endodormant state and require a certain amount of cold temperatures to resume growth in a favorable environment. Recent global warming potentially causes serious problems such as irregular or loss of flowering. Recently, we have found a MADS-box transcription factor that is putatively related to endodormancy induction and endodormancy release. We are now conducting functional study to characterize the MADS-box transcription factor toward the ultimate goal to understand the internal genetic factors controlling endodormancy of deciduous fruit tree species.

## A-2. Publications and presentations

a) Publications

**Original papers**

- Esumi, T., R. Tao, and K. Yonemori. Expression analysis of the *LFY* and *TFL1* homologs in floral buds of Japanese pear (*Pyrus pyrifolia* Nakai) and quince (*Cydonia oblonga* Mill.). J. Japan. Soc. Hort. Sci. 77; 128-136, 2008
- Habu, T., D. Matsumoto, K. Fukuta, T. Esumi, R. Tao, H. Yaegaki, M. Yamaguchi, M. Matsuda, T. Konishi, A. Kitajima, and T. Yamada. Cloning and characterization of twelve *S-RNase* alleles in Japanese apricot (*Prunus mume* Sieb. et Zucc.). J. Japan. Soc. Hort. Sci. 77; 374-381, 2008
- Matsumoto, D., H. Yamane, and R. Tao. Characterization of *SLFL1*, a pollen-expressed F-box gene located in the *Prunus S* locus. Sex. Plant Repr. 21; 113-121, 2008
- Sugiura, A., Y. Matsuda-Habu, M. Gao, T. Esumi, and R. Tao. Somatic embryogenesis and plant regeneration from immature persimmon (*Diospyros kaki* Thunb.) embryos. HortScience 43; 211-214, 2008
- Tsukamoto, T., D. Potter, R. Tao, C.P. Viera, J. Viera, A.F. Iezzoni. Genetic and molecular characterization of three novel *S*-haplotypes in sour cherry (*Prunus cerasus* L.). J. Exp. Bot. 59; 3169-3185, 2008
- Tsukamoto, T., R. Tao, and A.F. Iezzoni. PCR markers for mutated *S*-haplotypes enable discrimination between self-incompatible and self-compatible sour cherry selections. Mol. Breed. 21; 67-80, 2008
- Viera, J., N. A. Fonseca, R. A. M. Santos, T. Habu, R. Tao and C. P. Viera. The number, age, sharing and relatedness of *S*-locus specificities in *Prunus*. Genet. Res., Camb. 90; 17-26, 2008
- Viera, J., R.A. Santos, T. Habu, R. Tao, and C.P. Viera. The *Prunus* self-incompatibility locus (*S* locus) is seldom rearranged. J. Hered. 99; 657-660, 2008
- Yamane, H., M. Ichiki, R. Tao, T. Esumi, K. Yonemori, T. Niikawa, and H. Motosugi. Growth



characteristics of a small-fruit dwarf mutant arising from bud sport mutation in Japanese persimmon (*Diospyros kaki* Thunb.). HortScience 43; 1726-1730, 2008

Yamane, H., Y. Kashiwa, T. Ooka, R. Tao, and K. Yonemori. Suppression subtractive hybridization and differential screening reveals endodormancy-associated expression of an *SVP/AGL24*-type MADS-box gene in lateral vegetative buds of Japanese apricot. J. Amer. Soc. Hort. Sci. 133; 708-716, 2008

### ***Reviews***

### ***Books***

Tetsumura, T., E. Giordani, and R. Tao (2008) Persimmon (Kaki), p. 235-258. In: C. Kole and T. C. Hall (eds.). Compendium of Transgenic Crop Plants: Transgenic Tropical and Subtropical Fruits and Nuts. Blackwell Publishing, Oxford.

b) Conference and seminar papers presented

Spring meeting of the Japanese Society for Horticultural Science: 5 presentations

Autumn meeting of the Japanese Society for Horticultural Science: 6 presentations

The Fourth International Symposium on Persimmon: 5 presentations

## **A-3. Off-campus activities**

### ***Membership in academic societies (roles)***

Yonemori, K: Japanese Society for Horticultural Science (President, Board member),  
International Society for Horticultural Science (Board member)

Tao, R: International Society for Horticultural Science (Board member),

### ***Research grants***

Monbusho Research Grant: Scientific Research (B) Exploring the genes linked to tannin accumulation in persimmon and its utilization for analysis of genome composition and breeding (Leader; Yonemori), Scientific Research (B) Exploration of the original wild species of the cultivated *Diospyros kaki* (Leader; Yonemori), Scientific Research (A) Molecular basis of the S-RNase-based gametophytic self-incompatibility system in *Prunus* (Leader; Tao), Grant-in-aid for young scientist (B) Identification and characterization of chilling-responsive transcription factor in endodormant buds of temperate fruit tree species (Leader; Yamane)

## **A-4. International cooperation and overseas activities**

### ***International meetings (roles)***

Tao, R.: The Fourth International Symposium on Persimmon (Scientific Committee)

### ***International joint researches, overseas research surveys***

Yonemori, K.: Reproductive biology in tropical fruit trees (Thailand)

Yonemori, K.: Studies on the origin and development of European persimmon cultivars (Italy)

Yonemori, K.: Studies on a PCNA cultivar of Chinese origin (China)

Yonemori, K.: Studies on persimmon tannins (USA)

Tao, R.: Improvement of fruit trees through genetic transformation (USA)

Tao, R.: Molecular basis of gametophytic self-incompatibility of *Prunus* species (USA, Thailand, Spain)

Yamane, H.: Proteomics of the extracellular proteins of pistil (USA)

Yamane, H: Survey of low-chill deciduous fruit tree species adapted to subtropical regions (Thailand)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### a) Courses given

Undergraduate level: Pomology I (Yonemori), Pomology II (Yonemori, Tao), Seminar in Horticultural Science (Yonemori, Tao, Yamane), Laboratory Course in Bioresource Science I, II (Tao, Yamane), Fundamentals for the Laboratory Course in Bioresource Science (Tao, Yamane)

Graduate level: Pomology Seminar (Yonemori, Tao, Yamane), Plant Propagation in Horticulture (Tao), Special Laboratory Work in Pomology (Yonemori, Tao, Yamane)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Yonemori, K.: Fukui Prefectural Univ. (Special lecture for undergraduate students)

# Chair of Agricultural Ecology

## 2.1.5 Laboratory of Weed Science

Staff      Professor                    : Tominaga, Tohru, Dr. Agric. Sci.  
              Lecturer                     : Miura, Reiichi, Dr. Agric. Sci.  
              Lecturer                     : Wang, Guang-Xi, Dr. Agric. Sci.

Students and research fellows

Doctor's program : (4)              Master's program : (5)  
Research student : (1)              Undergraduate : (4)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Molecular and ecological analyses of herbicide resistance of paddy weeds

Repeated field applications of acetolactate synthase (ALS)-inhibiting herbicides have resulted in selection of resistant biotypes of more than 90 weed species throughout the world. Objective of this research is to analyze mechanisms of the ALS resistance with molecular and ecological techniques by using three paddy species: *Monochoria korsakowii*, *M. vaginalis* and *Limnophila sessiliflora*. In this research, we found that (1) in Japan, some populations originated from a preexisting and preadapted mutant *M. vaginalis* and showed lower genetic variation, whereas other populations showed higher genetic variation, and the resistance gene can be dispersed by outcrossing; (2) the resistant biotypes had naturally mutated ALS genes resulting a substitution of Pro (in susceptible biotypes) for other amino acid (in resistant biotypes) in Domain A of ALS, and (3) the experiment on inheritance of ALS-inhibiting resistance is in progress.

##### b) Discovery of single-nucleotide mutations in ALS genes by Self-EcoTILLING

Target site insensitivity is the most commonly reported mechanism of herbicide resistance. Target site resistance involving a single-nucleotide change and usually dominant gene is easily selected. In addition, target site changes often provide high levels of resistance. A number of techniques for identifying single-nucleotide mutations have been developed but all have their limitations and are relatively expensive and laborious when applied to multiple loci in large numbers of individuals. In this research, we developed a new method named Self-EcoTILLING for rapid detection of single-nucleotide mutations in ALS genes with the cooperation of Iwate Agricultural Research Center.

##### c) Ecological genetics of the crop-weed complex of pearl millet

Pearl millet fields of West Africa are almost invariably infested with a large number of weedy pearl millet plants that have shattering ears. We have revealed that the crop and weed types are actually in a state of balanced genetic polymorphism, and that the "weed" type is a heterozygote arising from sown crop seed. To resolve the function of the responsible gene(s), we are constructing a high-resolution linkage map of the target gene region using AFLP-based markers.

##### d) Determinants of the weed vegetation of urban lawn areas

To find a condition that permits lawn grass dominance against weeds under low-input

management, spatial variation of soil physicochemical factors and weed vegetation were analyzed. This approach is revealing different succession pathways (sere) of weed community in response to soil conditions.

## A-2. Publications and presentations

### a) Publications

#### *Original papers*

- Miura, R.: What is a weed? Senri Ethnological Reports 84: 35-50, 2009 (in Japanese)
- Tanaka, S., R. Miura and T. Tominaga: Relationship between weed vegetation and soil properties in public lawns in Kyoto City. Journal of Weed Science and Technology 54 (1): 7-16, 2009 (in Japanese)
- Ao, M., M. Ito, K. Ito, J. F. Yun, R. Miura and T. Tominaga: Floristic compositions of Inner Mongolian grasslands under different land-use conditions. Grassland Science 54 (4): 173-178, 2008
- Imaizumi, T., G.-X. Wang and T. Tominaga: Pollination of chasmogamous flowers and effects of light and emergence time on chasmogamy and cleistogamy in *Monochoria vaginalis*. Weed Biology and Management 8 (4): 260-266, 2008
- Inagaki, H., T. Imaizumi, G.-X. Wang and T. Tominaga: Distribution of sulfonylurea-resistant biotypes of *Monochoria vaginalis* in Shizuoka Prefecture, Japan. Journal of Weed Science and Technology 53 (3): 123-127, 2008 (in Japanese)
- Imaizumi, T., G.-X. Wang and T. Tominaga: Inheritance of sulfonylurea resistance in *Monochoria vaginalis*. Weed Research 48 (5): 448-454, 2008
- Wang, G.-X., T. Imaizumi, W. Li, H. Saitoh, R. Terauchi, T. Ohsako and T. Tominaga: Self-EcoTILLING to identify single-nucleotide mutations in multigene family. Pesticide Biochemistry and Physiology 92 (1): 24-29, 2008
- Niwa, K., H. Suzuki, T. Tominaga, S. Nasim, R. Anwar, M. Ogawa and Y. Furuta: Evaluation of genetic variation in high molecular weight glutenin subunits of seed storage protein using landraces of common wheat from Pakistan. Cereal Research Communications 36(2): 327-332, 2008
- Imaizumi, T., G.-X. Wang, T. Ohsako and T. Tominaga: Genetic diversity of sulfonylurea-resistant and -susceptible *Monochoria vaginalis* populations in Japan. Weed Research 48 (2): 187-196, 2008

#### *Reviews*

Tominaga, T.: Crop mimicry in weeds. Biophilia 4: 22-26, 2008 (in Japanese)

#### *Others*

- Tominaga, T.: Weed resistance to acetyl coenzyme A carboxylase inhibitors: an update, Journal of Weed Science and Technology. 53 (2): 84-86, 2008 (in Japanese)
- Tominaga, T.: Isoenzyme diversity in *Reynoutria* (Polygonaceae) taxa: escape from sterility by hybridization, Journal of Weed Science and Technology. 54 (1): 42-43, 2009 (in Japanese)

### b) Conference and seminar papers presented

- The Annual Meeting of the Weed Science Society of Japan: 7 presentations
- The 2008 Spring Meeting of the Turf Grass Science Society of Japan: 1 presentation
- The 115<sup>th</sup> Annual Meeting of the Japanese Society of Breeding: 1 presentation

The 105<sup>th</sup> Annual Meeting of the Japanese Society for Tropical Agriculture: 1 presentation

The 4<sup>th</sup> Pan Pacific Conference on Pesticide Science: 1 presentation

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

Tominaga, T.: Weed Science Society of Japan (Councilor, Editor-in-Chief of WEED BIOLOGY and MANAGEMENT)

Miura, R.: Weed Science Society of Japan (Editorial Board Member, International Exchange Committee member)

Wang, G.-X.: Weed Science Society of Japan (Editorial Board Member, Terminology Committee Member)

#### ***Research grants***

JSPS Research Grant: Grant-in-Aid for Scientific Research (B) Field surveys of herbicide-resistant weeds introduced from America (Tominaga)

JSPS Research Grant: Grant-in-Aid for Scientific Research (C) Evolution, diversification and maintenance of the weediness supergene in pearl millet (Miura)

The Sumitomo Foundation: Studies on the distribution expansion by hybridization between alien weeds of *Lolium*, Poaceae (Tominaga)

### **A-4. International cooperations and overseas activities**

#### ***International meetings (roles)***

Tominaga, T.: The 4<sup>th</sup> Pan Pacific Conference on Pesticide Science, Honolulu, USA (Invited lecturer)

#### ***International joint researches, overseas research surveys***

Tominaga, T.: Genecological study on the relationships among man, crop and weed in agro-ecosystems (National Plant Gene Bank, Iran and Cukuroba University, Turkey)

Tominaga, T.: Occurrences of herbicide-resistant weeds in upland fields and its control (Michigan State University, USA)

Miura, R.: Vulnerability and Resilience of Social-Ecological Systems (RIHN, Japan / Zambia Agriculture Research Institute, Zambia), Environmental Change and the Indus Civilization (RIHN, Japan / Institute of Rajasthan Studies, India)

Wang, G.-X.: Ecological studies on aquatic plants and the management (Wuhan Institute of Botany, the Chinese Academy of Sciences, China)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Weed Science I (Tominaga), Weed Science II (Tominaga, Miura), Laboratory Course for Bioresource Science (Tominaga, Miura, Wang), Seminar (Tominaga, Miura, Wang), Introduction to Research (Tominaga, Miura, Wang), Outline of Bioresource Science I (Tominaga), Nature and Culture (Miura)

Graduate level: Seminar (Tominaga, Miura, Wang), Special Laboratory Work in Weed Science (Tominaga, Miura, Wang), Thesis (Tominaga, Miura, Wang), Environmental Adaptation of Weeds (Miura)

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Tominaga, T.: Kinki University (Special Lecture on Weed Science)

Tominaga, T.: Tokyo University of Agriculture (Special Lecture)

### ***Open seminar***

Tominaga, T.: Kyoto Gardening Club (Lecturer)

Tominaga, T.: Senior Nature College (Lecturer)

Tominaga, T.: Global Environment “Natural Science” (Lecturer)

Wang, G.-X.: Uzura Public hall in Fukui Prefecture “The conservation of a threatened plant,  
*Monochoria korsakowii* in Fukui Prefecture” (Lecturer)

## **B-3. Overseas teaching**

### ***Students and research fellows from abroad***

Graduate student: 1 (China)

## **C. Other remarks**

Tominaga, T.: Research Institute for Humanity and Nature (Project member), Kyoto University  
(Person in charge of alumni association), Specialty Committee for the Fundamental  
Education, Institute for the Promotion of Excellence in Higher Education, Kyoto  
University (Member of biological team), Kyoto University (Member of student life  
committee; Member of construction committee; Board member of experimental farm)

Miura, R.: Research Institute for Humanity and Nature (Project member)

Wang, G.-X.: Wuhan Institute of Botany, Chinese Academy of Science (Guest Professor)

## 2.1.6 Laboratory of Plant Production Systems

*Staff      Professor                      : Inamura, Tatsuya, Dr. Agric. Sci.*

*Assistant Professor : Inoue, Hiromo, Dr. Agric. Sci*

*Students and research fellows*

*Doctor's program    : (1)*

*Masters program    : (10)*

*Undergraduate       : (4)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

a) Evaluation of the land productivity for the clarification of the optimal land utilization and cropping systems.

1) Evaluation of site-specific management zones in a farm with multiple-cropping system

The identification of homogeneous management zones (MZs) within a farm is a basis for site-specific management (SSM). We assessed the method of defining MZs based on the spatio-temporal homogeneity of six soil properties and above-ground biomass data from paddy rice, winter wheat and soybean over 3 years on a farm with 124 contiguous small paddy fields. A non-hierarchical cluster analysis was applied to the soil data and the algorithm grouped the sites into three clusters with similar soil properties. These clusters represent soil fertility and soil drainage. The three clusters were not randomly distributed across the fields, but formed contiguous areas associated with landscape position. This was due to the spatial variation of the soil properties in the study area. We delineated five MZs based on the spatial structure of the soil homogeneity of the study area. The validity of the MZs was evaluated using the three years' biomass data from paddy rice, winter wheat and soybean in each MZ. The biomass of three crops mainly depended on soil fertility when weather conditions of crop growth period were normal. When the growing season precipitation was greater than the 10-year average, the biomass of winter wheat and soybean depended on soil drainage. This suggested that the delineation of MZs for site-specific management in fields under a paddy-upland crop rotation system should be based on several soil properties which represent soil fertility and soil drainage.

2) Manipulating clod size distribution based on soil moisture at seeding provides an opportunity for maintaining tiller density

The moisture condition of paddy soil after rice cropping is major impediments to the establishment, tillering and yield of winter wheat in rice-wheat (R-W) cropping system. Optimizing seedling establishment ratio, based on soil moisture at seeding, may provide an opportunity for maintaining the number of establishment and tiller density of winter wheat in such moisture conditions, and resulting in high yield. Field experiment was conducted in the farmer's fields with R-W cropping system in Western Japan. We use the path analysis to investigate the relationship between tiller density and nine soil/plant traits with the aim of evaluating strategy for improving tiller density by changing seedling establishment ratio. The clod size of surface soil, which showed significant positive correlation with soil moisture at seeding, had a significant negative direct effect on the seedling establishment ratio. The reduction in seedling establishment ratio, together with fewer tillers per plant, resulted in significant

decrease in tiller density. The sum total of contribution of soil moisture contents to tiller density via clod size was smaller than that of seeding rate, and similar to that of amount of nitrogen (N) basal dressing. This data indicates that manipulating clod size based on soil moisture at seeding provides an opportunity for maintaining tiller density, as well as the changing of the amount of N basal dressing under soil moisture conditions after rice cropping.

b) Development of the environment-friendly technology for sustainable land utilization.

1) Methane emissions from a rice paddy fertilized with fermented manure liquid

Limited information is available on the dynamics of dissolved organic C (DOC) in flooded rice soil and its relationship with CH<sub>4</sub> emissions from a rice paddy fertilized with fermented manure liquid. Field experiments were conducted to determine C concentration in soil, and CH<sub>4</sub> emission from a flooded soil with fermented manure liquid. Soil solutions were sampled in the root zone. The DOC concentration increased in the order: rice paddy fertilized with fermented manure liquid = rice paddy fertilized with ammonium sulfate < rice paddy fertilized with rice straw < rice paddy fertilized with manure. Correspondingly, CH<sub>4</sub> emission rates increased. The results suggest that (i) DOC pool in the root zone of rice plants is not enriched by fermented manure liquid; (ii) the rates of CH<sub>4</sub> emissions are positively correlated with the dynamics of DOC in the root zone; (iii) the rates of CH<sub>4</sub> emissions are not increased by fermented manure liquid.

2) Evaluation of acetylene reduction activity in rice rhizosphere

Two rice cultivars, Taichung 65 (japonica type) and C5444 (indica type), were cultivated in 1/5000a pot using Masa-soil. Ammonium sulfate labeled by <sup>15</sup>N (10.3 atom%) was applied as nitrogen fertilizer (0, 8, 20 and 30 gN/m<sup>2</sup>). In every pot, acetylene reduction activity (ARA) was measured mainly at the rice heading-time stage. In the rice ripening stage, rice above-ground part, rice underground part and root area soil were sampled in every pot and total nitrogen content and <sup>15</sup>N content rate were measured using the tracer mat. Using these values, amount of total nitrogen uptake from fertilizer and total nitrogen residue in the root soil were estimated. In both two cultivars the highest value of ARA showed in 30gN/m<sup>2</sup> pot and the value of C5444 was higher than that of Taichung 65. In the total nitrogen uptake of rice, nitrogen absorption not from the fertilization was included in all treatments, and in both two cultivars the more amounts the nitrogen fertilizer was applied, the more amounts the nitrogen absorption not from the fertilization was observed. However, the ratio of the nitrogen absorption not from the fertilization in the total nitrogen uptake was less in the 30 gN/m<sup>2</sup> pot than in both 8 and 20 gN/m<sup>2</sup> pots. From these facts, it may be necessary for the correct evaluation in rice biological nitrogen fixation that amounts of the nitrogen absorption not from the fertilization is estimated and that the nitrogen applied condition in detail is examined.

## A-2. Publications and presentations

a) Publications

### ***Book***

Inamura, T. : Development and evaluation of sustainable animal production systems integrated with crop production (edited by Hirooka, Kume, Mato and Inamura), pp.204, Kyoto University press, Agriculture and Forestry Statistics Publishing Inc.Tokyo, 2009 (in Japanese)

### ***Original papers***

Hirai, Genichi, H. Nishioka, N. Yamamoto, T. Okumura, T. Inamura: Effects of atmospheric



saturation deficiency and nitrogen concentration in the culture solution on the growth of Japonica-type rice Nipponbare and Indica-type rice IR24. *Journal of crop sci.* 77; 333-340, 2008 (in Japanese)

Homma, K., H. Mikoshiba, H. Mori, H. Okai, T. Shiraiwa, K. Sudo, T. Inamura: Analysis of production variability of Soybean ‘Tanbaguro’. *Journal of Crop Research* 53; 25-31, 2008 (in Japanese)

Inamura, T., Y. Mukai, A. Maruyama, S. Ikenaga, G. Li, X. Bu, Y. Xiang, D. Qin, T. Amano: Effects of nitrogen mineralization on paddy rice yield under low nitrogen input conditions in irrigated rice-based multiple cropping with intensive cropping of vegetables in southwest China. *Plant Soil* 315; 195-209, 2008

b) Conference and seminar papers presented

The 227th Ann Meet. of Crop Sci. Soc. of Japan (3 presentation).

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Inamura, T.: The Crop Science Society of Japan (Editorial board member of *Plant Production Science*), The Society of Crop Science and Breeding in Kinki (Council member)

#### ***Research grants***

Research Grant-in-Aid for Scientific Research (B) (2) “Analysis of the sources of variations of quality of wheat and soybean in the field, and variable rate management” (Leader; Inamura), Grant-in-Aid for Scientific Research (B) (2) “The research on systematization of conservational animal industry for cooperating crop farming with animal industry, and it’s evaluation” (Collaborator; Inamura)

Nara City: The effect of irrigating the treated wastewater on rice growth (Leader; Inamura).

### **A-4. International cooperations and overseas activities**

#### ***International meetings (roles)***

#### ***International joint researches, overseas research surveys***

Inamura, T. and H. Inoue: International joint research about the improvement of the water pollution in the agricultural irrigation system in southwest China (Cooperation with Kunming University of Science and Technology, Kunming, Yunnan Province of China).

## **B. Educational activities (2008.4-2009.3)**

### **B-1. On campus teaching**

a) Courses given

Undergraduate level: Seminar on experience of farm work (2) (Inamura, Inoue), Crop Production Techniques and Farm Practice (Inamura, Inoue), Plant Production Systems I (Inamura), Plant Production Systems II (Inamura), Laboratory Work in Bioresource Science I, II (Inamura and Inoue), Seminar in Agricultural Ecology (Inamura, Inoue), Introduction to Research (Inamura, Inoue).

Graduate level: Plant Production Systems (Advanced Course) (Inamura), Plant Production Systems-Seminar (Inamura), Special Laboratory Work in Plant Production Systems (Inamura).

**B-2. Off campus teaching, etc.*****Part-time lecturer***

Inamura, T.: Kyoto University of Education (Agriculture and Environment)

**C. Other remarks**

Inamura, T.: Experimental Farm (Member of council)

# Chair of Food Quality Science

## 2.1.7 Laboratory of Food Quality Design and Development

*Staff*      *Professor: Utsumi, Shigeru, Dr. Agric. Sci.*

*Associate Professor: Maruyama, Nobuyuki, Dr. Agric. Sci.*

*Assistant Professor: Masuda, Taro, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's Program: (2)*

*Master's Program: (10)*

*Postdoctoral fellow: (1)*

*Undergraduate: (3)*

*Assistant: (3)*

### **A. Research Activities (2008.4-2009.3)**

#### **A-1. Main subjects**

##### **a) Protein engineering and X-ray crystallography of food proteins**

Three dimensional structure, mechanism of food functional properties and structure-function relationships of food proteins are studied at molecular level by means of protein engineering and X-ray crystallography. The main targets are soybean storage proteins, glycinin and  $\beta$ -conglycinin. The structure-physicochemical function relationship of  $\beta$ -conglycinin and glycinin have been elucidated at subunit level, and molecular level analysis is in progress. Elucidation of the three dimensional structures of glycinin and  $\beta$ -conglycinin has been achieved by X-ray crystallography at 1.9-2.8 Å resolutions. Enrichments of health-promotion and physicochemical functions of soybean proteins based on their three dimensional structures have been attempted, and we have achieved some successes. Crystallization, crystallography and protein engineering of adzuki bean, French bean, pumpkin, pea, and mung bean proteins have been going, and general relationships between their structures and functions at molecular levels have been elucidated.

##### **b) Mechanism of protein sorting and accumulation in legume seeds**

Storage proteins of legume seeds are synthesized during maturation at a high level. Such a spatial-, temporal- and quantity-specific expression is controlled by a gene. Proteins synthesized on the rough ER are transported from the ER to protein storage vacuoles and accumulate to form protein bodies. Such a process of intracellular transport and accumulation is defined by the property and structure of the storage proteins. However, essential structural factors are unknown. Studies on sorting signals and receptors of glycinin and  $\beta$ -conglycinin for transportation from the ER to the vacuole are in progress based on their three dimensional structures. We have found that the C-terminal 10 amino acid residues of  $\beta$ -conglycinin contain C-terminal and sequence specific type sorting signals and glycinin contains C-terminal, sequence specific and structural type signals. In addition, identification of receptor species for each signal and elucidation of recognition mechanism are in progress.

##### **c) Development of transgenic crops producing food proteins and/or enzymes with improved/altered**

functions

A major effort is being made to develop transgenic crops producing food proteins with improved food functions (nutritional value and physiological and physicochemical functions). Soybean proteins having improved nutritional values and physicochemical and health-promoting functions have been successfully expressed in transgenic rice seeds and potato tubers. Development of transgenic rice accumulating modified soybean proteins at a high level is in progress. So far, we have attained the accumulation level of 20% of total proteins.

d) Structural factors determining allergenicity of legume seed proteins

Peanut induces a critical condition of an allergy patient, but pea and field bean do not induce and soybean induces mild symptom, although these plants contain similar proteins to each other. Eight allergens are identified so far from peanut. We are now preparing the recombinant proteins for their crystallography and characterization.

## A-2. Publications and presentations

a) Publications

***Original papers***

- Kimura, A., Fukuda, T., Zhang, M., Motoyama, S., Maruyama, N. and Utsumi, S.: Comparison of physicochemical properties of 7S and 11S globulins from pea, fava bean, cowpea, and French bean with those of soybean-French bean 7S globulin exhibits excellent properties. *J. Agric. Food Chem.* 56, 10273-9, 2008
- Fukuda, T., Maruyama, N., Mohamad Ramlan, M.S., Mikami, B. and Utsumi, S.: Crystallization and characterization of recombinant 7S globulins of adzuki bean and structure-function relationships with 7S globulins of various crops. *J. Agric. Food Chem.* 56, 4145-4153, 2008
- Yamada, Y., Nishizawa, K., Yokoo, M., Hui, X., Onishi, K., Teranishi, M., Utsumi, S., Ishimoto, M. and Yoshikawa, M.: Anti-hypertensive activity of genetically modified soybean seeds accumulating novokinin. *Peptides*, 3, 331-337, 2008
- Maruyama, N., Okuda, E., Tatsuhara, M. and Utsumi, S.: Aggregation of proteins having Golgi apparatus sorting determinant induces large globular structures derived from the endoplasmic reticulum in plant seed cells. *FEBS Lett.* 582, 1599-1606, 2008
- Takaiwa, F., Sakuta, C., Choi, S.-K., Tada, H., Motoyama, T. and Utsumi, S.: Co-expression of soybean glycinins A1aB1b and A3B4 enhances their accumulation levels in transgenic rice seed. *Plant Cell. Physiol.* 49, 1589-1599, 2008
- Rotari, V., Prak K., Stepurina, T., Morari, D., Lapteva, N., Mikami, B., Utsumi, S., Wilson, K. and Shutov, A.: Phaseolin subjected to limited proteolysis by papain-like proteinase: primary structure and crystallization. *Studia Universitatis, Revista Stiintifică a Universității de Stat din Moldova*, 2008
- Okamura, N., Masuda, T., Gotoh, A., Shirakawa, T., Terao, S., Kaneko, N., Suganuma, K., Watanabe, M., Matsubara, T., Seto, R., Matsumoto, J., Kawakami, M., Yamamori, M., Nakamura, T., Yagami, T., Sakaeda, T., Fujisawa, M., Nishimura, O., Okumura, K.: Quantitative proteomic analysis to discover potential diagnostic markers and therapeutic targets in human renal cell carcinoma. *Proteomics*, 8, 3194-3203, 2008

***Book***

- Rudakova, A., Rudakov, S., Kakhovskaya, I., Wilson, K., Yagasaki, K., Utsumi, S. and Shutov,

A.: Limited proteolysis controls massive degradation of glycinin, storage 11S globulin from soybean seeds. In: Agrobiodiversitatea Vegetală în Republica Moldova: Evaluarea, Conservarea și Utilizarea. Materialele Simpozionului Național, Chișinău, 396-402, 2008

b) Conference and seminar papers presented

The Annual Meeting (2008) of Japan Society for Bioscience, Biotechnology, and Agrochemistry (3 papers)

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Utsumi, Shigeru: Japanese Biochemical Society (Councilor), Japan Society for Bioscience, Biotechnology, and Agrochemistry (Editorial Board), The Japanese Society for Food Science and Technology (Editorial Board)

#### ***Research grants***

Monbukagakusho Research Grant: Research (B) Molecular mechanism of vacuolar sorting and accumulation of seed storage proteins (Leader; Utsumi)

Ministry of Agriculture, Forestry and Fisheries: Development of efficient breeding techniques based on genomic breeding (Collaborator; Utsumi and Maruyama)

Ministry of Economy, Trade and Industry: Development of production system of bioactive peptide by means of transgenic soybean (Collaborator; Utsumi)

Research Foundation: The Asahi Glass Foundation (Leader; Utsumi)

### **A-4. International cooperations and overseas activities**

#### ***Overseas joint research surveys***

Utsumi, S.: Processing of soybean glycinin (Germany, IPK), Molecular evolution of seed storage proteins (Moldova, University of Moldova), Functional properties of mung bean globulins (Philippines, UPLB), Allergenicity of soybean glycinin and  $\beta$ -conglycinin (Germany, PEI)

Maruyama, N.: Systems biology of seed development (Netherlands, Wageningen University), Functional properties of mung bean globulins (Philippines, UPLB)

### **B. Educational Activities (2008.4-2009.3)**

#### **B-1. On-campus teaching**

a) Courses given

Undergraduate Level: Basic Bioresource Science (Utsumi), Cell Biology I (Utsumi, Maruyama), Outline of Bioresource Science I (Utsumi), Quality Design and Development (Utsumi, Maruyama), Quality Science (Utsumi, Maruyama)

Graduate Level: Food Quality Design and Development, Advanced Course (Utsumi, Maruyama)

#### **B-2. Off-campus teaching, etc.**

##### ***Part-time lecturer***

Utsumi, S.: Faculty of Health and Welfare Science, Okayama Prefectural University (Food Biotechnology, Advanced Course)

#### **B-3. Overseas teaching**

***Students and research fellows from abroad***

Student: Master Course (1, Malaysia)

Doctor course (1, Philippines)

## 2.1.8 Laboratory of Quality Analysis and Assessment

*Staff      Professor                      : Matsumura, Yasuki, Dr. Agric. Sci.*  
*Associate Professor: Hayashi, Yukako, Dr. Agric. Sci.,*  
*Assistant Professor : Matsumoto, Shinya, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (3)*

*Master's program : (9)*

*Undergraduate : (4)*

### A. Research Activities (2007.4-2008.3)

#### A-1. Main subjects

a) Evaluation and improvement of quality as food stuffs for soybean and wheat.

A great variety of foods are produced from various crops, for instance, soybean curd (*tofu*) and bread is prepared from soybean and wheat, respectively. The quality of final product changes according to cultivars of crops, weather, district, and conditions of storage and transportation, etc. It is not practical and economical to evaluate the suitability of crops to final products in a large scale. This situation needs us to develop the new methods to evaluate the quality of crops as foodstuffs efficiently and accurately using only a small sample. We are testing validity of various analytical methods, in order to establish the appropriate evaluation methods in a small scale for soybean and wheat. Another goal of this research is to understand the factors determining the quality of the crops. If we get a plenty information on such factors, we will be able to give a good index to breeding scientists when improving the properties of crops.

b) Quality control of food products containing lipids.

Lipids coexist with water, proteins and other components in many foods such as mayonnaise, milk, ice cream, soybean curd, etc. In these emulsion type foods, lipids are dispersed in water as fine particles. The stability of lipid particles against flocculation and coalescence is crucial for the acceptability and shelf-life of the emulsions. Chemical aspects, such as oxidation degree of lipids, also affect deeply flavor, safety, nutritional and physiological quality of emulsion foods. The objective of our research is to improve the quality of emulsion foods by controlling the physical and chemical stability of lipids. Recently, the interaction of lipids with proteins and polysaccharides in low water activity system such as pasts and powders became our target of research.

c) Control of interaction of food macromolecules.

Main food macromolecules consist of proteins and polysaccharides. Our group has been studying the effects of plant polysaccharides on the dispersion behavior and gelling properties of milk and soybean proteins. Our goal of this project is to understand the mode of macromolecules' interaction such as network formation of mixed polymers, phase separation, and coacervation, etc., and to develop the new useful texture of food macromolecules. Our group is also trying to improve the physical properties of food macromolecules using the new type enzyme, for instance, protein-deamidase.

d) Analyses of perceptual mechanism of umami taste by physiological and biochemical methods.

Scientific interest in how food taste affect the functioning of the human body, for example, appetite, digestive enzymes, metabolism, etc., is growing. Five primary taste stimuli-acids, salts, sugars, amino acids and bitter substances-have been used as standard stimuli. The taste reception to amino acids, sugar and some bitter substance are known to be initiated by the adsorption of the chemical stimuli to the receptors on the taste cell membranes. In this laboratory, the taste perceptual mechanisms are focused and studied by the electrophysiological (taste cell patchclamp and nerve recordings) and biochemical techniques (optical calcium imaging and immunoassaying methods) using mice and humans. Also, sensory evaluation of human and preference test of mice would reveal the main pathway in the bitter and umami taste transduction under fatigue.

e) Aroma compounds in plants and foods

We enjoy enormous varieties of aroma compounds in plants (flowers and leaves) and foods. The composition of aroma compounds is various according to the kinds of plants and foods. Aroma compounds are also influenced by diverse environmental factors, for example, climate and nutritional conditions in the soil for plants, and processing and storage conditions for foods. We are investigating the effects of aroma compounds from plants and foods on human physiology.

## A-2. Publications and presentations

a) Publications

**Original papers**

- Narukawa M., K. Morita and Y. Hayashi: L-theanine elicits an umami taste with inosine 5'-monophosphate. *Biosci Biotechnol Biochem.*, 72; 3015-3017, 2008
- Narukawa M, K. Kitagawa-Iseki, H. Oike, K. Abe, T. Mori and Y. Hayashi: Characterization of umami receptor and coupling G protein in mouse taste cells. *Neuroreport.* 19; 1169-1173 , 2008
- Uemura M., M. Narukawa, K. Morita, H. Ue, Y. Matsumura and Y. Hayashi: The effect of physical stress on gustatory sensation. *Japanese J. Taste and Smell Res.* 15; 309-312, 2008 (in Japanese)
- Narukawa M., K. Morita, H. and Y. Hayashi: Analysis of taste characteristics of L-theanine. *Japanese J. Taste and Smell Res.* 15; 475-478, 2008 (in Japanese)
- T. Ukai, Y. Matsumura and R. Urade: Disaggregation and reaggregation of gluten proteins by sodium chloride. *J. Agric. Food Chem.*, 56, 1122-1130 (2008)
- E. Yamazaki, O. Kurita and Y. Matsumura: High viscosity of hydrocolloid from leaves of *Corchorus olitorius* L., *Food Hydrocoll.*, **23**, 655-660 (2008).
- E.Y. Park, M. Morimae, Y. Matsumura, Y. Nakamura and K. Sato: Antioxidant activity of some protein hydrolyzates and their fractions with different isoelectric points. *J. Agric. Food Chem.*, 56, 9246-9251 (2008).
- M.M. Sakuno, S. Matsumoto, S. Kawai, T. Koseki and Y. Matsumura: Adsorption and structural change of  $\beta$ -lactoglobulin at diacylglycerol-water interface. *Langmuir*, 24, 11483-11488 (2008).

**Reports**

- Yukako Hayashi: Food additive for improvement of taste - the 6<sup>th</sup> Forum for Creating High Value Food. *J. Jpn Soc Food Engineering.* v 29 No1 pp.46-50.



b) Conference and seminar papers presented

The Annual Meeting of Japan Society for Bioscience, Biotechnology and Agro chemistry 2008: 2 subjects

The Annual Meeting of Japanese Society for Food Science and Technology 2008:6 subjects, invited speaker 1 (Matsumura,Y)

The 42<sup>th</sup> JASTS Annual Meeting: 4 subjects, invited speaker 1

The Annual Meeting of Japan Society for Food Engineering: 1 subject

Satellite Symposium of FSFF in AOCS and JOCS: 2 subjects

The Annual Meeting of Japanese Society of Physical Fitness and Sports Medicine: 1 subject

The 6<sup>th</sup> Forum of Japan Society of Food Engineering: invited speaker (Hayashi,Y)

Rheology Society of Japan, Educationl course: lecturer (Matsumura, Y)

The 19<sup>th</sup> Hydrocolloid Symposium: invited speaker (Matsumura,Y)

Chiba Bio-forum: invited speaker (Matsumura)

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Matsumura, Y.: Symposium on Physical Properties of Foods and Food Materials (Member of the Steering Committee), Kansai Branch of Japanese Society for Food Science and Technology (Counselor), Rheology Society of Japan, Division of Dispersion and Interfacial Science (Member of the steering committee), Japan Society for Food Engineering (Counselor + Editorial Committee), Japan Society for Bioscience, Biotechnology and Agrochemistry (Editorials Committee), Japan Society of Food Engineering (Counselor + Editorial Committee), Japan Oil Chemists Socceity (Member of the Steering Committee of Kansai branchi + Representative of Function and Structure of Food Oil Division)

Hayashi, Y.: Japanese Society for the Study of Taste & Smell (Counselor + Editorial Committee)

#### ***Research grants***

Monbusho Reseach Grant: Scientific Research (B) Evaluation and Control of Physical Properties and Flavor of Foods Utilizin Human Sensing System (Leader Matsumura, Y.),  
Scientific Research (C) Identification of the type of Taste cell and the related component in the taste transduction. (Leader Hayashi, Y)

Ministry of Agriculture, Forestry and Fisheries: Development of techniques on nano-scale processing and evaluation of food materials. (Leader Matsumura, Y.)

Research Foundation: The Iijima Memorial Foundation For The Promotion Of Food Science And Technology (Leader Hayashi, Y)

### **A-4. International cooperations and overseas activities**

#### ***International meetings (roles)***

Matsumura, Y: Satellite Symposium of FSFF in AOCS and JOCS in Kyoto (Organizer)

Matsumura, Y: Rheology Socceity of Japan/ International Workshop on Food Dispersions in Tsukuba (Organizer)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Food Quality Science (Matsumura, Y.), Quality Analysis and Assessment (Matsumura, Y., Hayashi, Y.), Cell Biology I (Hayashi, Y.), Outline of Bioresource Science I (Matsumura, Y.), Laboratory Course in Bioresource Science I, II (Matsumura, Y., Hayashi, Y., Matsumoto, S.), Fundamentals for the Laboratory Course in Bioresource Science (Hayashi, Y., Matsumoto, S.)

Graduate level: Quality Analysis and Assessment (Matsumura, Y., Hayashi, Y.)

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Hayashi, Y: Doshisha Women's College of Liberal Arts (Experiment for chemistry A, Food Experiment for Processing, Experiment for Food )

Matsumoto, S: Mukogawa Women's University The Junior College Division (Basic Nutrition)

## **B-3. Overseas teaching**

### ***Students and research fellows from abroad***

Doctor's program: 1 (Brazil1)

## **C. Other remarks**

## Chair of Plant Production Science (Experimental Farm)

### 2.1.9 Laboratory of Plant Production Control

*Staff*      *Professor*                      : *Kitajima, Akira, Dr.Agric.Sci. (2008.4-)*  
*Associate Professor: Nakazaki, Tetsuya, Dr.Agric.Sci. (2008.10-)*  
*Assistant Professor: Kataoka, Keiko, Dr.Agric.Sci.*  
*Assistant Professor: Teraishi, Masayoshi, Dr.Agric.Sci. (-2008.11)*  
*Assistant Professor: Fudano, Takashi, Dr.Agric.Sci.*  
*Assistant Professor: Habu, Tsuyoshi, Dr.Agric.Sci.*  
*Assistant Professor: Katsura, Keisuke, Dr.Agric.Sci.*

*Students and research fellows*

*Doctor's Program*   : (2)

*Master's Program*   : (3)

*Undergraduate*       : (4)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

- a) Transposable elements in soybean genome.

We are identifying some transposable elements in soybean genome. We try to find elements potential to transpose and reveal composition and variation among soybean varieties.

- b) Screening of tanbaguro mutant

Tanbaguro is a Japanese traditional soybean variety, characterized by the big black seeds. We are screening tanbaguro mutants with interesting agronomic traits from  $\gamma$ -ray irradiated population.

- c) Relationships of grain characters and agronomical characters in brewer's rice

Yamadanishiki, the most famous Japanese brewer's rice, was proved to have a dwarf gene in spite of its long culm length. We find the relationships between grain characters and agronomical characters as well as revealing genetic linkage relationships of the dwarf gene.

- d) Studies on high productivity in rice under upland conditions.

We are collecting the data about crop physiological traits of upland rice in order to determine the potential productivity of rice under upland condition and seek the way for further increase in rice yield under upland conditions.

- e) Studies on seedlessness in citrus

We have been cleared that no seed development in seedless cultivar 'Mukaku Kishu' is resulted from embryo arrest at zygote or proembryo stage and the seed development is induced under green house condition. In this year, the effects of thermal environment on embryo development in 'Mukaku Kishu' and the mechanisms of embryo development under higher temperature condition were investigated.

- f) Search of citrus seedless native cultivars in East Asia and their origin

We went to China, Thailand and Vietnam to investigate native citrus cultivars. Most of

mandarin cultivars were poly-embryony but a few were mono-embryony similar to Japanese cultivars of *Citru kinokuni*. We found Chinese native citrus cultivar that is mandarin type and almost seedless with mono-embryony seeds.

g) Studies of self-compatibility in *Prunus*

Peach and some cultivars in Japanese apricot or apricot exhibit self-compatibility, although many other species or cultivars in *Prunus* exhibit gametophytic self-incompatibility. In this study, we investigate the *S*-locus of such self-compatible cultivars or species to elucidate the mechanism of gametophytic self-incompatibility in *Prunus*.

h) Role of gibberellin on tomato fruit development

We have revealed that the addition of gibberellic acid to 4-CPA solution, treated at anthesis for inducing fruit set and growth, can increase sugar contents per fruit of 'Mini-charol' and 'Louis 60' tomatoes. This year, the effect of the combination of 4-CPA and GA<sub>3</sub> in different concentrations on fruit growth of 'Micro Tom' tomato was investigated.

i) Studies on seed formation of genetic parthenocarpic tomatoes

Genetic parthenocarpy of tomatoes has labor-saving advantages for fruit production even in seasons unsuitable for pollination. Fertile seeds can be obtained by pollination at the appropriate time; however, the number of true seeds obtained is quite small, complicating both seed production and breeding. In order to control the seed production of parthenocarpic tomato cultivars, we investigate the seasonal change of seed formation capability and the effect of gibberellin biosynthesis inhibitor with histological observations to reveal the source of the obstruction.

j) Promoted growth of *Phalaenopsis* in embedded culture.

We succeeded in promoted growth of cultured plant embedded in solid medium. Therefore it is investigated that the embedded culture is useful for horticultural production. It is revealed that growth of axillary bud of flower-stalk and seedling are promoted in embedded culture.

k) Avoidance of the microorganism contamination in vitro shoot apex culture of *Paphiopedilum*.

In many cases, microorganism contamination occur in vitro shoot apex culture of *Paphiopedilum*. Therefore the microorganism is identified, and it is investigated how to avoid the microorganism contamination. Until now, some microorganism was identified, and it could improve the avoidance rate of microorganism contamination.

## A-2. Publications and presentations

a) Publications

**Books**

Yonemori, K. and A. Kitajima: Persimmon. p. 326-336. In: Janick, J. and R. E. Paull (eds.). The Encyclopedia of Fruits and Nuts. CABI, Oxfordshire, UK, 2008

Kitajima, A. and K. Yonemori: Wild nuts in Japan. Encyclopedia of Fruits. A. Sugiura et al. (eds), Asakura, Tokyo, pp.605-607, 2008

Habu, T.: Classification of self-(in)compatible Japanese apricot cultivars by S haplotypes. The Survey of Japanese Agricultural Techniques, Fruit Tree (6) Peach, Japanese Apricot, Plum, Prune and Apricot. Rural Culture Association, Tokyo, pp. 32-2 – 34-4, 2008

Habu, T.: Classification of self-(in)compatible Japanese apricot cultivars by S haplotypes. Latest Agricultural Techniques of Fruit Trees. Rural Culture Association. Tokyo, 1: 141-143, 2008

- Habu, T.: Cranberry. Encyclopedia of Fruits. A. Sugiura et al. (eds), Asakura, Tokyo, pp.266-268, 2008
- Mizutani, F., T. Takagi and A. Kitajima: Citrus. Encyclopedia of Fruits. A. Sugiura et al. (eds), Asakura, Tokyo, pp.197-241, 2008
- Nakazaki, T., K. Naito, Y. Okumoto and T. Tanisaka: Active transposons in rice. In Rice Biology in Genomics Era., Biotechnology in Agriculture and Forestry. H.-Y. Hirano et al. (eds.) Springer-Verlag Berlin Heidelberg pp.69-79, 2008

### **Original papers**

- Yamasaki, A., A. Kitajima, N. Ohara, M. Tanaka and K. Hasegawa: Characteristics of arrested seeds in Mukaku Kisyu-type seedless citrus. J. Japan. Hort. Sci. 78; 61-67, 2009
- Fudano, T. and T. Hayashi: Differences of inflorescence architecture among varieties of *Gypsophila paniculata* L.. Bull. Exp. Farm Kyoto Univ. 17; 1-5, 2008
- Tanaka, Y., S. Kato, K. Kataoka, T. Watanabe and S. Yazawa: Breeding of new non-pungent peppers with the soft-juicy fruits and the examination of using DNA markers for identifying non-pungent plants. Bull. Exp. Farm Kyoto Univ. 17; 21-25, 2008
- Matsuda, M., T. Habu, F. Kishida, M. Morikita, T. Konishi, K. Katsura and A. Kitajima.: Effect of Disbudding on Increased Profitability of Fruit Production in Japanese Persimmon (*Diospyros kaki* Thunb.) cv. Hiratanenashi. Bulletin of Experimental Farm Kyoto University. 17: 7-13, 2008
- Kanzaki, S., A. Sato, M. Yamada, N. Utsunomiya, A. Kitajima, A. Ikegami and K. Yonemori: RFLP markers for the selection of pollination-constant and non-astringent (PCNA)-type persimmon and examination of the inheritance mode of the markers. J. Japan. Soc. Hort. Sci. 77; 28-32, 2008
- Kataoka, K., T. Sakakibara, K. Nishikawa, K. Kusumi and S. Yazawa: Seed formation is affected by uniconazole, an inhibitor of gibberellin biosynthesis, in a parthenocarpic cultivar Severianin of tomato (*Lycopersicon esculentum* Mill.). J. Japan. Soc. Hort. Sci. 77; 283-288, 2008
- Katsura, K., S. Maeda, I. Lubis, T. Horie, W. Cao and T. Shiraiwa: The high yield of irrigated rice in Yunnan, China: 'A cross-location analysis' Field Crops Res. 107; 1-11, 2008
- Habu, T., D. Matsumoto, K. Fukuta, T. Esumi, R. Tao, H. Yaegaki, M. Yamaguchi, M. Matsuda, T. Konishi, A. Kitajima and T. Yamada: Cloning and characterization of twelve S-RNase alleles in Japanese apricot (*Prunus mume* Sieb. et Zucc.). J. Japan. Soc. Hort. Sci. 77; 374-381, 2008
- Vieira, J., N. A. Fonseca, R. A. M. Santos, T. Habu, R. Tao and C. P. Vieira: The number, age, sharing and relatedness of S-locus specificities in *Prunus*. Gent. Res., Camb. 90; 17-26, 2008
- Vieira, J., R. A. M. Santos, T. Habu, R. Tao and C. P. Vieira: The *Prunus* self-incompatibility locus (S locus) is seldom rearranged. J. Hered. 99; 657-660, 2008
- Yonemori, K., C. Honsho, S. Kanzaki, H. Ino, A. Ikegami, A. Kitajima, A. Sugiura and D. E. Parfitt: Sequence analyses of the ITS regions and the matK gene for determining phylogenetic relationships of *Diospyros kaki* (persimmon) with other *Diospyros* (Ebenaceae) species. Tree Genet. Genomics 4; 149-158, 2008
- Yonemori, K., C. Honsho, A. Kitajima, M. Aradhya, E. Giordani, E. Bellini, and D.E. Parfill: Relationship of European persimmon (*Diospyros kaki* Thunb.) cultivars to Asian

- cultivars, characterized using AFLPs. *Genet. Resour. Crop Evol.* 55: 81-89, 2008
- Tanaka, Y., T. Shiraiwa, A. Nakajima, J. Sato and T. Nakazaki: Leaf gas exchange activity in soybean as related to leaf traits and stem growth habit. *Crop Sci.* 48: 1925-1932, 2008
- Xayphakatsaa, K., T. Tsukiyama, K. Inouyeb, Y. Okumoto, T. Nakazaki and T. Tanisaka: Gene cloning, expression, purification and characterization of rice (*Oryza sativa* L.) class II chitinase CHT11. *Enzyme Microb. Technol.* 43: 19-24, 2008
- Oki, N., K. Yano, Y. Okumoto, T. Tsukiyama, M. Teraishi and T. Tanisaka: A genome-wide view of miniature inverted-repeat transposable elements (MITEs) in rice, *Oryza sativa* ssp. Japonica. *Genes Genet. Sys.* 83: 321-329, 2008
- Yamada, Y., K. Nishizawa, M. Yokoo, H. Zhao, K. Onishi, M. Teraishi, S. Utsumi, M. Ishimoto and M. Yoshikawa: Anti-hypertensive activity of genetically modified soybean seeds accumulating novokinin. *Peptides* 29: 331-337, 2008
- Umezawa T, T. Sakurai, Y. Totoki, A. Toyoda, M. Seki, A. Ishiwata, K. Akiyama, A. Kurotani, T. Yoshida, K. Mochida, K. Kasuga, D. Todaka, K. Maruyama, K. Nakashima, A. Enju, S. Mizukado, S. Ahmed, K. Yoshiwara, K. Harada, Y. Tsubokura, M. Hayashi, M. Sato, T. Anai, M. Ishimoto, H. Funatsuki, M. Teraishi, M. Osaki, T. Shinano, R. Akashi, Y. Sakaki, K. Yamaguchi-Shinozaki, and K. Shinozaki: Sequencing and Analysis of Approximately 40000 Soybean cDNA Clones from a Full-Length-Enriched cDNA Library. *DNA Res.* 15: 333-346, 2008
- Sayama, S., T. Nakazaki, G. Ishikawa, K. Yagasaki, N. Yamada, N. Hirota, K. Hirata, M. Teraishi, , T. Yoshikawa, H. Saito, M. Teraishi, Y. Okumoto, T. Tsukiyama and T. Tanisaka: QTL analysis of seed-flooding tolerance in soybean (*Glycine max* (L.) Merr.). *Plant Sci.* 176: 514-521, 2009

b) Conference and seminar papers presented

Annual Meeting of JSBBA 2008: 1 presentation

The 225th meeting of Japanese Society for Crop Science : 1 presentation

The 113th Congress of Japanese Society of Breeding: 1 presentation

2008 Spring Meeting of the Japanese Society for Horticultural Science : 2 presentations

The 5th International Crop Science Congress: 3 presentations

2008 Meeting of Kinki branch of the Japanese Society for Horticultural Science: 2 presentations

The 226th meeting of Japanese Society for Crop Science : 1 presentation

The 114th Congress of Japanese Society of Breeding: 5 presentations

2008 Autumn Meeting of the Japanese Society for Horticultural Science : 1 presentations

The 11th International Citrus Congress: 1 presentations

The 166th Congress of the Society of Crop Science and Breeding in Kinki: 1 presentation

The 112th Symposium of the Sustainable Humanosphere: 1 presentation

### A-3. Off-campus activities

#### *Membership in academic societies (roles)*

Kitajima, A.: International Society of Citriculture, Japan Branch (Board)

Nakazaki, T.: The Society of Crop Science and Breeding in Kinki (Editorial board)

Kataoka, K.: The Japanese Society for Horticultural Science (Editorial board)

Teraishi, M.: The Japanese Society of Breeding (Secretary member)

Katsura, K.: Crop Science Society of Japan (Secretary member), The Society of Crop Science and Breeding in Kinki, Japan (General secretary)

### ***Research grants***

Monbusho Research Grant: Scientific Research (B) Mechanisms of citrus seedlessness derived from 'Mukaku Kishu' and development of seedless citrus breeding system (Leader: Kitajima), Scientific Research (B) Search for seedless native cultivars and their origin in citrus (Leader: Kitajima), Scientific Research (B) Investigation of origin species in Diospyros kaki and development process in PCNA type kaki lines (Collaborator: Kitajima), Research for Young Scientist (B) Identification of pollen determinant of gametophytic self-incompatibility in *Maloideae* (Leader: Habu), Scientific Research (A) Elucidation of self-recognition mechanism of S-RNase-based gametophytic self-incompatibility in Prunus (Collaborator: Habu)

## **A-4. International cooperations and overseas activities**

### ***International joint researches, oversea research surveys***

Kitajima, A.: Surveys of native citrus cultivars in East Asia (China), Surveys of wild and PCNA types *D. kaki* (China)

Nakazaki, T.: Cloning of a erect panicle gene in rice and analysis of its function (China, Shenyang Agriculture University)

Habu, T.: Transcriptome analysis of incompatible- and compatible-crossed styles of sweet cherry by next generation sequencing technology (USA, Michigan State University)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Plant Cultivation Technology and Farm Practice (Kitajima, Nakazaki, Kataoka, Teraishi, Fudano, Habu, Katsura), Agricultural Technology and Farm Practice (Kitajima, Nakazaki, Kataoka, Teraishi, Fudano, Habu, Katsura), Seminar on Plant Production Control Science (Kitajima, Nakazaki, Kataoka, Teraishi, Fudano, Habu, Katsura), Lecture on Outline of Bioresource Science I (Kitajima), Lecture on Outline of Agricultural Science II (Yamada), Introduction to Research (Kitajima, Nakazaki, Kataoka, Teraishi, Fudano, Habu, Katsura), Laboratory Course in Bioresource Science I · II (Nakazaki)

Graduate level: Seminar on Plant Production Control Science (Kitajima), Plant Production Technique (Nakazaki), Plant Production Control Science Seminar (Kitajima, Nakazaki, Kataoka, Teraishi, Fudano, Habu, Katsura), Special Laboratory Work in Plant Production Control Science (Kitajima, Nakazaki, Kataoka, Teraishi, Fudano, Habu, Katsura)

Collaboration with other institutes: Cultivation Practice of Kyoto University of Education (Kitajima, Kataoka, Teraishi, Fudano, Habu, Katsura), Kyoto Study Center of The Open University of Japan- Current situation of promoting education and research in pomology (Kitajima, Habu), Lecture and Practical Training in JICA Seminar 'Upland rice variety selection techniques for sub-Saharan Africa' (Katsura)

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Kitajima, A.: Kyoto University of Education

Nakazaki, T.: Faculty of Engineering, Kyoto Sangyo University (Fundamentals of Biological Experiment I, Fundamentals of Biological Experiment II)

### ***Open seminar***

Katsura, K.: The 12th Open Seminar of Experimental Farm, Kyoto University

## **B-3. Overseas teaching**

### ***Students and research fellows from abroad***

Research fellow: 1 person (China) (2008.8.5-2008.8.27)

### ***Overseas lectures and Open lectures***

Nakazaki, T.: Shenyang Agriculture University (China)

## **C. Other remarks**

Kitajima, A.: The Public Corporation of Tree-Planting and Forest of Takatsuki-shi (Director),  
The Committee of Experimental Farm of Kyoto University (Board member)

Nakazaki, T.: The Committee of Experimental Farm of Kyoto University (Board member), The  
Safety Control Committee for Recombinant DNA of Research Institute for Humanity and  
Nature (Committee)

Kataoka, K.: Cooperative Expert of the Committee to Investigate the Advanced Technology and  
Information about Plant Variety Right in the Agriculture, Forestry and Fisheries  
Technical Information Society.



## 2.2 DIVISION OF FOREST AND BIOMATERIALS SCIENCE

### 1. Outline of the Division

Forests play a very important role in the environment of the earth and provide wood resources that are continuously renewable in contrast with fossil resources such as petroleum and coal. Research and educational activities of this division cover not only preservation, cultivation, and continuous production of forest resources, but also utilization of forest products for our life and culture with the aim of coexistence of forest and human beings

This division consists of 20 laboratories, including 2 laboratories of Field Science Education and Research Center and 5 laboratories of Research Institute for Sustainable Humanosphere (renamed Wood Research Institute reconstructed in April, 2005), and their activities are international and interdisciplinary

### 2. Number of students

There are 98 students (53 freshmen and 45 2nd year students) in the Master's program and 61 students in the doctor's program of this division

### 3. Divisions and laboratories offering lectures

Division of Forest and Biomaterials Science: Laboratories of Forest Resources and Society, Forest Environment Planning, Tropical Forest Resources and Environments, Forest Utilization, Forest Biology, Landscape Architecture, Erosion Control, Biomaterials Design, Wood Processing, Biofibrous Materials, Tree Cell Biology, Composite Materials Chemistry, and Chemistry of Biomaterials

Field Science Education and Research Center:

Laboratories of Forest Information, and Silviculture

Research Institute for Sustainable Humanosphere:

Laboratories of Active Bio-based Materials, Sustainable Materials, Structural Function, Innovative Humano-habitability, Biomass Morphogenesis and Information

### 4. Event in 2008

The orientation course for freshmen on April 7 at the Graduate School of Agriculture in Kitashirakawa Campus offered a curriculum-guidance. On May 12, a welcome part was held at Kamigamo Experimental Station. After the introduction, a short Station-tour and subsequent welcome party were carried out. Open laboratories were also held on three dates, April 9, May 7, and September 30, and recent research activities in the belonging 20 laboratories were introduced with posters and in person.

# Chair of Forest Resource Management

## 2.2.1 Laboratory of Forest Resources and Society

*Staff      Professor : Iwai, Yoshiya, Dr. Agric. Sci.*

### **A. Research Activities (2008.4-2009.3)**

#### **A-1. Main subjects**

- a) World forestry and global forest resources management

The topics include forest, forestry and forest industry in the world, and correlation between developed and developing countries through wood trade.

- b) Production and uses of forest products

The topics include wood, paper and bamboo from the view point of historical development.

#### **A-2. Publications and presentations**

### **B. Educational Activities (2008.4-2009.3)**

#### **B-1. On-campus teaching**

- a) Courses given

Undergraduate Level: World Forest Resources (Iwai)

## 2.2.2 Laboratory of Tropical Forest Resources and Environments

*Staff      Professor                      : Ohta, Seiichi, D. Agric. Sci.*

*Ass. Professor                      : Kanzaki, Mamoru, D. Sci.*

*Assistant Professor : Kaneko, Takayuki*

*Students and research fellows*

*Doctor's program : (8)*

*Master's program : (10)*

*Undergraduate : (4)*

### A. Research Activities (2007.4-2008.3)

#### A-1. Main subjects

- a) Elements cycling and sustainable management of industrial tree plantations in the tropics

To evaluate and predict the sustainability of industrial plantation rapidly expanding in the devastated land in the tropics, and to present the measures to solve the related problems, the researches have been initiated on budget of nutrient elements and GHEG in soil-plant systems of industrial tree plantation of leguminous species and also on the mechanism of their fluctuation with forestry practices. The soil management for the reduced emission of GHEG is also studied.

- b) Soil ecology and forest distribution in the area of tropical seasonal forests

To elucidate the factors which controlling the distribution of evergreen forest and deciduous forest in tropical seasonal region, the soil physical characteristics as mechanical composition, pore distribution and hydraulic conductivity, and structure, species composition and leaf area index of forests for major soil-forest combinations are studied in Northeastern Thailand.

- c) Carbon sequestration function of tropical seasonal forests and its fluctuation

For the quantitative evaluation of the carbon sequestration function of forest, members of the laboratory are studying at a tropical seasonal evergreen forest of Thailand and a mangrove forest of Myanmar with special reference to coarse woody debris (CWD) and long-term forest dynamics.

- d) Maintenance and regeneration mechanism of tropical forests

For elucidating the maintenance and natural regeneration mechanisms of tropical forests, dynamics of seedlings and saplings and insect-plant interactions of several forest types are being studied. Furthermore, various disturbances to forests, such as fire and slash-and-burn activity of human beings in the areas of rainforest, seasonal forests and montane forests in Asian tropics are also being studied.

- e) Inventory and monitoring of plants in the canopy layer of a tropical montane forest

To clarify the diversity and long-term dynamics of plants growing in canopy layer, such as epiphyte, parasite, strangler and liana, field survey is conducting in a tropical montane forest of northern Thailand.

#### A-2. Publications and presentations

- a) Publications

##### *Original papers*

Fukushima, Maki, Mamoru Kanzaki, Masatoshi Hara, Tatsuhiro Ohkubo, Pornchai Preechapanya, Chalathon Choocharoen : Secondary forest succession after the cessation

- of swidden cultivation in the montane forest area in Northern Thailand. *Forest Ecology and Management* 255: 1994–2006, 2008
- Naito, Yoko, Mamoru Kanzaki, Hiroyoshi Iwata, Kyoko Obayashi, Soon Leong Lee, Norwati Muhammad, Toshinori Okuda, Yoshihiko Tsumura : Density-dependent selfing and its effects on seed performance in a tropical canopy tree species, *Shorea acuminata* (Dipterocarpaceae). *Forest Ecology and Management* 256 (2008) 375–383, 2008
- Nishimura, Sen, Tsuyoshi Yoneda, Shinji Fujii, Erizal Mukhtar, and Mamoru Kanzaki : Spatial patterns and habitat associations of Fagaceae in a hill dipterocarp forest in UluGadut, West Sumatra. *Journal of Tropical Ecology* 24:535-550, 2008
- Ito, E., M. Araki, B. Tith, S. Pol, C. Trotter, M. Kanzaki, S. Ohta : Leaf-shedding phenology in lowland tropical seasonal forests of Cambodia as estimated from NOAA satellite images. *IEEE Transactions on Geoscience and Remote Sensing* 46(10):2867-2871, 2008
- Konda, R., Ohta, S., Ishizuka, S., Arai, S., Ansori, S., Tanaka, N., Hardjono., A. : Spatial structures of N<sub>2</sub>O, CO<sub>2</sub>, and CH<sub>4</sub> fluxes from *Acacia mangium* plantation soils during a relatively dry season in Indonesia. *Soil Biology & Biochemistry* 40:3021-3030, 2008
- Yoda A., A. Takayanagi, M. Kanzaki: Comparison of tree seedling populations between Kasugayama primary forest and nagi forest. *Kansai Bullatin of Kansai Organization for Nature Conservation*:30(2): 123-133, 2008 (In Japanese)
- Van Achterberg, C., Hosaka, T., Ng, Y. F., and Ghani, I. B. A. : The braconid parasitoids (Hymenoptera: Braconidae) associated with seeds of Dipterocarpaceae in Malaysia. *Journal of Natural History* 43: 635-686, 2009

### ***Reports***

- Ya Min Thant, Kanzaki Mamoru, Maung Maung Than. Preliminary Report on the Impacts of Cyclone Nargis on Mangrove Forests and Human Settlement in the Ayeyarwady Delta, Myanmar. *Tropical Ecology Letters*. *Tropical Ecology Letters* No.73:11-17, 2008
- b) Conference and seminar papers presented
- International Conference “Toward Sustainable Land-use in Tropical Asia” by Asia-Pacific chapter of the Association for Tropical Biology and Conservation/Japanese Society for Tropical Ecology (Kuchin, Malaysia, April 2008):(2)
- The 18<sup>th</sup> Ann. Meeting of Japanese Society of Tropical Ecology(Tokyo University, June 2008) (4)
- 6th Workshop of “uneven-aged silviculture” IUFRO group in Shizuoka (Shizuoka, Japan, October 2008):(2)
- FORTROP II International Conference. Tropical forestry change in changing world (Bangkok, Thailand, November 2008) : (8)
- Asia Forest Workshop 2008 “Interdisciplinary and Transnational Discussion on Multiple Impacts of Forestry and Land use Change in Tropical asia” (Cambodia, November 2008) : (1)
- The Second International Conference of Kyoto University Global COE Program. In Search of Sustainable Humanosphere in Asia and Africa. Biosphere as a Global Force of Change. (Kyoto, Japan, March 2009) (1)
- The 120<sup>th</sup> Ann. Meeting of Japanese Forest Society(Kyoto University, March 2009) (8)

## **A-3. Off-campus activities**

### ***Membership in academic societies (roles)***

Ohta, S.: The Japanese Forestry Society (Council member), Japanese Society of Forest Environment (Council member), Editorial board of The Pedologist (Editor)

Kanzaki, M.: The Japanese Association of Tropical Ecology (Council member, Secretary), Kansai Organization of Nature Conservation (Council member)

#### ***Research grants***

Ohta S.: JSPS research grant: Kiban-kenkyu A-2; Evaluation of the tropical fast growing species plantation as N<sub>2</sub>O emission source and mitigation options. (Rep. Ohta, Kaneko,), Kiban-kenkyu A; Field examination of the performance of genetic modified poplar for the industrial plantation (Ohta, Rep. Hayashi T.), Kiban-kenkyu A; Function in carbon, nutrients and water cycling within seasonally dry tropical forests. (Ohta, Kanzaki, Rep. A. Ishida), Ministry of Environment; Construction of super monitoring site and networking in middle to down stream area of Mekong River (Contract Research with Forest and Forest Products Research Institute).

Kanzaki M.: JSPS research grant: Kiban-kenkyu B-2; Inventory and monitoring of plants in canopy layer of the tropical cloud forest: Construction of monitoring site. (Rep. Kanzaki), Kiban-kenkyu-A; Ecological study of gregarious flowering of *Melocanna baccifera* in Mizoram, India. (Kanzaki. Rep. S. Shibata), Kiban-kenkyu A; Function in carbon, nutrients and water cycling within seasonally dry tropical forests. (Ohta, Kanzaki, Rep. A. Ishida), Kiban-kenkyu B-2; Geographic changes of multiscale distribution pattern of tree species of Fagaceae in Asian tropical montane forest. (Kanzaki, Rep. T. Ohkubo), Kiban-kenkyu C; Impact of deer and alien species on the dynamics of evergreen oak forest and biodiversity conservation. (Kanzaki, Rep. Y. Maesako), Ministry of Environment; Construction of super monitoring site and networking in middle to down stream area of Mekong River (Contract Research with Forest and Forest Products Research Institute), Mitsui Bussan Foundation; Research on the rehabilitation of tropical degraded forest and local community living with the forest. (Kanzaki, Rep. S. Kobayashi).

Kaneko T.: JSPS research grant: Kiban-kenkyu A-2; Evaluation of the tropical fast growing species plantation as N<sub>2</sub>O emission source and mitigation options. (Rep. Ohta, Kaneko,)

Toriyama J.: Grant for Research Fellow DC2; Research on soil water dynamics as a factor controlling the leaf-phenology of evergreen and deciduous forest of tropical monsoon Asia.

### **A-4. International cooperation and overseas activities**

#### ***International meetings(roles)***

Kanzaki, M.: Asia forest workshop “Interdisciplinary and transnational discussion on multiple impacts of forestry and land use change in tropical Asia (Invited Keynote Speaker)

#### ***International joint researches, overseas research surveys***

Ohta, S.: Study on clarifying the soil acidification under leguminous fast-growing tree plantation in humid tropic (Indonesia), Survey for the Project of technical development for promoting CDM tree plantation (Indonesia), Carbon, nutrients and water cycling within seasonally dry tropical forests (Thailand)

Kanzaki, M.: Carbon, nutrients and water cycling within seasonally dry tropical forests

(Thailand), Study of bamboo flowering (India), Biomass growth and soil carbon of mangrove plantation in Myanmar (Myanmar), Inventory and monitoring of plants in the canopy layer of a tropical montane forest (Thailand)

Kaneko, T.: Study on clarifying the soil acidification under leguminous fast-growing tree plantation in humid tropic (Indonesia)

***Scholars from abroad***

Invited foreign researcher 1 (Forest Department of Thailand, Senior Researcher)

**B. Educational Activities (2007.4-2008.3)**

**B-1. On-campus teaching**

a) Courses given

Undergraduate level: Forest Science I (Ohta, Kanzaki), Tropical Forest Environment (Ohta), Tropical Forest Resources (Kanzaki), Practice in Environmental Science (Ohta, Kanzaki), Laboratory Course in Biological and Environmental Science I (Kanzaki, Kaneko), Laboratory Course in Forest and Biomaterials Biology (Kanzaki, Kaneko), Laboratory Course in Ecology (Kanzaki, Kaneko), Practice in University Forest I (Kanzaki, Kaneko). Practice in University Forest III (Kanzaki). Environmental Studies (Kanzaki), International Exchange Subjects (Kanzaki), Leading of Foreign Literature II (Ohta, Kanzaki)

Graduate level: Tropical Forest Resources (Kanzaki), Seminar in Tropical Forest Resources and Environments (Ohta, Kanzaki), Practice in Tropical Forest Environments (Ohta, Kanzaki), Scientific Writing and Presentation in English (Kanzaki)

**B-2. Off-campus teaching, etc.**

***Part-time Lectures***

Kanzaki, M.: JICA Training Course: Conservation and Sustainable Management of Mangrove Ecosystem (Lecturer), Faculty of Science, Nara Women's University (Global Environmental Biology)

**B-3. Overseas teaching**

***Teaching in abroad***

Kanzaki, M.: Doctor course co-advisor (Faculty of Forestry, Kasetsart University, Thailand)

***Students and research fellows from abroad***

Doctor Course Student 1 (Myanmar)

**C. Other remarks**

Ohta, S.: UFJ Research Institute, the issues of forest carbon sink (Working group member); Japanese Center for Environment and Health, Acid Deposition and Oxidants Research Center, Soil and vegetation monitoring (Analyzing group member), Interior data verification group (Committee member), Working group for soil and vegetation (Committee member), Supporting group for soil and vegetation task force (Committee member), Group for methodological development of catchment analysis (Committee member); JIFPRO, Project of technical development for promotion of CDM tree plantation (Committee member); Ministry of Environment, Project of counter-measure

for acid deposition (Committee member); Japanese Center for Overseas Plantation Promotion, Project of environmental impacts of artificial forest in developing countries (Committee member); Japan Forestry Technology Association, Project of system development for identification of carbon sink forests (Committee member); Forestry Agency, Monitoring of acid deposition and forest decline (Committee member); Japan Society for the Promotion of Science, funding for science research (Technical committee member)

Kanzaki, M.: Environmental Committee of Higashiomi City (Committee member)

## 2.2.3 Laboratory of Forest Environment Planning

*Staff      Professor                      : Ohta, Seiichi, Dr. Agric. Sci.*  
*Associate Professor: Matsushita, Koji, Dr. Agric. Sci.*

*Students and research fellows*  
*Master's program : (5)*  
*Undergraduate     : (5)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Forest planning system

Social demands for forest resources are multiple and changing. The most recent change is the increase of forest management problems related to global warming. To solve these current problems, we are conducting research to change the forest planning system and forest survey methods to include a broader range of public benefits.

##### b) Laws relating to forest management

The development of legal systems is necessary for forest management because the forest resources are connected to various public benefits. In our laboratory, the following laws relating to the forest are being examined: Forest Law, Basic Forest and Forestry Law, National Forest Management Law, Law to Promote the Modernization of the Rights for the Common Forest.

##### c) Sustainable forest tourism

The national forest has a protective forest system. The area of protective forest and the surroundings also have importance from the point of tourism. Protection forest for scenic beauty and recreational use are contributing to tourism. We conduct research on how to develop sustainable forest tourism.

#### A-2. Publications and presentations

##### a) Publications

###### *Reports*

Matsushita, K.: Forest owners' association and its forest practices sponsored by private company.

Proceedings of Common Forest Society of Middle Japan 29; 37-38, 2009

Taguchi, K., Matsushita, K. and Uno, H.: Old documents on forestry and forest products in Ohara, Kyoto, Japan (2) Documents related to Kimura Sohemon, Magistrate of Gonyubokuyama.

The Natural Resource Economics Review, Kyoto University 14; 142-194, 2009

#### A-3. Off-campus activities

##### *Membership in academic societies (roles)*

Matsushita, K.: Japanese Forest Economic Society (Awards Committee), Common Forest Society of Middle Japan (Editor), The Japanese Forest Society (Executive Committee of 120<sup>th</sup> Annual Meeting)

### B. Educational Activities (2008.4-2009.3)

#### B-1. On-campus teaching



a) Courses given

Undergraduate Level: Forest and Biomaterial Science IV (Matsushita), Laboratory Course in Forest and Biomaterials Science IV (Matsushita), Laboratory Course in Applied Forest and Biomaterial Science (Matsushita), Forest Planning (Matsushita), Forest Law (Matsushita), Reading of Foreign Literature II (Matsushita), Seminar in Forest and Biomaterial Science (Matsushita)

Graduate level: Forest Environment Planning (Matsushita)

b) Part-time Lectures

Matsushita, K.: Faculty of Agriculture, Kyoto Prefectural University (Forest Policy I, Forest Policy II)

**C. Other remarks**

Matsushita, K.: Member of the evaluation board on public works projects of Shiga Prefecture; Policy consultant of Nara Prefecture on the promotion of the effective utilization of common forests; Member of the advisory body of Kyoto Prefectural Forestry Workers Support Center

# Chair of Forest and Forestry Production

## 2.2.4 Laboratory of Forest Utilization

*Staff*      *Professor*                      : *Osawa, Akira, Ph.D.*  
                 *Associate Professor: Okada, Naoki, Dr. Agric. Sci.*  
                 *Instructor*                        : *Hasegawa, Hisashi, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program* : (5)

*Master's program* : (5)

*Undergraduate*    : (3)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Stand development and carbon dynamics of boreal forests

Stand development and carbon accumulation and dynamics after large-scale disturbances are studied in boreal forest ecosystems, particularly of high-latitude coniferous forests in the northern hemisphere. Chronosequence stands have been selected, their stand structures measured, and carbon dynamics patterns estimated by the ecological summation method in jack pine forests of northwestern Canada. Sum of fine-root ingrowth and mortality was estimated as 409, 454, and 203 gC/m<sup>2</sup>/year for the young, medium age, and old jack pine forests, respectively, indicating that 85%, 86%, and 74%, respectively, of NPP of these forest ecosystems goes to the fine-root compartment. Compared to published literature, these proportions are unusually large for a forest ecosystem. Generality of this estimate needs to be examined by further analyses.

##### b) Growth of tropical trees

Wood anatomical methods for detecting growth rings were applied to Leguminosae species in seasonally dry forests in Thailand, and crossconfirmed with the method of carbon isotope analysis. Vessel traits (mean lumen diameter, proportion of lumen area and vessel number per cross sectional area) showed cyclic changes along radius, indicating that the traits are under the influence of the growing environment. Mean lumen diameter and proportion of lumen area showed negative correlations with the carbon isotope ratio of xylem, whereas vessel density showed a positive one. The results indicated that the difference of soil moisture availability between the wet and dry seasons causes the variation of both carbon isotope ratio and vessel traits.

##### c) Structure and function of broad-leaved trees

Tree species with homobaric and heterobaric leaves growing in a deciduous broad-leaved forest were compared with respect to their water relations. To evaluate the degree of heterobaric, compartment size index (CSI) was defined. CSI is the number of intersection points of 1 cm line and leaf vein. Drought tolerant species are tend to have larger CSI values.

Resource allocation within each first year branch was compared based on Huber value (cross sectional area of a shoot/ total leaf area) between ring-porous and diffuse-porous species. The

former were tend to have lower HV than the latter, but the trend was not so clear as observed for current year shoots. When we compared (water-conducting area of the branch/ total leaf area) among two groups, Ring-porous species had lower values than diffuse-porou species.

d) Developing models of forest harvesting

We are required to study not only environmental sustainability but also economic sustainability for forest resource utilization. Then, we tried to develop a precise forest harvesting models using system dynamics based on observation of actual harvesting operations. We clarified that consideration of dbh distribution of trees to be felled is effective in the precise evaluation of productivity and production costs in applying system dynamics simulation to forest harvesting. Moreover, the addition of processing-time variations is also effective. The new model can estimate the differences in productivity and production costs involved in variations of the thinning method, such as low or crown thinning. Another advantage of using a model that considers diameter distribution and variations in processing time is that it can be applied to the evaluation of productivity and production costs in future harvesting through combination with a forest growth model. This model can therefore be used for long-term evaluation of forest harvesting including thinning methods.

e) Studies on precision forestry for sustainable use of forest resources

Site-adapted forest management with precision forestry technologies is essential for highly sustainable utilization of diverse forest functions. Therefore, (1) monitoring forest resources by using remote-sensing data, (2) GPS performance under tree canopies, (3) development of silvicultural process for extensive forestry with early intensive thinning, and (4) relationship between construction costs of forest roads and terrain, were discussed.

## A-2. Publications and presentations

a) Publications

***Books***

- Osawa, A., O.A. Zyryanova, Y. Matsuura, T. Kajimoto, and R.W. Wein (eds.): Permafrost Ecosystems: Siberian Larch Forests (Ecological Studies). Springer-Verlag, Berlin (in press)
- Osawa, A., O.A. Zyryanova: Introduction. In: A. Osawa et al. (eds.) Permafrost Ecosystems: Siberian Larch Forests (Ecological Studies). Springer-Verlag, Berlin (in press)
- Osawa, A., T. Kajimoto: Development of stand structure in larch forests. In: A. Osawa et al. (eds.) Permafrost Ecosystems: Siberian Larch Forests (Ecological Studies). Springer-Verlag, Berlin (in press)
- Osawa, A., Y. Matsuura, T. Kajimoto: Characteristics of larch forests in Siberia and potential responses to warming climate. In: A. Osawa et al. (eds.) Permafrost Ecosystems: Siberian Larch Forests (Ecological Studies). Springer-Verlag, Berlin (in press)
- Kajimoto, T., A. Osawa, V.A. Usoltsev, A.P. Abaimov: Biomass and productivity of Siberian larch forest ecosystems. In: A. Osawa et al. (eds.) Permafrost Ecosystems: Siberian Larch Forests (Ecological Studies). Springer-Verlag, Berlin (in press)
- Mori, S., S.G. Prokushkin, O.V. Masyagina, T. Ueda, A. Osawa, T. Kajimoto: Respiration of larch trees. In: A. Osawa et al. (eds.) Permafrost Ecosystems: Siberian Larch Forests (Ecological Studies). Springer-Verlag, Berlin (in press)
- Nishida, M, Nobuchi, T, Okada, N, Siripatanadilok, S, Veenin, T, Siangchob, W: Physiological and phenological features of tropical seasonal forest trees in Thailand in relation to wood

formation. In: Nobuchi T. and Mohd. Hamami Sahri (eds.) The Formation of Wood in Tropical Forest Trees –A Challenge from the Functional Wood Anatomy–, UPM Press. 31–44, 2008

### ***Original papers***

Ohashi, S., N. Okada, T. Nobuchi, S. Siripatanadilok, T. Veenin: Detecting invisible growth rings of trees in seasonally dry forests in Thailand: isotopic and wood anatomical approaches. *Trees – Structure and Function* (in press)

Takahashi, S., N. Okada, T. Nobuchi: Examination of wood sampling method with an increment borer: An investigation of seasonal changes in vessel formation. *Forest Research* 77;123–128, 2008

大塚和美, 長谷川尚史, 野淵正: スギ大径並材生産を目指した強度間伐の多面的評価:徳島県における選木育林・早期仕上げ間伐を例として. *Forest Research*, Kyoto 77;109–121, 2008

### ***Reports***

Ohashi, S., N. Okada, S. Siripatanadilok, T. Veenin: Detecting tree rings of Leguminosae in tropical seasonal forests by wood anatomy. *Proceeding of FORTROP II*. (in press)

Sugimoto, K: Introduction of process management in log production in the field—an example of Yagi Mokuzai Co. in Hyogo Prefecture. *Kikaika-Ringyo* 663, 2009.

### **b) Conference and Seminar papers presented**

First SELIS International Workshop, Eco-Climate Dynamics in Eurasia/Monsoon Asia, Nagoya University: 1件

JPGU2008 Meeting (1 presentation)

The 120th Ann. Meet. Jpn. For. Soc. (2 presentation)

The 57th Ann. Meet. Jpn. Ecol. Soc. (2 presentation)

The 18th Ann. Meet. Jpn. Soc. Trop. Ecol. (2 presentation)

FORTROP II International Conference “Tropical Forestry Change in a Changing World”, Bangkok, Thailand (2 presentation)

## **A-3. Off-campus activities**

### ***Membership in academic society (roles)***

Osawa, A.: Japanese Forest Society (The 120<sup>th</sup> Annual Meeting Local Organizing Committee)

Hasegawa, H.: Society of Japan Forest Engineering (director), Society of Forest Spatial Utilization (executive), Society of Forest Production (executive)

### ***Research grant***

Monbu-Kagakusho Research Grant: Scientific Research (A) (Overseas) Phosphorous limitation in the tropical forest in Borneo: bottom up effect and adaptation of plants (Okada), Scientific Research (A) (Overseas) Ecological research on large-scale bamboo flowering in Mizoram, India. (Hasegawa), Monbu-Kagakusho Research Grant: Scientific Research (B) (Overseas) Forest fire and vegetation changes in the tropical seasonal forests in Thailand (Okada PI),

Others: Sumitomo Foundation Environmental Research Grant, Forest fire and vegetation changes in the tropical seasonal forests in Thailand (Okada PI), JSPS Japan-Russia Bilateral

Exchange (Joint Research) Plant species diversity and productivity in permafrost larch ecosystems of Central Siberia (Osawa)

#### **A-4. International cooperation and overseas activities**

##### ***International meetings (roles)***

Osawa, A.: First International Symposium on the Arctic Research (Organizing Committee)

Hasegawa, H.: IUFRO All-D3-Conference (Organizing Committee)

##### ***International joint researches and overseas research survey***

Osawa, A.: Plant species diversity and productivity in permafrost larch ecosystems of Central Siberia (Russia),

Osawa, A.: Carbon budget of Canadian boreal forests (Canada),

Hasegawa, H.: Ecological research on the large-scale bamboo flowering in Mizoram, India (India)

Okada, N.: Forest fire and vegetation changes in the tropical seasonal forests (Thailand)

#### **B. Educational Activities (2007.4-2008.3)**

##### **B-1. On-campus teaching**

a) Course given

Undergraduate level: Measuring tropical forests (Okada), Social and environmental changes under sustainable development in Monsoon Asia (Okada), Basic Science for Forest and Biomaterials IV (Osawa), Forest Utilization (Osawa), Tree Physiology (Okada), Mushroom Science (Okada), Reading of Foreign Literature II (Osawa), Seminar in Forest Utilization (Osawa, Okada, Hasegawa), Introduction to Research (Osawa, Okada, Hasegawa), Comprehensive Practice in Forest (Okada, Hasegawa), Practice for Forest Utilization (Osawa, Okada, Hasegawa), Laboratory Course in Forestry and Biomaterial Science IV (Okada),

Graduate level: Scientific writing and presentation in English (Okada), Seminar in Forest Utilization (Osawa, Okada, Hasegawa), Laboratory course in Forest Utilization (Osawa, Okada, Hasegawa)

##### **B-2. Off-campus teaching, etc.**

###### ***Open Lecture***

Hasegawa, H.: Training Lectures for Foresters in Hyogo (Lecturer), Technical Meeting for Thinning in Tokushima (Lecturer), Technician Training for University Forests in Japan (Lecturer)

#### **C. Other remarks**

Osawa, A.: Preparatory committee on Arctic research (Member), Committee on Arctic research (Member)

Hasegawa, H.: Preparatory Committee of Forest Database in North Okayama (Chairman), Forest Management Project Team in Hyogo, Low Cost Forestry Project Team in Wakayama

## 2.2.5 Laboratory of Forest Biology

Staff      Professor                    : Isagi, Yuji, Ph. D.  
             Lecturer                     : Takayanagi, Atsushi, Dr. Agric. Sci  
             Assistant Professor : Yamasaki, Michimasa, Dr. Agric. Sci

Students and research fellows

Doctor's program : (4)

Master's program : (6)

Undergraduate : (5)

Research student : (1)

JSPS Research fellow : (1)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Genetic traits and biological conservation of forest plants

Regeneration process and genetic structure of plant community in forest ecosystems were analysed by means of field researches and genetic analysis. In order to conserve biological diversity of forest, fine genetic markers were developed for a variety of plant species. Analyses of genetic structure and genetic diversity for endangered plant species were conducted.

##### b) Forest damage by big mammals

In order to know the mechanism of black bear bark stripping damage, we investigated the nutritional traits of inner-bark of *Cryptomeria japonica*, damages in natural forests. DNA analysis of hairs sticking on scars can identify black bear. Shoot breakage by Sika deer was happened mostly from April to July and strong relationships with phenology of plants. Vegetation change processes were compared between different browsing pressure at herbaceous community dominated by low-preference species. Biomass under several artificial *Cryptomeria japonica* stands were estimated.

##### c) Mass mortality of oak trees

The ambrosia beetle, *Platypus quercivorus*, causes mass mortality of oak trees by transporting pathogenic fungi from trees to trees. We examined whether the uneven distribution of oak trees, *Quercus crispula*, in a natural forest affects the spread of this disease. The calculated index of dispersion showed a clumped distribution of *Q. crispula* in the study area with an estimated clump size of 0.08 ha. We constructed the model to predict the mortality of *Q. crispula*, and DBH and basal area of *Q. crispula* per 0.09 ha had significant positive effects on the probability of mortality. These results suggest that *P. quercivorus* first flew to a cluster of *Q. crispula* aggregated in about a 0.1-ha area, and then DBH played a role in determining the target trees.

#### A-2. Publications and presentations

##### a) Publications

###### **Original papers**

Franklin, D.C., S. Kaneko, N. Yamasaki and Y. Isagi: Some wild bamboo clumps contain more than one genet. Australian Journal of Botany 56; 433-436, 2008

- Kaneko, S., N. Nakagoshi and Y. Isagi: Origin of the endangered tetraploid *Adonis ramosa* (Ranunculaceae) assessed with chloroplast and nuclear DNA sequence data. *Acta Phytotaxonomica et Geobotanica* 59; 165-174, 2008
- Matsuki, Y., R. Tatenno, M. Shibata and Y. Isagi: Pollination efficiencies of flower-visiting insects as determined by direct genetic analysis of pollen grains. *American Journal of Botany* 95; 925-930, 2008
- Kaneko, S., Y. Isagi and F. Nobushima: Genetic differentiation among fragmented populations in an oceanic island: the case of *Metrosideros boninensis*, an endangered endemic tree species in the Bonin Islands. *Plant Species Biology* 23; 119-128, 2008
- Mori, K., S. Kaneko, Y. Isagi, N. Murakami and H. Kato: Isolation and characterization of ten microsatellite loci in *Callicarpa subpubescens* (Verbenaceae), an endemic species of the Bonin Islands. *Molecular Ecology Resources* 8; 1423-1425, 2008
- Katabuchi, M., Y. Isagi and T. Nakashizuka: Development of 17 microsatellite markers for *Ceratosolen constrictus*, the pollinating fig wasp of *Ficus fistuolsa*. *Molecular Ecology Resources* 8; 840-842, 2008
- Kaneko, S., D.C. Franklin, N. Yamasaki and Y. Isagi: Development of microsatellite markers for *Bambusa arnhemica* (Poaceae: Bambuseae), a bamboo endemic to northern Australia. *Conservation Genetics* 9; 1311-1313, 2008
- Inoue, M., R. Goda, S. Sakaguchi, D. Fujiki, M. Yamasaki, A. Takayanagi and K. Fujisaki: Context of the specific topic "Impact on Ashiu forest ecosystem due to deer". *Forest Research, Kyoto* 77; 1-4, 2008
- Fukuda, A. and A. Takayanagi: Influence of snow cover on browsing of *Cephalotaxus harringtonia* var. *nana* by *Cervus nippon* Temminck in heavy snow region in central Japan. *Forest Research, Kyoto* 77; 5-11, 2008
- Tanaka, Y., S. Takatsuki and A. Takayanagi: Decline of *Sasa palmata* community by grazing of Sika deer (*Cervus nippon*) at Ashiu Research Forest Station. *Forest Research, Kyoto* 77; 13-23, 2008
- Ishikawa, M. and A. Takayanagi: Effects of deer exclosures on herbaceous communities under different light conditions. *Forest Research, Kyoto* 77; 25-34, 2008
- Goda, R. and A. Takayanagi: Effects of deer habitat use on herbaceous communities. *Forest Research, Kyoto* 77; 35-41, 2008
- Sakaguchi, S., D. Fujiki, M. Inoue and A. Takayanagi: Plant species diversity and community structure of old-growth beech forest in Kamitani, Ashiu, Kyoto: community structure and endangered plant species detected by gradsect networks. *Forest Research, Kyoto* 77; 43-61, 2008
- Goda, R., M. Inoue and A. Takayanagi: Road census for Sika deer monitoring at the Ashiu Forest Research Station of Kyoto University. *Forest Research, Kyoto* 77; 89-94, 2008
- Fujiki, D. and A. Takayanagi: Researches and surveys on impacts of Sika deer (*Cervus nippon*) on forest ecosystem in Ashiu Forest Research Station, Kyoto University. *Forest Research, Kyoto* 77; 95-108, 2008
- Yamasaki, M. and K. Futai: Host selection by *Platypus quercivorus* (Murayama) (Coleoptera: Platypodidae) before and after flying to trees. *Applied Entomology and Zoology* 43; 249-257, 2008

## ***Reports***

Isagi, Y.: Genetic disturbance. *Environment Education* 38; 2451-2459, 2008

b) Conference and seminar papers presented

The Mammalogical Society of Japan 2008 Annual Meeting (1 presentation)

The 56th Annual Meeting of The Japanese Ecological Society (8 presentations)

The 120th Annual Meeting of Japanese Forestry Society (11 presentations)

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Isagi, Y.: The Ecological Society of Japan (Journal of the Ecological Society of Japan, Editor; Committee for the Kinki District), The Japanese Forest Society (Executive Director), The Society for the Study of Species Biology (Regional Secretary, Selection Committee for the Kataoka Encouragement Prize)

Takayanagi, A.: Mammalogical Society of Japan (Audit)

#### ***Research grants***

Isagi, Y.: JSPS research grant: Kiban-kenkyu A; Comprehensive conservation of biodiversity hot spots based on information from ubiquitous genotyping (Rep.: Y. Isagi)

Isagi, Y.: JSPS research grant: Kiban-kenkyu B; Why bamboos flower simultaneously? Analysis on the effects of simultaneous flowering for the maintenance of genetic diversity (Y. Isagi, Rep.: A. Makita)

Isagi, Y.: JSPS research grant: Kiban-kenkyu B; Evaluation of the effect of forest fragmentation in sub-tropical island ecosystems on species and genetic diversity (Y. Isagi, Rep.: K. Yoneda)

Takayanagi, A.: JSPS research grant: Kiban-kenkyu C; Study on effects of habitat quality and protection fences on crop damage intensity by sika deer (Rep.: A. Takayanagi)

### **A-4. International cooperation and overseas activities**

#### ***International joint researches, overseas research surveys***

Isagi, Y.: Phylogeographic study of plant species in Australia (Australia), Research of range expansion of invasive alien species in Australia (Australia)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Basic Science for Forest and Biomaterials I (Isagi), Reproductive Ecology in Forest Trees (Isagi), Wildlife Conservation Science (Takayanagi), Laboratory Course in Forest and Biomaterials Science I (Takayanagi), Laboratory Course in Forest and Biomaterials Biology (Takayanagi, Yamasaki), Laboratory Course in Ecology (Takayanagi, Yamasaki), Practice in University Forests II (Takayanagi), Seminar in Forest and Biomaterials Science (Isagi, Takayanagi, Yamasaki)

Graduate level: Forest biology I (Isagi), Seminar in Forest Biology (Isagi, Takayanagi, Yamasaki), Laboratory Course in Forest Biology (Isagi, Takayanagi, Yamasaki)

### **B-2. Off-campus teaching, etc.**



***Part-time lecturer***

Isagi, Y.: Graduate School of Science, Kumamoto University (Special Lecture on Biological Diversity A)

Takayanagi, A.: Kyoto Gakuen University (Wildlife Conservation)

Yamasaki, M.: Faculty of Engineering, Doshisha University (Life Science II, Animal Behavior)

***Open seminar***

Isagi, Y.: Open Seminar of Forest Science, Kyoto University (Lecturer)

Takayanagi, A.: Open Seminar of Field Science Education and Research Center, Kyoto University (Lecturer)

Yamasaki, M.: Open Seminar of Field Science Education and Research Center, Kyoto University (Lecturer)

**C. Other remarks**

Isagi, Y.: Tokyo Metropolitan University (guest scientist), Hiroshima University Museum (guest scientist), Hiroshima Prefecture (landscape adviser), The 25<sup>th</sup> Kyoto Prize Selection Committee.

# Chair of Forest Environment Conservation

## 2.2.6 Laboratory of Landscape Architecture

*Staff      Professor                      : Morimoto, Yukihiro, Dr. Agri. Sci.*

*Associate Professor: Fukamachi, Katsue, Dr. Agri. Sci.*

*Assistant Professor : Imanishi, Junichi, Dr. Agri. Sci.*

*Students and research fellows*

*Doctor's program : (4)                      Research fellow : (1)*

*Master's program : (8)                      Research student : (1)*

*Undergraduate : (4)*

### A. Research Activities (2006.4-2007.3)

#### A-1. Main subjects

##### a) Theory and history of landscape design

History and theory of modern landscape design have been researched continuously. The purpose of the studies is to clarify the social significance of public open spaces through the researches on economic and political backgrounds.

##### b) Habitat restoration and conservation research

Technological studies on conservation of forest and wildlife habitat have been researched through works in urban forest.

##### c) Landscape and land-use planning research

Landscape and land-use preference studies on open space in urban and urban fringe areas are conducted in order to get landscape and land-use planning theory.

##### d) Practice in landscape design

This laboratory has participated in the practical processes of several projects such as parks and urban planning.

#### A-2. Publications and presentations

##### a) Publications

###### ***Books***

Morimoto, Y.: Satochi-Satoyama. In Washitani, I. ed. *Nature Crisis in Japan*, Tokyo, Koseisha Koseikaku Co. Ltd., 280pp., 2008.9.

Morimoto, Y.: Disaster Prevention and Biodiversity Conservation. In Research Group on Forest Environment ed. *Forest Environment 2008: Woody and Herbaceous Biomass*, Tokyo, Forest Culture Association, 214pp., 2008.2.

Morimoto, Y.: Biotope. In The Japan Scientists' Association ed. *Encyclopedia of environment*, Tokyo, Junposha Co. Ltd., 1200pp., 2008.10.

###### ***Original papers***

Sasaki, T., Imanishi, J., Ioki, K., Morimoto, Y., Kitada, K.: Estimation of leaf area index and canopy openness in broad-leaved forest using airborne laser scanner in comparison with

- high-resolution near-infrared digital photography. *Landscape and Ecological Engineering* 4(1); 47-55, 2008
- Murakami, K., and Morimoto, Y.: Range expansion of two tropical to subtropical ferns, –ladder brake (*Pteris vittata* L.) and lace fern (*Microlepia strigosa* (Thunb. ex Murray) K. Presl.), –in the urban Osaka Bay area, western Japan. *American Fern Journal* 98(3); 171-176, 2008
- Morimoto Y.: Need for landscape management in regards to species conservation. *J Jpn Ins Landscape Architecture* 72(4); 378-380, 2009.
- Matushima Y., Oku H., Fukamachi K., Horiuchi M., Morimoto Y.: Comparison of the landscape perception between native residents and new residents in a satoyama area on the west side of the Lake Biwa, Diga Prefecture. *Landscape Research Japan* 71(5):741-746, 2008
- Mizushima M., Fukamachi K., Miyoshi I., Oku H.: Study on plant species composition according to erosion control facilities in a small river on the western shire of Lake Biwa. *Papers on Environmental Information Sciences* 22; 163-168, 2008
- Imanishi, A., Shibata, S., Imanishi, J., Terai, A., Nakanishi, A., Sakai, S., Osawa, N., Morimoto, Y.: Change of woody-species composition in an early stage of plant succession after cutting in a suburban secondary forest dominated by *Chamaecyparis obtusa*. *J. Jpn. Soc. Reveget. Tech.* 34(4); 641-648, 2009
- Horikawa, M., Murakami, K., Tsuyama I., Oyabu, T., Matsui, T., Morimoto, Y., Tanaka, N.: Predicting potential distribution of *Thelypteris dentata* and the changes based on climate change scenario. *J. Jpn. Soc. Reveget. Tech.* 34(1); 85-90, 2008
- Murakami, K., Horikawa, M., Morimoto, Y., Matsui, R.: Leaf phenology of *Thelypteris dentate* (Forssk.) E.P.St.John) colonized and expanded in city areas. *J. Jpn. Soc. Reveget. Tech.* 34(1); 261-264, 2008
- Ooishi, Y., Morimoto, Y. : Changes in the bryophyte flora in an urban afforested woodland. *J Jpn Ins Landscape Architecture* 71(5); 577-580, 2008.
- Matsumoto, H., Imanishi, A., Imanishi, J., Morimoto, Y., Natuhara, Y.: Persistence and vertical distribution of diaspores of aquatic plants in the surface soil layer of Oguraike and Yokoojinuma drained lands . *Landscape Research Japan* 72(5); 543-546, 2009.
- Ooishi, Y., Murakami, K., Morimoto, Y.: Distribution pattern of an exotic moss *Tortula pagorum* (Milde) De Not. in Kyoto City. *J. Jpn. Soc. Reveget. Tech.* 34 (1); 81-84, 2008
- Ooishi, Y., Yamada, K.: Liverwort and Hornwort from Rishiri Island, Hokkaido. *Rishiri Research* 27; 63-72, 2008
- Nishimura, N., Michimori, M., Kawai, K., Ooishi, Y., Akiyama, H.: Bryophytes of the Tanba District, Hyogo Prefecture. *Human and Nature* 19: 115-134, 2008
- Reports**
- Morimoto, Y.: Biodiversity and Satoyama : From the Viewpoint of Landscape. *Environmental Research Quarterly* 148; 41-49, 2008.
- Morimoto, Y.: Conservation of biodiversity near at hand. *J Resources and Environment* 44(10); 2-10, 2008.
- Fukamachi, K: Satochi-Satoyama as local commons. *J Resources and Environment* 44(10); 38-43, 2008.
- Fukamachi K.: Aesthetic Scenery of Satoyama landscapes, *Env. Res.* 148; 113-119, 2008
- Miyoshi I., Fukamachi K., Oku, H.: Changes in land use based on topographic factors in

mountainous villages on the Tango Peninsula, Japan. Landscape Ecology and Conservation: Proceedings of the 15th annual IALE(UK) conference, held at Murray Edwards College Cambridge, 2008:9-16, 2008

Imanishi, J., Imanishi, J.: The use of natural environment in integrated medicine of next generation. Hospitals 67(11); 974-978, 2008.

Yoshimura, K., Imanishi, J., Morimoto, Y.: Relationship between waterside vegetation and management at school biotopes in Kyoto City. J. Jpn. Soc. Reveget. Tech. 34(1); 273-276, 2008

b) Conference and seminar papers presented

Annual meeting of the Ecological Society of Japan (1)

Annual meeting of JILA (2)

Annual meeting of JILA Kansai Branch (1)

ELR2008 (5)

National River Symposium (1)

IUFRO (1)

The 4th International Conference on Landscape and Ecological Engineering (2)

International Association of Landscape Ecology (UK) (2)

Geo-Environmental Engineering 2008 (1)

GIS-IDEAS 2008 (1)

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

Morimoto, Y.: Japanese Institute of Landscape Architecture, Japanese Society of Revegetation Technology (Auditor), Japanese Society of Landscape Ecology (President), Environmental Information Center (Councilor), Science Council of Japan (member), International Consortium for Landscape and Ecological Engineering (Vice President), International Federation of Landscape Architects – Japan (board member)

Fukamachi, K.: Japanese Institute of Landscape Architecture (Editorial Board Member), Japanese Society of Revegetation Technology (Executive Board Member), Japanese Society of Landscape Ecology (Editorial Board Member), The Japanese Forest Society (Editorial Board Member)

Imanishi, J.: Japanese Institute of Landscape Architecture Kansai Branch (Secretary and Branch Office), Japanese Association for Landscape Ecology (Expert Member), Japanese Society of Revegetation Technology (Editorial Board Member), Japanese Society of Revegetation Technology (Councilor)

#### ***Research grants***

Morimoto, Y.: JSPS Grants-in-Aid for Scientific Research. (A) (1) Studies on ground design of hierarchical nature restoration. (delegate: Morimoto, Y., member: Imanishi, J.)

Morimoto, Y.: JSPS Grants-in-Aid for Exploratory Research. Landscape architectural basic study on realization of a plant garden in outer space. (delegate: Matsui, S., member: Morimoto, Y.)

Morimoto, Y.: JSPS Grants-in-Aid for Scientific Research. (A) (1) Interdisciplinary studies on extracting prioritized ecosystems, practical techniques and scientific assessment for nature restoration. (delegate: Nakamura F.)

- Morimoto, Y.: Funded Research. Surveys for the Independent Forest in Expo'70 park. (Commemorative Organization for the Japan World Exposition '70)
- Morimoto, Y.: Funded Research. Spiritual care for cancer patients by integrated medicine in Expo'70 park. (Integrated Medicine Planning)
- Morimoto, Y.: JSPS Bilateral Joint Research Projects.
- Morimoto, Y., Fukamachi, K., Imanishi, J.: JSPS Grants-in-Aid for Scientific Research. (A) (1) Assessment of Satochi-Satoyama based on comparative landscape ecology (delegate: Natuhara Y.)
- Imanishi, J.: JSPS Grants-in-Aid for Young Scientists (B). Assessing vigor conditions of cherry trees using a hyperspectral sensor. (delegate: Imanishi, J.)

#### **A-4. International cooperation and overseas activities**

##### ***International meetings***

- Morimoto, Y.: Satoyama initiative as smart adaptation to the climate change. The 4th International Conference on Landscape and Ecological Engineering, November 22-24. Taipei, R.O.C. 2008
- Morimoto, Y.: Changes in SATOYAMA and the Significance of their Conservation, Int. symp. for the discussion toward the sustainable community and farmlands in urban neighborhoods. Nishinomiya, Hyogo, Dec. 16, 2008
- Song, Y.K., Imanishi, J., Hashimoto, H., Hagiwara, A., Morimura, A. and Morimoto, Y.: Assessing tree vigor condition in *Prunus* species using hyperspectral remote sensing data. The 4th International Conference on Landscape and Ecological Engineering, November 22-24. Taipei, R.O.C. 2008
- H. Hashimoto, A. Imanishi, K. Murakami and Morimoto Y.: History of urban woods in Kyoto, Japan. IUFRO Landscape Ecology International Conference: Landscape Ecology and Forest Management Challenges and Solutions, September 16-22. Chengdu, China. 2008
- Koh, J.-H., Hur, Y.-H., Morimoto, Y., and Park J.-S.: An Experimental Study Using the Soil Seed Bank for Ecological Restoration in a Constructed Area, Geo-Environmental Engineering 2008, June 12. Kyoto, Japan. 2008
- Mizuno, K., Imanishi, J. and Motoki, T.: Landscape analysis with multispectral aerial images in the Bo Watershed, Central Vietnam. GeoInformatics for Spatial-Infrastructure Development in Earth and Allied Sciences (GIS-IDEAS) 2008, December 4-6. Hanoi, Vietnam. 2008.

#### **B. Education Activities (2007.4-2008.3)**

##### **B-1. On campus teaching**

###### **a) Courses given**

Undergraduate level: Landscape Architecture Part I, II (Morimoto, Y.), Planting Design for Landscape (Imanishi, J. and Morimoto, Y.), Landscape Planning (Fukamachi, K.), Practice in Landscape Planning and Design Part I, II (Morimoto, Y. and Imanishi, J.), Laboratory Course in Applied Forest and Biomaterials Science (Morimoto, Y., Fukamachi, K. and Imanishi, J.), Laboratory Course in Forest and Biomaterials Science IV (Morimoto, Y., Fukamachi, K. and Imanishi, J.), Forest and Biomaterials Science, IV (Morimoto, Y.), Information Technology in Forest and Biomaterials Science (Imanishi, J.)

and others)

Graduate level: Special Lecture in Landscape Architecture (Morimoto, Y.), Seminar in Landscape Architecture (Morimoto, Y.), Laboratory Works in Landscape Architecture (Morimoto, Y.)

Graduate School of Global Environmental Studies: Landscape Ecology and Planning (Morimoto, Y.), Seminar in Landscape Ecological Conservation (Morimoto, Y.), Theory of Ecological Impact Mitigation (Morimoto, Y.), Regeneration of Woodland in Countryside (Fukamachi, K.), Internship in Environmental Management (Morimoto, Y.), Seminar on Environmental Management (Imanishi, J.)

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Morimoto, Y.: Kyoto Prefecture University (Landscape Design, Forest Management)

Fukamachi, K.: Kyoto Prefecture University (Environmental System), University of Shimane (Forest landscape and management)

Imanishi, J.: Kyoto Seika University (Landscape Design)

### ***Open seminar***

Morimoto, Y.: Green and Kyoto as Smart Adaptation. “Town Creation of *Fuga*: From viewpoints of water and green” (Cooperated Forum of Graduate School of Human and Environmental Sciences, Kyoto University and Kyoto City), February 5, 2009, Kyoto University

Morimoto, Y.: “Save the Flowering cherries of One Thousand Years: Yoshino Forum in Nara” (Group of Saving Yoshino Flowering Cherries, The Yomiuri Shimbun Osaka Headquarter, NHK Nara Broadcast Station), March 7, 2009. (Forum Speaker)

Fukamachi, K.: Nature and community development of Kohoku. “Town Creation of *Fuga*: From viewpoints of landscape and green” (Cooperated Forum of Graduate School of Human and Environmental Sciences, Kyoto University and Kyoto City), March 7, 2009, Kyoto University

Imanishi, J.: On the Forest Therapy. Kamo-Nature School, Kyoto Prefectural Kizu City Kamo Town Commerce and Industry Association, February 26, 2009 (Lecturer)

Imanishi, J.: Green Environment. the 4th Expo’70 Park Natural Environment Seminar, the Expo’70 Park, September 13, 2008

## **B-3. Overseas teaching**

### ***Students and research fellows from abroad***

Research student (1), (GSGES) Doctor course (1) (Korea), Master course (1) (Malaysia)

## **C. Other remarks**

Morimoto, Y.: Central Environmental Council (Extraordinary Members of the Natural Environment Group), Expert Committee for Environmental Research and Technology Promotion of Ministry of Environment, Kyoto City Scenice Beauty Committee, Kyoto City Scenic Beauty Consultant, Kyoto City City Planning Board Member, Committee Member of City Planning of Osaka Prefecture, Committee Member of the Council of Park and Greenery of Kobe City, Executive Board Member of the Council of Urban Greenery Initiative of Kyoto City, Director of the Promotive Society of Urban Greenery Initiative of Kyoto City, Councilor of Japan Highway Landscape Association, Committee Member of

Public Association for Forests and Greenery of Kyoto Prefecture, Chair of Committee of Utilization and Conservation of Yodo Main River, Research Advisor of Organization for Landscape and Urban Greenery Technology Development, Committee Member of Natural Environment of Makioo River Dam (Osaka Prefecture), Committee Member of Town Planning of Kizu District (Academic Research City Promotion Institution), Executive Board Member of NPO Green Environment, Executive Board Member of Natural Environment Restoration Society

Fukamachi, K: Kyoto City Scenice Beauty Committee, Kyoto City Scenic Beauty Consultant, Kyoto City City Planning Board Member, Kyoto City Environmental assessment Board Member, Committee Member of Forest Council of Kyoto Prefecture, Committee Member of Environment Council of Kyoto Prefecture, Committee Member of Landscape Council of Kyoto Prefecture, Committee Member of Environment Council of Shiga Prefecture, Executive Board Member of NPO Satoyama Network Seiya, Executive Board Member of NPO Hira-no-Satobito

Imanishi, J: Osaka Prefecture Referee Board of Proposals on Special Plants and Gardens (Board Member)

## 2.2.7 Laboratory of Erosion Control

*Staff Professor : Mizuyama, Takahisa, Dr. Agric. Sci.*

*Associate Professor: Kosugi, Ken'ichirou, Dr. Agric. Sci.*

*Postdoctoral fellows: Fujimoto, Masamitsu, Dr. Agric. Sci.*

*Katsura, Shinya, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (5)*

*Master's program : (8)*

*Undergraduate: (4)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Mechanism of sediment movement

Basic research has been carried out on debris flow, flash flood, and shallow landslide. The relationship between shallow landslide and underground pipe flow and the flow in bedrock are studied particularly.

##### b) Countermeasures to prevent or reduce sediment disasters

Effective permeable dams are investigated in order to store the excessive sediment and, at the same time, not to damage the eco-system established in the streams. Barakawaeng landslide in Indonesia was studied in 2008.

##### c) Hydrologic cycle in forested slopes

Elements controlling hydrologic cycle in forest are studied. Effects of forest soil hydraulic properties on water discharge from forested watersheds are analyzed by laboratory experiments, field measurements, and numerical simulation methods. Seepage into bed rock and seepage along tree trunks and tree roots were observed. Simulation models to explain these phenomena were developed.

##### d) Sediment movement and integrated sediment management in river system

Sediment production process and sediment movement process in mountain region are investigated. A numerical model for calculating sediment routing is also developed. Using these results, the sediment management for mitigating sediment-related disaster and providing better natural environment from mountains to seashore is studied. Abrasion of stones was studied by experiments with rotating device and a flume.

##### e) Bedload measurement with hydrophone and pits

New bedload measurement methods; hydrophone and a pit bedload sampler were developed. They have been applied in the field. The data were collected and analyzed.

##### f) Survey and research on sediment disasters

Natural landslide dams formed by Iwate Miyagi Earthquake and Sichuan Earthquake were studied to predict flood discharge to evaluate countermeasures.

##### g) Buffer green belt against sediment hazards

The effects of trees against debris flow and landslide are studied to design buffer green belts. Infiltration and water storage characteristics are studied in different tree kinds.

##### h) Development a debris flow simulator equipped with GUI



A simulator 'Kanakano' is developed, that evaluate several types of debris flow control structures.

## A-2. Publications and presentations

### a) Publications

#### **Books**

- Mizuyama, T.: Sabo dam. Dictionary of Volcano (2<sup>nd</sup> Edit.) (edited by Shimozuru et al.), pp.387-389, Asakura Publishing Co. Ltd., Tokyo, 2008 (in Japanese)
- Miyata, S., and K. Kosugi.: Soil water repellency and generation of surface runoff (in *Devastation of Artificial Forest and Ater Runoff* edited by Onda, Y.), Iwanami, 2008. (in Japanese)
- Kosugi, K.: *Encyclopedia of River* (Edited by Takahashi, Y), Maruzen, 2009. (in Japanese)

#### **Original papers**

- Mizuyama, T.: Sediment hazards and SABO works in Japan. International Journal of Erosion Control Engineering (IJECE) 1-1; 1-4, 2008
- Inoue, K., T. Mori, T. Mizuyama: Two large landslide dams and outburst disasters in the Shinano River, Central Japan. INTERPRAEVENT 2008, Dornbirn, Vorarlberg, Austria vol. 1; 121-130, 2008
- Ishikawa, N., R. Inoue, K. Hayashi, Y. Hasegawa, T. Mizuyama: Experimental approach on measurement of impulsive fluid force using debris flow model. INTERPRAEVENT 2008, Dornbirn, Vorarlberg, Austria vol. 1; 343-354, 2008
- Mizuyama, T., Y. Satofuka, J. Laronne, M. Nonaka, M. Matsuoka: monitoring sediment transport in mountain torrents. INTERPRAEVENT 2008, Dornbirn, Vorarlberg, Austria vol. 1; 425-432, 2008
- Oda, A., Y. Hasegawa, N. Sugiura, T. Mizuyama: Recent trends in Japanese SABO model experiment technology. INTERPRAEVENT 2008, Dornbirn, Vorarlberg, Austria vol. 1; 433-444, 2008
- Mizuyama, T., M. Matsuoka and M. Nonaka : Bedload measurement by acoustic energy with Hydrophone for high sediment transport rate. Journal of the Japan Society of Erosion Control Engineering (JSECE) 61-1; 35-38, 2008 (in Japanese)
- Nakatani, K., T. Wada, Y. Satofuka, T. Mizuyama : Development of 'Kanakano', a wide use 1-D and 2-D debris flow simulator equipped with GUI. Monitoring, Simulation, Prevention and Remediation of Dense and Debris Flows II, WITpress; 49-58, 2008
- S.H.R.Sadeghi, T. Mizuyama, S. Miyata, T. Gomi, K. Kosugi, T. Fukushima, S. Mizugaki, Y. Onda : Determinant factors of sediment graphs and rating loops in a reforested watershed. Journal of Hydrology 356, Issues 3-4; 271-282, 2008
- Wada, T., Y. Satofuka, T. Mizuyama : Integration of 1- and 2- dimensional models for debris flow simulation. Journal of JSECE 61-2; 36-40, 2008 (in Japanese)
- Nakatani, K., Y. Satofuka, T. Mizuyama : Development of "kanako Ver.1.10", a wide use one dimensional debris flow simulator equipped with GUI. Journal of JSECE 61-2; 41-46, 2008 (in Japanese)
- Nakatani, K., T. Wada, Y. Satofuka, T. Mizuyama: Development of an user friendly debris flow simulator. Proceedings of the 4<sup>th</sup> Symposium on Sediment-Related Disasters; 149-154, 2008 (in Japanese)
- Mizutani, T., Y. Satofuka, D. Tsutsumi, T. Mizuyama (2008): Moisture changes in deposits on a steep stream. JJSECE 61-3; 27-30, 2008 (in Japanese)
- Oda, A., T. Mizuyama, K. Mizuyama, Y. Hasegawa : The estimate method of erosion rate of

- cohesive materials (CRL-AET). ICSE-4 Tokyo 2008, C-8; 430-435 CD, 2008
- Tsutsumi, D., T. Mizuyama, M. Nonaka, M. Fujita, M. Shida(2008) Development of a sediment flow monitoring system in a mountainous catchment. Disaster Prevention Research Institute, Kyoto University, 50B; 661-668, 2008 (in Japanese)
- Masuda, S., T. Mizuyama, A. Oda, H. Otsuki(2008):Deposition and erosion at a river confluence due to a difference in peak flood times, JJSECE 61-4; 27-31, 2008 (in Japanese)
- Laurentia Dhanio, T. Mizuyama, K. Kosugi, Agnes Rampisela: Changes in sediment discharge after the collapse of Mt. Bawakaraeng in south Sulawesi, Indonesia. JJSECE 61-4; 32-38, 2008
- Dhanio, L.L., T. Mizuyama, K. Kosugi, D.A.A. Rampisela : Changes in sediment discharge after the collapse of Mount Bawakaraeng in South Sulawesi, Indonesia. Sediment Dynamics in Changing Environment, IAHS Publ. 325; 607-611, 2008
- Nakatani, K., T. Wada, Y. Satofuka, T. Mizuyama: Development of “kanako 2D(ver.2.00)” a user friendly one- and two- dimensional debris flow simulator equipped with a graphical user interface. IJ-ECE 1-2, 63-73, 2008
- Yasuda, Y. T. Mizuyama, M. Touhei and T. Taniguchi: Erosion and sediment outflow from devastated basin where hillside works has been implemented and influence on the downstream river. J-JSECE 61-5; 12-20, 2008 (in Japanese)
- Musashi, Y., T. Mizuyama :Investigation on collapsed soil movement in disastrous slope failures. J-JSECE 61-5; 31-36, 2009 (in Japanese)
- Wei-Li Liang, K. Kosugi, T. Mizuyama: A three-dimensional model of the effect of stemflow on soil water dynamics around a tree on a hillslope. Journal of Hydrology 366; 62-75, 2009
- Oda, A., T.Mizuyama, K. Miyamoto: Experimental study on the shape of small landslide dams in torrents and the discharge hydrograph during an outburst. Annual Journal of Hydraulic Engineering, JSCE 53; 691-696, 2009 (in Japanese)
- Satofuka, Y., T.Mizuyama : Numerical simulation of study debris flow developing on unsaturated deposit. Annual Journal of Hydraulic Engineering, JSCE 53; 697-702, 2009 (in Japanese)
- Nakatani, K., Sumaryono, Satofuka, Y., T.Mizuyama : Application of a debris flow simulation ‘Kanako’to a debris flow danger torrent. Annual Journal of Hydraulic Engineering, JSCE 53; 703-708, 2009 (in Japanese)
- Ito,H. S. Yazawa, K. Ishida, S. Yamashita, Y. Sako, K. Takahashi and T. Mizuyama : Sediment discharge observation in Yotagiri River. J- JSECE, 61-6; 19-26, 2009 (in Japanese)
- Kosugi, K.: Comparison of three methods for discretizing storage term of the richards equation. Vadose Zone J., 7; 957-965, doi:10.2136/vzj2007.0178, 2008.
- Gomi, T., R.C. Sidle, S. Miyata, K. Kosugi, and Y. Onda: Dynamic runoff connectivity of overland flow on steep forested hillslopes: scale effects and runoff transfer. Water Resour. Res., 44; W08411, doi:10.1029/2007WR005894, 2008.
- Zhang, Z., T. Fukushima, Y. Onda, T. Gomi, S. Mizugaki, Y. Asano, K. Kosugi, S. Hiramatsu, H. Kitahara, K. Kuraji, T. Terajima, K. Matsushige: Baseflow concentrations of nitrogen and phosphorus in forested headwaters in Japan. Sci. Total Environ., 402; 113-122, DOI: 10.1016/j.scitotenv.2008.04.045, 2008.
- Katsura S., K. Kosugi, T. Mizutani, S. Okunaka, T. Mizuyama: Effects of bedrock groundwater on spatial and temporal variations in soil mantle groundwater in a steep granitic headwater catchment. Water Resour. Res., 44; W09430, doi:10.1029/2007WR006610., 2008.

- Gomi, T., R.C. Sidle, M. Ueno, S. Miyata, and K. Kosugi: Characteristics of overland flow generation on steep forested hillslopes of central Japan. *J. Hydrol.*, 361; 275–290, doi:10.1016/j.jhydrol.2008.07.045, 2008.
- Hayashi, Y., K. Kosugi, and T. Mizuyama: Characterization of soil water retention curves of a natural forested hillslope using a scaling technique based on a lognormal pore-size distribution. *Soil Sci. Soc. Am. J.*, 73; 55–64, doi:10.2136/sssaj2007.0235, 2008.
- Kosugi, K., Y. Yamakawa, N. Masaoka, and T. Mizuyama: A combined penetrometer–moisture probe for surveying soil properties of natural hillslopes. *Vadose Zone J.*, 8; 52–63, doi:10.2136/vzj2008.0033, 2009.
- Zhang, Z., T. Fukushima, P. Shi, F. Tao, Y. Onda, T. Gomi, S. Mizugaki, Y. Asano, K. Kosugi, S. Hiramatsu, H. Kitahara, K. Kuraji, T. Terajima, and K. Matsushige: Seasonal changes of nitrate concentrations in baseflow headwaters of coniferous forests in Japan: A significant indicator for N saturation. *CATENA*, 76(1); 63–69, 2008.
- Mukhlisin, M., M.R. Taha, and K. Kosugi: Numerical analysis of effective soil porosity and soil thickness effects on slope stability at a hillslope of weathered granitic soil formation. *Geosciences Journal*, 12(4); 401–410, DOI 10.1007/s12303-008-0039-0, 2008.
- Kosugi, K., S. Katsura, T. Mizutani, H. Kato, T. Mizuyama, K. Goto, K. Ishio: Roles of deep bedrock groundwater in surface hydrological processes in a headwater catchment. *From Headwaters to the Ocean* (Ed. Taniguchi, M. et al.); 341–347, Taylor & Francis Group, London, 2008.
- Hayashi, Y., K. Kosugi, T. Mizuyama: Change in hydraulic properties of forest soil resulting from removal of litter and compaction of human traffic. *From Headwaters to the Ocean* (Ed. Taniguchi, M. et al.); 117–122, Taylor & Francis Group, London, 2008.
- Liang, W.L., K. Kosugi, Y. Yamakawa, T. Mizuyama: Generation of a saturated zone at the soil–bedrock interface around a tree. *From Headwaters to the Ocean* (Ed. Taniguchi, M. et al.); 69–74, Taylor & Francis Group, London, 2008.

## **Reviews**

- Mizuyama, T. : Balance between Information and Action Techniques in Sabo Engineering. *J-JSECE*, 61-1;1-2, 2008 (in Japanese)
- Satofuka, Y., T. Mizuyama, K. Kosugi: Debris flow occurrence and its development on unsaturated torrent bed. 2008 Sabo Technical Center Reports; 71-83, 2008 (in Japanese)
- Katsura, S., K. Kosugi, H. Kato, M. Fujimoto, T. Mizuyama: Field observation and physical tests at Mount Nishi-otafuku in Rokko-mountain. *J-JSECE*, 61-4; 52-55, 2008 (in Japanese)
- Mizuyama, T.: Structural countermeasures for debris flow disasters. *IJ-ECE*, 1-2; 38-43, 2008
- Kosugi, K., Y. Yamakawa, N. Masaoka, T. Mizuyama: Soil survey and hydrological observation on steep forest slope. *J-JSECE* 61-6; 54-58, 2009 ( in Japanese)

## **b) Conference and seminar papers presented**

- The 119th annual meeting of Japanese Forestry Society (5 presentations)
- 2008 annual meeting of Japan Society of Erosion Control Engineering (26 presentations)
- International Association of Hydrological Science Conference (4 presentations)
- INTERPRAEVENT 2008 (4 presentations), IAHS-ICCE symposium (1 presentation), International Debris Flow Symposium (1 presentation), Annual Journal of Hydraulic Engineering, JSCE (3 presentations)
- American Geophysical Union (6 presentations)

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Mizuyama, T.: Science Council of Japan (Associate member), Japan Society of Erosion Control Engineering (president), Japanese Geomorphological Union (member of committee), Japan Society for Civil Engineers, the Japan Landslide Society, Japan Society for Natural Disaster Science, the Japan Society of Revegetation Technology, Japanese Forestry Society, Japan Society of Hydrology & Water Resources

Kosugi, K.: Japan Society of Erosion Control Engineering (member of committee), Japanese Forestry Society (member), Japan Society of Hydrology & Water Resources (member), Japanese Society of Soil Physics (member)

#### ***Research grants***

##### **Monbusho research grant:**

General scientific research (A) (1); Development of a combined rock-soil-plan-atmosphere model, and flood and draught predictions at ungauged mountainous watersheds (Head: Tani, Member: Kosugi et al.)

General scientific research (B); Physical analyses on critical rainfall to trigger shallow landslides (Head: Kosugi, Member: Mizuyama et al.)

### **A-4. International cooperations and overseas activities**

#### ***International Meetings***

Mizuyama, T: INTERPRAEVENT 2008 (Chairman, presentation), International Hydraulic Engineering Research (Presentation)

Kosugi, K: American Geophysical Union (Presentation)

#### ***Membership in international academic societies***

Mizuyama, T.: Editor of Journal of Hydrological Sciences (editor), International Workshop on Debris Flow Hazard Mitigation (member of the International Committee)

Kosugi, K.: SSSA, IAHS, IUFRO-J, AGU

#### ***International joint researches, overseas research surveys***

Kosugi, K.: Joint Research on Integrated Watershed Management for Sustainable Water Use in a Humid Tropical Region (Indonesia)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Theory of Erosion Control 1,2 (Mizuyama), Practice in Erosion Control (Mizuyama, Kosugi), Planning of Erosion Control (Mizuyama, Kosugi), Reading of Foreign Literature II (Mizuyama, Kosugi), Special Seminar on Erosion Control 1,2 (Mizuyama, Kosugi), Basic Science for Forest and Biomaterials III (Mizuyama), Forest and Biomaterial Science III (Kosugi), Laboratory Course in Forest and Biomaterials Science III (Mizuyama, Kosugi)

Graduate level: Theory of sediment induced disaster control (Kosugi), Advanced theory of Erosion Control (Mizuyama), Advanced experiment of Erosion Control (Mizuyama, Kosugi),

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Mizuyama, T.: Kyoto Prefectural Univ. (Materials and constructive methods), Japan International Cooperation Agency (Infrastructure), College of Land, Infrastructure, Transport and Tourism (Sediment related hazard mitigation)

## **B-3. Overseas teaching**

### ***Students and research fellows from abroad***

Students from abroad: 2 (Taiwan, Indonesia)

JICA trainee: 1 (Indonesia)

# Chair of Biomaterials Technology

## 2.2.8 Laboratory of Biomaterials Design

*Staff Professor* : Nakano, Takato, D. Agric. Sci.

*Lecturer* : Nakamura, Masashi, D. Agric. Sci.

*Assistant Professor* : Murata, Koji, D. Agric. Sci.

*Students and research fellows*

*Doctor's program* : (3)

*Master's program* : (5)

*Undergraduate* : (3)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

- a) Characterization of physical properties of wood: Physical properties of wood such as relaxational behavior, fatigue properties, and water adsorption are affected by ultrastructure and various factors, for example moisture content, temperature and so on. Effects of these factors on physical properties are thermodynamically researched by relating to ultra-structure of wood. Prediction of fatigue life of wood is analytically examined on the basis of various factors associated in fatigue life. Additionally, relationship between adsorption water and the above properties is also researched.
- b) Swelling mechanism of cell wall and physical properties: Swelling behaviour of cell wall with water adsorption is tightly related to physical properties of wood and gives many information. Relationship between adsorption water and swelling behaviour is examined using a model of cell wall. Swelling behaviour of wood and wood cell walls is also visualized and analyzed by using digital image correlation method.
- c) Fracture mechanics of anisotropic materials, and strength designing for wooden structural elements: Metal and plastics are isotropic materials but wood is an anisotropic material. Strength of wood parallel to the grain is extremely high because of its cellulose filament winding around the cell walls. This is the reason why wood is light and strong. Because of this reason wood is consequently used for building and furniture in large quantities. Mechanics of anisotropic material is necessary for designing of these structural elements. Real stresses-strains curve is measured using image correlation technique.
- d) Nondestructive grading of lumber: Wood has large deviation in strength like as other natural products. Since strength of fifth percentile exclusive limit is generally used for strength designing, nondestructive grading is important for effective use of wood resources. Thermal changes during repeated bending are tried to use for detecting defects (knot and others), and deflection distribution curves and optical properties are also used for evaluating strength.
- e) Properties of wood as sensory stimuli to human: Wood is one of the most friendly and comfortable material for human. Dominant factors of such effects are investigated scientifically and its application to interior designing are studied. For example; i) Investigation on

characteristics of wood as visual stimuli, especially, grain figure, color and glossiness, and its application to the designing of interior space and furniture. ii) Generation of wood grain figures by computer graphics. iii) Formulation of relations between psychological impressions, especially 'natural' and 'comfortable' images and physical characteristics of visual images. iv) Evaluation of visual inducement of wood by using eye-tracking method.

## A-2. Publications and presentation

### a) Publications

#### *Original papers*

- Y. Ohmae, Y. Saito, M. Inoue, T. Nakano: Water adsorption process of bamboo heated at low temperature. *J Wood Sci*, 55; 13-17, 2009
- Y. Ohmae, Y. Saito, M. Inoue, T. Nakano: Mechanism of water adsorption capacity change of bamboo by heating. *Holz als Roh-und Werkstoff*, 67; 13-18, 2009
- M. Shiga and T. Nakano: Effects of heating at lower temperature on water adsorption behavior for wood. *Zairyo (Journal of the society of materials science, Japan)*, 58; 175-179, 2009
- K. Bessho and T. Nakano: Analysis of adsorption and desorption processes for heated wood. *Zairyo (Journal of the society of materials science, Japan)*, 58; 53-56, 2009
- S. Aoyagi and T. Nakano: Effects of longitudinal and radial position on creep for bamboo. *Zairyo (Journal of the society of materials science, Japan)*, 58; 57-61, 2009
- Y. Ishikura and T. Nakano: Compressive stress-strain properties of natural materials treated with NaOH. *Holzforschung*, 62; 448-452, 2008
- T. Nakano: Analysis of cell wall swelling on the basis of a cylindrical model. *Holzforschung*, 62; 352-356, 2008
- J. Miyazaki, T. Nakano: Fracture Behavior of Laminated Wood Bonded with Aqueous Vinyl Polymer-Isocyanate Resin and Resorcinol-Formaldehyde Resin under Impact Fatigue. *J. Appl. Polym. Sci.*; 276-281, 2008
- Murata, K., Koyabu, H., Nakano, T.: Effect of Interlocked Laminates on Fracture of Laminated Veneer Lumber in Dowel-Bearing Strength Test. *Journal of The Society of Materials Science, Japan*, 57(4); 322-327, 2008

#### *Reports*

- Nakamura, M.: Where do we look at on wood? "Relationships between wood and human mental and physiological responses" (Report of the 10 th research subcommittee of JWRS); 76-90, 2009
- Nakamura, M.: Feature extraction of wood grain pattern using image analysis. "Kyoto forum on engineering, structure and properties of foods"; 1-6, 2008
- Nakamura, M.: Symposium "Nice utilization of wood and bamboo in house." *Wood industry*, 63 (5); 23-233, 2008

### b) Conference and seminar papers presented

- The 26th Annual Meeting of Japan Wood Technological Association, Tokyo, Oct. 23-24, 2008: 1 presentations (Nakamura)
- The 59th Annual Meeting of Japan Wood Research Society, Matsumoto, Mar. 15-17, 2009: 12 presentations (Nakano, Nakamura, Murata)

### A-3. Off-campus activities

#### *Membership in academic societies*

Nakano, T.: The Japan Wood Research Society (Member of the screening committee for the awards, Member of the editorial board) ; Wood Technological Association of Japan (An auditor of Kansai Branch)

Nakamura, M.: The Japan Wood Research Society (Member of the committee for information processing, Secretary of the Division of Living Comfort, Member of the working committee for annual meetings); Japan Society of Physiological Anthropology (Trustee for homepage); Wood Technological Association of Japan (Member of the planning committee of Kansai Branch)

Murata, K.: The Society of Materials Science, Japan (Councilor, Committee member of the Division of Wood Based Materials, Editorial board member of the journal; Wood Technological Association of Japan (Secretary of the planning committee of Kansai Branch, Member of the committee for fast growing trees of Kansai Branch), The Japan Wood Research Society (Editorial board member of the journal).

#### *Research grants*

Nakano, T.: JSPS Grant-in-Aid for Scientific Research (C), Water in wood substance and Swelling properties of Cell wall (Head)

Murata, K.: JSPS Grant-in-Aid for Exploratory Research, Fatigue of wooden blade for vertical axis wind turbines (Head)

Nakamura, M.: Sekisui Chemical Grant Program for Research on Manufacturing Based on Learning from Nature, Principle of Design for “Irregular” Pattern Learning from Wood-grain Figure (Head)

Murata, K.: NEDO Industrial Technology Research Grant Program, Environment Friendly Wood-based Material and New Grading System (Head)

### B. Educational Activities (2008.4-2009.3)

#### B-1. On-campus teaching

##### a) Courses given

Under graduate level: Basic Science for Forest and Biomaterials III (Nakano), Forest and Biomaterials Science III (Nakano), Properties of Biomaterials (Nakano), Wood and Timber Construction (Nakamura), Practice in Biomaterials Design (Nakano, Nakamura, Murata), Information Technology in Forest and Biomaterials Science (Nakamura, Murata), Laboratory Course in Forest and Biomaterials Science III (Nakamura, Murata), Laboratory Course in Physics of Forest and Biomaterials (Nakamura, Murata), Laboratory Course in Wood Technology (Nakamura, Murata), Architectural Design and Drawing (Nakamura)

Graduate level: Biomaterials Design I (Nakano), Seminar in Biomaterials Design (Nakano, Nakamura, Murata), Laboratory Course in Biomaterials Design (Nakano, Nakamura, Murata)

#### B-2. Off-campus teaching, etc.

##### *Part-time lecturer*

Nakamura, M.: Kyoto city university of arts (Material science 5)



*Open seminar, etc.*

Nakamura, M.: “Why wood grain pattern does attract us?” in Special Symposium by Graduate School of Agriculture, Kyoto Univ, 17~28 Nov., 2008 (poster and lecture); “Feature extraction of wood grain pattern using image analysis” in Kyoto forum on engineering, structure and physical properties of foods, Kyoto, 25 Nov., 2008 (lecture); “Wood and living environment” in wood science seminar of wood technological association Japan Kansai branch, Osaka, 14 Nov. 2008 (lecture); “Mystery of wood grain pattern” in Research competition of forest and forestry 2009 by KINKI & CHUGOKU Regional Forest Office, Osaka, 14 Nov. 2008 (lecture).

### C. Other remarks

Nakano, T. : [Inside campus] Director of Division of Forest and Biomaterials Science, Committee for Educational Affairs of Graduate School of Agriculture, Committee for General Affairs of Students of Department of Agriculture.

Nakamura, M.: [Award] Japan Wood Research Society Best Paper Award 2008; [Inside campus] Advisory Board for Information Systems in Faculty of Agriculture; Committee for Computer Literacy in Center of Information and Multimedia Studies; [Outside campus] Member of data collection and maintenance committee in Japan Housing and Wood Technology Center.

## 2.2.9. Laboratory of Wood Processing

<i>Staff</i>	<i>Professor</i>	<i>: Okumura, Shogo, Dr. Agric. Sci.</i>
	<i>Associate Professor</i>	<i>: Fujii, Yoshihisa, Dr. Agric. Sci.</i>
	<i>Assistant Professor</i>	<i>: Sawada, Yutaka, M. Agric. Sci.</i>
	<i>Assistant Professor</i>	<i>: Yanase, Yoshiyuki, M. Agric. Sci.</i>
	<i>Research Assistant (part time)</i>	<i>: Fujiwara, Yuko, Dr. Agric. Sci.</i>

### *Students and research fellows*

*Doctor's program : (1)*

*Master's program : (2)*

*Undergraduate : (2)*

## **A. Research Activities (2008.4-2009.3)**

### **A-1. Main subjects**

#### **a) Fundamental problems in wood machining**

The main subjects are concerned with solution of cutting mechanism of wood and wood based materials and of phenomena in wood cutting, by thermographic measurement and analysis of tool-chip-work system in wood cutting. For the evaluation of the surface roughness of wood, the novel filtering method and 2D and 3D roughness parameters that coincide with tactile sensation are proposed. Influence of machine surface finishing on the performance of painted surface is also studied.

b) Improvements of woodworking machines and cutting tools and automatization of machining process. For the improvements of accuracy, efficiency and safety of the wood cutting and grinding, following subjects are studied: analysis of deformation and vibration of tool using FEM, analysis of stress generated on the tool, and prediction of concentration of airborne dust in the woodworking chamber using computer simulation and the optimization of a condition of dust collection. An algorithm of pattern recognition of the processing sound to simulate the auditory sense of the skilled worker and its master process is developed. It is also applied to the control of the grinding machine of band saw tooth to realize fully automatic control using artificial intelligence technique. Another subjects are pattern recognition of the transient signals from wood using wavelet analysis, simulation of distribution of temperature and stress during drying wood, and simulation of roll pressing of wood using FEM as an application of CAE to the woodworking process.

#### **c) Scanning of wood and wood based materials**

The subjects on this field are use of acoustic emission (AE) for prediction of checks and for solution of mechanism of AE generation during the drying of wood, thermographic detection of starved joints of wood and the grain direction and recognition of blue stained wood with image analysis and pattern recognition technique. Movement of free water in wood tissues under drying is also evaluated by a micro-focus X-ray CT system. Fundamental researches for the analysis of biology of wood-destroy insects and practical application for detection of termite attack using AE monitoring are studied, including developments of portable AE detector, new AE sensor using PVDF film, waveguides, and AE monitoring system for wooden house. Detection of metabolic gas components from termite colony such as H<sub>2</sub>, CH<sub>4</sub> and CO<sub>2</sub> are also studied. Development of

physical barrier using crushed cement-stabilized sludge for termite attack. Fact-findings of the damages by termite and other wood-destroy insects in the houses and cultural properties, and research of damage using AE monitoring. Detection of cavity and deterioration points in the material using radar and millimeter wave for the non-destructive inspection of decay and damage by wood-destroy insects in the wooden house.

## **A-2. Publications and presentations**

### **a) Publications**

#### ***Original Papers***

- Tshushiya, A., Y. Fujiwara and S. Okumura : Cutting performance and wear characteristics of Chromium Nitride-coated Tools, Edge wear and machined surface quality in end-grain milling of oak. *Mokuzai Gakkaishi*, 54(5), 263–271, 2008
- Komine, Y., R. Kigawa, M. Harada, Y. Fujii, Y. Fujiwara and W. Kawanobe :Damage by a rare kind of anobiid, *Priobium cylindricum*, found during restoration work of Sanbutsu-do, Rinnohji temple in Nikko (World Heritage). *Science for Conservation*, No.48, 207–213, 2009
- Fujii, Y., Y. Fujiwara, M. Harada, R. Kigawa and Y. Komine : Evaluation of insect attack in wooden historic buidings using drill resistance method – A case study on Sanbutsu-do of Rinnohji tempe. *Science for Conservation*, No.48, 215–222, 2009

#### ***Reviews***

- Fujii, Y.: Problems and future prospect of diagnosing techniques of wood deterioration. *Wood Preservation*, 34(6), 256-260, 2008

#### ***Reports***

- Fujii, Y. : Future prospect of maintenance techniques for long life house. *Wood Preseravation*, 34(4), 74–178, 2008
- Fujii, Y. : Present status and future prospect of Wood Technology 10. *Wood Machining. Mokuzai Kogyo*, 63(11), 522–524, 2008
- Fujii, Y. : Maintenance Manual of Wooden Exterior Constructions, The Japan Wood Preseravation Society, 2008
- Fujii, Y. : Literature Review, *Mokkokikai*, No.208, 25–26, 2008
- Fujii, Y. : Japanese house overviewed form the points of maintenance technologies. *Journal of the Union "Kenchiku-Kogyo-Kyodo-Kumiai, Kyoto Prefecture*, No.84, 10–14, 2008
- Fujii, Y. : Diagnose of bio-degradation and maintenance technology of wooden religious buildings, *Inspection Engineering*, 13(5), 55–62, 2008

### **b) Conference and seminar papers presented**

- The 24<sup>th</sup> Annual Meeting of Japan Wood Preservastion Association (Tokyo, 2008.6.2) : 3 (Okumura, Fujii, Yanase, Fujiwara)
- 2008 Annual Meeting of the Japan Society for Precision Engineering (Sendai, 2008.9.17-18) :1 (Fujii, Fujiwara)
- The 26<sup>th</sup> Annual Meeting of Wood Technological Association of Japan ( Tokyo, 2008.10.23-24 ) :1(Okumura, Fujii, Fujiwara)
- The 20<sup>th</sup> Annual Meeting of the Japanese Society of Environmental Entomology and Zoology

(Kyoto, 2008.11.16-17) :4(Okumura, Fujii, Yanase, Fujiwara)  
 The 19<sup>th</sup> International Acoustic Emission Symposium (Kyoto, 2008.12.9-12) :1 (Okumura, Fujii, Yanase)  
 The 6<sup>th</sup> Conference of the Pacific Rim Termite Research Group (Kyoto, 2009.3.2-3) :1 (Okumura, Fujii, Yanase)  
 The 58<sup>th</sup> Annual Meeting of Japan Wood Research Society (Matsumoto, 2009.3.15.17) :5 (Okumura, Fujii, Sawada, Yanase, Fujiwara)

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Okumura, S.: The Japan Wood Research Society (director, chairperson of Information Committee), Wood Technological Association of Japan (councilor, director of Kansai Branch)  
 Fujii, Y.: Wood Technological Association of Japan (Kansai branch, organizing committee), Japan Wood Preserving Association (director, committee chair of wood degradation inspector)  
 Sawada, Y.: Wood Technological Association of Japan (Kansai branch, organizing committee), Japan Society of Materials Science (Kansai branch, organizing committee, co-chair for finance)  
 Yanase, Y. : Japan Society of Materials Science (Organizing Committee, Co-chair for Finance of Division of Wooden Materials)

#### ***Research grants***

Grant-in-Aid for Scientific Research (KAKENHI)  
 Fujii, Y: Grant-in-Aid for Scientific Research (A), Nondestructive testing of wood and wood based materials using millimeter wave imaging (Representative)

### **A-4. International co-operations and overseas activities**

#### ***International meetings (roles)***

## **B. Educational Activities (2006.4-2007.3)**

### **B-1. On-Campus teaching**

#### **a) Courses given**

Undergraduate level: Forest and Biomaterials Science III (Okumura), Basic Forest and Biomaterials Science III (Fujii), Wood Processing I (Okumura), Wood Processing II (Fujii), Laboratory Course in Physics of Forest and Biomaterials (Fujii, Sawada, Yanase), Laboratory Course in Wood Processing (Fujii, Sawada, Yanase), Seminar for Forest Products Engineering (Okumura, Fujii), Reading of Foreign Literature II (Okumura)  
 Graduate level: Wood Processing I (Okumura), Seminar in Wood Processing (Okumura, Fujii), Laboratory Course in Wood Processing (Okumura, Fujii, Sawada, Yanase)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Okumura, S.: Graduate School of Agricultural and Life Science, Tokyo University (Special Lecture for Material and Housing Sciences III)  
 Fujii, Y.: Workshop of the Foundation “Keikan-Machidukuri Center, Kyoto City”, 2008.10.7

(Lecturer)

Fujii, Y.: Workshop of the corporation aggregate "Kenchikishi-Jimusho-Kyokai, Kyoto City", 2008.11.8

(Lecturer)

Fujii, Y.: Program for building technology of wooden houses, Hyogo Prefecture, 2009.2.27 (Lecturer)

Yanase, Y. : Workshop of the Foundation "Keikan-Machidukuri Center, Kyoto City", 2008.7.7

(Lecturer)

Yanase, Y.: Workshop of the Union "Kenchiku-Kogyo-Kyodo-Kumiai, Kyoto Prefecture", 2009.3.5

(Lecturer)

### **B-3. Overseas teaching**

#### ***Students and research fellows from abroad***

Student (Doctor course) 1 (Ghana)

### **C. Other Remarks**

Okumura, S.: Councilor, Education and Research Council, Kyoto University; Dean, Graduate School and Faculty of Agriculture, Kyoto University; Technical Development Adviser, Hyogo Prefecture

Fujii, Y.: Visiting Researcher, National Research Institute for Cultural Properties, Tokyo

### 2.2.10 Laboratory of Fibrous Biomaterials

<i>Staff</i>	<i>Professor:</i>	<i>Kimura Tsunehisa, Dr.Eng.Sci</i>
	<i>Associate Professor:</i>	<i>Yamauchi, Tatsuo, Dr. Agric. Sci.</i>

### *Students and research fellows*

*Doctor's program* : (1)      *Research fellow* : (2)

*Master's program* : (5)

*Undergraduate* : (5)

### A. Research Activities (2008.4-2009.3)

### A-1. Main subjects

### a) Processing of Cellulosic Materials Using Magnetic Fields

Using the technique of magnetic processing, we are trying to create novel cellulosic materials in which the alignment and pattern are finely controlled. These materials could show novel properties having mechanical, optical, thermal, and piezoelectric anisotropies.

(i) **Filler-in-cellulosic matrix:** we prepare 2-dimensional composite materials in which organic, inorganic, and metal particles are precisely aligned and patterned magnetically in cellulosic materials such as paper, cellophane, and films of cellulose derivatives. These composites are expected to exhibit anisotropic mechanical, optical, thermal, and electrical properties.

(ii) Cellulose-as-filler: the sizes of cellulose fibers are controlled from millimeter to nanometer sizes. Depending on their size, they exhibit various physical properties. In addition, by introducing nano particles onto the fiber, further functionalization of fibers can be achieved. By alignment of these fibers using magnetic field, 2-dimensional functional composites will be created.

b) Development of the technique of pseudo-single crystals and its application to diffraction method.

A magnetic method that we have developed enables to fabricate a pseudo-single crystal (PSC) from a powder sample. The obtained PSC gives rise to XRD equivalent to that obtained from a real single crystal. This method (PSC method) will provide the third way, coming after the powder method and the single crystal method in the diffraction methods including X-ray and neutron method. Since the protein structure analysis is becoming important, encouraged by a current trend of biorefinery, we expect an increasing demand to our PSC technique.

### c) Paper friction-Effect of real contact area-

Relating to real contact area against plane smooth surface, effects of the measuring conditions on paper friction, surrounding atmosphere and applied pressure, were examined. An optical interference method using a scanning laser microscope was adopted to measure the real contact area against a plane smooth surface. The estimated contact area of paper is around 1% of nominal area for common non-coated papers. The increase in the contact area with increasing relative humidity is considered as a cause of the increase in the friction coefficient with an increase in relative humidity. The contact area of non-coated paper generally increased in a ratio of two-thirds power of the apparent pressure over a wide range of pressure. It suggested that contact of the paper was generally elastic and this fact was one reason

**describing the decrease in the coefficient with increasing apparent pressure. However the decrease in the coefficient is little and the frictional behavior of paper can not be fully described by the contact area against a smooth surface.**

d) Role of the additives for new function development in paper materials

Fundamental mechanical and optical properties of papers were considered to comprehensively study the mechanism of strength development by addition of polyacrylamide dry strength resin (PAM) in relation to the application method. Handsheets made from lightly beaten hardwood kraft pulp with various amount of PAM were prepared by both the internal and external application methods. The difference in PAM distribution between internal and external application methods caused the difference in the mechanism of strength development. In the internal application method, the molecularly dispersed PAM within a fiber wall forms a kind of PAM-cellulose composite in which the bonding between those composite fibers may be stronger than that between cellulosic pulp fibers, leading to the increase in bond strength per unit bonding area. Furthermore, a slight increase of fiber strength as shown in an increase in zero-span strength might partly contribute the increase in tensile strength. On the other hand a formation of fiber-PAM-fiber bonding at the external method may reinforce fiber-to-fiber bonding. Temperature dependence of storage modulus and  $\tan \delta$  of the paper sheet added with PAM by external method showed the typical polymeric feature from PAM. The increasing behavior of  $\tan \delta$  with PAM content highly corresponded to the increase in tensile strength at external application method. These results supported the above described mechanism, i.e. a reinforcement of fiber fiber bonding by the surrounding fiber-PAM-fiber bonding as a major factor of strength increase in the external application.

e) Characterization of recycled paper

Paper recycling has become important in modern paper-making, however, it is well known that paper from kraft pulp shows a significant decrease in the tensile strength with increasing recycle number. The previous investigations by many researchers suggested that strong binding between microfibrils in fiber wall occurred during the drying process on recycling, generally referred to as the hornification . This reduces fiber conformability, leading to a decrease in fiber-to-fiber bonding area, and hence to paper strength reduction. In this study to confirm this explanation, laboratory made handsheets were subjected to a drying-rewetting cycle and a part of them were additionally and repeatedly disintegrated. Furthermore a series of handsheets having various tensile strength were made by means of beating. Comparison of basic properties and tensile behavior was conducted on these samples.

f) Blots by Chinese ink on Paper and the Evaluation Based on Klemm Method

Laboratory handsheets from softwood kraft pulp, having various basis weights, were prepared with or without wet pressing. Each part of them was soaked in Chinese ink for 5, 30, 60 seconds as Klemm method. After drying, they were scanned with an image scanner set 800 dpi. Threshold values were properly set so that soaked area became black, and the bitmap images were changed to binary images by this threshold values. Using these images, blots by the ink were studied on the blotting speeds, evenness of the outlines made by blots, and rises in luminance of the blotting heads. Average blotting speeds were estimated from the rises of the ink (max., mean, and min.) in certain time. Evenness of the outlines made by blots was estimated from the differences between max. and min. of the rises of the ink, blotting rates , fractal dimensions of the outlines. Rises in luminance of the blotting heads were estimated from the change in the rises of the ink and evenness of the outlines when thresholds increased.

## **A-2. Publications and presentations**

a) Publications

**Books**

**Original papers**

Nanorods of Endohedral Metallofullerene Derivative. T. Tsuchiya, R. Kumashiro, K. Tanigaki, Y. Matsunaga, M. O. Ishitsuka, T. Wakahara, Y. Maeda, Y. Takano, M. Aoyagi, T. Akasaka, M. T. H. Liu, T. Kato, K. Suenaga, J. S. Feong, S. Iijima, F. Kimura, T. Kimura, S. Nagase, *J. Am. Chem. Soc.*, **130**, 450-451 (2008)

Magnetic Alignment and Patterning of Cellulose Fibers. F. Kimura and T. Kimura, *Sci. Technol. Adv. Mater.* **9**(2), 024212 (2008)

Eddy-Current-Induced Magnetic Alignment of Electroconductive Particles under Rotating Magnetic Field. T. Kimura, T. Uemura, T. Araki, M. Sugitani, K. Kojima, and M. Tsubouchi, *Jpn. J. Appl. Phys.*, **47**(6), 4515-4517 (2008).

Orientation of Pearl Pigments Under High Magnetic Fields (2). Y. Fuchida, A. Takahashi, K. Kitahara, M. Yamato, T. Kimura, , *Printing Sci. & Tech.*, **45**(1), 27-32 (2008).

Magnetic Processing of Feeble Magnetic Materials: Magnetic Alignment of Clay Particles. T. Kimura, *The Clay Soc. Jpn.*, **47**(1), 13-15 (2008) .

Mihara, I. and Yamauchi, T.: Dynamic mechanical properties of paper containing polyacrylamide dry strength resin additive and its distribution within a fiber wall –Effect of application method- *J. Applied Polymer Sci* 110(6) 3836-3842 (2008)

Yamauchi, T. and Yamamoto, M.: Effects of repeated drying-and rewetting and disintegration cycles on fundamental properties of kraft pulp fibers and paper made from them *Appita J.* 61(5) 396-401 (2008)

Kawashima, N., Sato, J., and Yamauchi, T.: Paper friction –Effect of real contact area- *Seni Gakkaishi* 64(11) 329-335 (2008)

Kawashima, N., Sato, J., and Yamauchi, T : Paper friction at the various measuring conditions –Effect of relative humidity- *Seni Gakkaishi* 64(11) 336-339 (2008)

Mihara, I., Sakaemura, T., and Yamauchi, T.: Mechanism of paper strength development by the addition of dry strength resin and its distribution within and around a fiber wall –Effect of application method- *Nordic Pulp Paper Res. J.* (4) 382-388 (2008)

**Reviews**

b) Conference and seminar papers presented

Spring 2008 ACS National Meeting & Exposition (Salt Lake City) : 1paper ( invited ) T.



Kimura

3rd International Workshop on Materials Analysis and Processing in Magnetic Fields  
(MAP3) ( Tokyo ) 1 paper

IUCr2008 ( Osaka ) : 4 papers

The 4<sup>th</sup> meeting of Magneto-Science Soc. of Jpn. ( Hirosaki ) : 2 papers

The 2008 Annual Conference of Fiber Science and Technology Japan, 1 paper

The 75th Symposium on Paper and Pulp Research, 1 paper

The 17<sup>th</sup> Annual Conference of Packaging Science and Technology Japan, 1 paper

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

Kimura, T.: The Magneto Science Society of Japan (vice president), The Society of Polymer Science, Japan (Polymer Journal, Associate Editor), The Cellulose Society of Japan (Board member)

Yamauchi, T.: The Japan Technical Association of Pulp and Paper Industry (committee member for wood science and technology), The society of Japan Packaging Science and Technology (councilor, Associate editor)

#### **Research grant**

JSPS Research Grant

Yamauchi, T.: Grant-in-Aid for Scientific Research(B) Gelled biomass including cellulose turning to resources(coworker)

### **A-4. International cooperations and overseas activities**

Kimura T. : Asia-research center((Nagoya University)

#### ***International meetings (roles)***

Kimura ACS Cell Div. Anselme Payen Symposium, Organizer.

Yamauchi, T.: 2008 Progress in Paper Physics Seminar, Helsinki Finland, (Presentation)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Forest Science II (Kimura) Physical Chemistry in Bio-materials (Kimura), Pulp and Paper (Yamauchi), Laboratory Course in Forest and Biomaterials Science II (Yamauchi), Laboratory Course in the Basic Forest and Biomaterials Chemistry (Yamauchi), Laboratory Course in the Biomaterials Chemistry II (Kimura, Yamauchi), Seminar in Forest and Biomaterials Science (Kimura, Yamauchi)

Graduate level: Fibrous Biomaterials II (Yamauchi), Seminars in Fibrous Biomaterials (Kimura, Yamauchi), Laboratory Course in Fibrous Biomaterials (Kimura, Yamauchi)

### **B-2. Off Campus teaching, etc.**

*Open seminar, etc*

Kimura T. : Seminar in Graduate school of KyotoUniversity (lecturer)

### **C. Other Remarks**

Yamauchi, T: Representative of “Paper Science Forum”

# Chair of Biomaterials Function

## 2.2.11 Laboratory of Tree Cell Biology

*Staff*      *Associate Professor: Takabe, Keiji, Dr. Agric. Sci.*  
              *Assistant Professor: Yoshinaga, Arata, Dr. Agric. Sci.*  
              *Assistant Professor: Awano, Tatsuya, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (2)*

*Master's program : (6)*

*Undergraduate : (4)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Formation and ultrastructure of plant cell walls

Many subjects on the formation and ultrastructure of plant cell walls were investigated as the basic studies on plant materials. Immuno-electron microscopic methods were applied to the investigations of cell wall formation in *Populus*, *Eucalyptus* and softwood species. Deposition and arrangement of cellulose microfibrils in differentiating fibers in *Eucalyptus* were studied by using a newly equipped apparatus for freeze fracture. Formation of cellulose microfibrils by *Acetobacter* in mediums containing xylan, mannan and pectin, and their crystalline structures were studied by using a transmission electron microscope, FT-IR and NMR. Immunocytochemistry revealed the distribution of enzymes involved in lignin biosynthesis. It also showed the deposition process and distribution of hemicelluloses and lignins.

##### b) Diversity of wood structure and the quantitative evaluation

Structures and properties of woods considerably vary between and within species. In order to use wood effectively, variations in structures and properties should be characterized in detail and evaluated quantitatively. Then, the variations are ordered on several levels such as macro, micro and chemical levels, and analyzed by proper methods. For instance, quantitative evaluation of wood cell structures became possible by the image processing, especially by the Fourier transform and soft X-ray and cell shaped and arrangements were analyzed. Also minute shape changes in the wood drying were evaluated by the method: Three dimensional graphics were applied to the investigation of vessels and cellular structure of wood during differentiation. As to the chemical components of the cell wall, particularly characteristics of lignin composition and its variation among cellular elements were examined by the combination of the microscopic spectrophotometry, chemical analysis and immunocytochemistry.

##### c) Structural studies on the formation, physiology and functions of the cells in vascular bundles in plants.

Structures and behaviors of cell organellae, stored substances and walls in xylem and phloem cells are investigated mainly in trees, bamboos and grass, lianas in relation to their development, physiological events and functions. The distribution of living wood fibers in some trees and structural difference between liana and tree are investigated in relation to their

functions.

## **A-2. Publications and presentations**

### **a) Publications**

#### ***Original papers***

Zhang, C., Fujii, T., Abe, H., Fujiwara, T., Fujita, M., Takabe, K.: Anatomical features of radial resin canals in *Pinus densiflora*. IAWA Journal 29; 179-187, 2008

Kamitakahara, H., Yoshinaga, A., Aono, H., Nakatsubo, F., Klemm, D., Burchard, W.: New approach to unravel the structure-property relationship of methylcellulose. Self-assembly of amphiphilic block-like methylated cello-oligosaccharides. Cellulose 15; 797-801, 2008

Nishikawa, K.; Ito H., Awano T., Hosokawa M., Yazawa S.: Characteristic thickened cell walls of the bracts of the 'eternal flower' *Helichrysum bracteatum*. Annals of Botany 102; 31-37, 2008

### **b) Conference and seminar papers presented**

The 59th Annual Meeting of the Japan Wood Research Society: 11 papers

## **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Takabe, K.: International Academy of Wood Science (Fellow), The Japan Wood Research Society (Councilor)

Yoshinaga, A.: The Japan Wood Research Society (Editorial board member of the journal)

#### ***Research grants***

The Japan Society for the Promotion of Science Research Grants: Grant in Aid for Young Scientists (B): Comprehensive histochemistry of enzymes in hemicellulose biosynthesis using DNA aptamer (Awano)

## **A-4. International cooperation and overseas activities**

#### ***International meetings (roles)***

#### ***International joint researches, overseas research survey***

Yoshinaga: Characterization of lignin in transgenic trees that are grown in field for more than 10 years with altered lignin metabolisms(France)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-Campus teaching**

#### **a) Courses given**

Undergraduate level: Basic Forest and Biomaterials Science I (Takabe), Structural and Physiological Biology of Woody Plant Cells (Takabe), Formation of Plant Cell Walls (Takabe), Mushroom Science (Awano), Information Technology in Forest and Biomaterials Science (Awano), Reading of Foreign Literature II (Yoshinaga, Awano), Laboratory Course in Forest and Biomaterials Science I (Takabe, Yoshinaga, Awano), Laboratory Course in Forest and Biomaterials Biology (Takabe, Yoshinaga, Awano), Laboratory Course in Ultrastructural Observation of Wood (Takabe, Yoshinaga, Awano), Practice in University Forests I (Yoshinaga), Seminar in Forest and Biomaterials Science

(Takabe)

Graduate level: Tree Cell Biology II (Takabe), Seminar on Tree Cell Biology (Takabe), Laboratory  
Course in Tree Cell Biology (Takabe)

## **B-2. Off-Campus teaching**

*Open seminar, etc*

Yoshinaga: Kyoto University Open Seminar (Committee)

## **B-3. Overseas teaching**

*Students and research fellows from abroad*

Student (Doctor course) 1 (South Korea)

## 2.2.12 Laboratory of Chemistry of Composite Materials

*Staff      Professor    : Nishio, Yoshiyuki, Dr. Eng. Sci.*

*Lecturer   : Yoshioka, Mariko, Dr. Agric. Sci.*

*Assistant Professor: Teramoto, Yoshikuni, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program        : (3)*

*Master's program        : (8)*

*Undergraduate        : (4)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

The major specialization of this laboratory is the chemical conversion of renewable natural resources such as wood and its constituents (cellulose, lignin, etc.), starch, chitin, lipids, and so forth into useful materials showing specific functions in some advanced applications and/or adequate conformity with the environment. Various kinds of chemical techniques are employed, including interfacial reactions in bulk, solvolysis, molecular modifications, and microscopic hybridization with supplementary compounds, to design and fabricate new types of biodegradable polymers and composites, liquid crystals, and intellectual polymer networks, and so on.

##### a) New Functionalization of Polysaccharides and Related Natural Compounds

Naturally occurring polysaccharides represented by cellulose and chitin, and a polyphenol lignin have been re-evaluated recently as renewable organic resources. They are environmentally benign substances and possess a high potential to be newly developed for industrial and medical applications in themselves or in combination with various synthetic compounds. Our current research is concerned with utilization of the inexhaustible natural polymers as new functional chemicals or high-performance materials. Efforts are also devoted to elucidating several fundamental problems on the molecular and supramolecular structures and physical properties of carbohydrate polymers and related natural compounds. Of particular interest are (1) the microscopic incorporation (including graft-copolymerization) of cellulose and chitin with other polymers or inorganic substances, (2) the liquid crystallinity and chiroptical properties of cellulose and chitin derivatives, (3) the complex formation and crosslinking or gelation behavior of carbohydrate polymers and lignin derivatives, and (4) the molecular assembly of cholesterol-based lipids, each directed toward the design and fabrication of new, useful functional materials. Concretely, the material functionalities arousing interest include highly controllable biodegradability coupled with easiness of processing, and further extensions for special uses demanding dynamic controls, e.g., in shape memory-recovery performance or in novel optical, electro-optical, and magnetic functions.

##### b) Thermoplasticization and Liquefaction of Plant Biomass, Nanocomposite of Polymer / Biomass, and their Applications to High-performance, High-functional Materials

Wood can be converted to a thermally flowable material directly by chemical modifications in various structural levels, which may be termed “internal plasticization” of wood. In some cases, the thermoplastic property can be attained by blending the modified wood with supplementary plasticizers. By virtue of such plasticizing techniques, we can design and fabricate a variety of

wood-based, melt-moldable composites, applicable to many articles of daily use, housing materials, and so on. Wood can also be liquefied through reaction and solvolysis in phenols or polyhydric alcohols. In addition to fundamental studies to elucidate the liquefaction mechanism, we are making efforts to apply the high reactivity of the liquefied wood and ingredients, e.g., to preparations of composites for adhesives, molding materials, foams, and coatings which are desirable to be environmentally friendly or biodegradable in view of practical uses. It has also been studying that clay (layered silicate), silica and cellulose nanofiber are combined with the synthesized plastics, wood plastics or liquefied wood to get high performance and/or high functional nanocomposite materials. As well, studies directed towards utilization of other biomasses along the above-mentioned line are in progress.

## **A-2. Publications and presentations**

### **a) Publications**

#### ***Original papers***

- Teramoto, Y., S. H. Lee, and T. Endo: Phase structure and mechanical property of blends of organosolv lignin alkyl esters with poly( $\epsilon$ -caprolactone). *Polym. J.* 41 (3); 219-227, 2009
- Kuse, Y., D. Asahina and Y. Nishio: Molecular structure and liquid-crystalline characteristics of chitosan phenylcarbamate. *Biomacromolecules* 10 (1); 166-173, 2009
- Yoshioka, M., S. Mizohata and N. Shiraishi: Reactive Processing of Cellulose Acetate/Corn Starch Biodegradable Composite Materials and their Characterization, *Journal of The Society of Materials Science, Japan*, 58 (1); 22-28, 2009
- Lee, S. H., Y. Teramoto and T. Endo: Enzymatic saccharification of woody biomass micro/nanofibrillated by continuous extrusion process I – Effect of additives with cellulose affinity. *Biores. Technol.* 100 (1); 275-279, 2009
- Teramoto, Y., S. H. Lee and T. Endo: Pretreatment of woody and herbaceous biomass for enzymatic saccharification using sulfuric acid-free ethanol cooking. *Biores. Technol.* 99 (18); 8856-8863, 2008
- Kusumi, R., Y. Teramoto and Y. Nishio: Crystallization behavior of poly( $\epsilon$ -caprolactone) grafted onto cellulose alkyl esters: Effects of copolymer composition and intercomponent miscibility. *Macromol. Chem. Phys.* 209 (20); 2135-2146, 2008
- Khan, F. Z., M. Shiotsuki, F. Sanda, Y. Nishio and T. Masuda: Synthesis and properties of amino acid esters of hydroxypropyl cellulose. *J. Polym. Sci. Part A: Polym. Chem.* 46 (7); 2326-2334, 2008
- Khan, F. Z., M. Shiotsuki, Y. Nishio and T. Masuda: Synthesis, characterization, and gas permeation properties of *t*-butylcarbamates of cellulose derivatives. *J. Membr. Sci.* 312 (1-2); 207-216, 2008
- Hasegawa, D., Y. Teramoto and Y. Nishio: Molecular complex of lignosulfonic acid/poly(vinyl pyridine) via ionic interaction: characterization of chemical composition and application to material surface modifications. *J. Wood Sci.* 54 (2); 143-152, 2008
- Lee, S. H., S. Wang and Y. Teramoto: Isothermal crystallization behavior of hybrid biocomposite consisting of regenerated cellulose fiber, clay, and poly(lactic acid). *J. Appl. Polym. Sci.* 108 (2); 870-875, 2008

#### ***Reviews***

- Nishio, Y.: New development of cellulose-based functional materials. *Kobunshi: High Polymers*,

Japan 57 (6); 434-437, 2008

Teramoto, Y., S. H. Lee and T. Endo: Development of pretreatment for enzymatic saccharification of lignocellulosics from a viewpoint of accessibility of enzyme to cellulose. Cellulose Communications 16 (1); 6-11, 2009

### ***Reports***

Nishio, Y. and Teramoto, Y.: Report on the availability of bio-based monomers for synthetic fiber production, Ministry of Economy, Trade and Industry, March 2009.

### ***Patents***

Patent applied for

Patent no. 2008 – 150446 ‘Production method of nanofiber, nanofiber, mixture nanofiber, compounding method, composite materials and molding’ , inventors: Shiraishi, N., Yoshioka, M., patentee: Shiraishi, N., Yoshioka, M., application date: June 9, 2008

Patent no. 2009–6705 ‘Liquefied biomass, its production method and thermosetting resin’ , inventors: Shiraishi, N., Yoshioka, M., patentees: Shiraishi, N., Yoshioka, M., application date: Jan. 15, 2009

Patent no. 2009–012722 ‘Biomass nanofiber added three-dimensional setting resin’ , inventors: Shiraishi, N., Yoshioka, M., patentees: Shiraishi, N., Yoshioka, M., application date: Jan. 23, 2009

b) Conference and seminar papers presented

Study Meeting of Kobunshi Doyukai (The Federation of Technological Management in Polymer Industries, Japan) (Osaka), 1 paper (invited)

The 57th Annual Meeting of the Society of Polymer Science, Japan (Yokohama), 4 papers

2008 Annual Meeting of the Society of Fiber Science and Technology, Japan (Tokyo), 1 paper

The 15th Annual Meeting of the Cellulose Society of Japan (Kyoto), 5 papers

The 53rd Lignin Symposium (Tokyo), 1 paper

The 57th Hokuriku Polymer Symposium (Fukui), 1 paper (invited)

Pre-symposium of ACS Cellulose & Renewable Materials Division Symposia (Uji), 1 paper (invited)

9th Green & Sustainable Chemistry Symposium (Tokyo), 2 papers

The 59th Annual Meeting of the Japan Wood Research Society (Matsumoto), 4 papers

237th ACS National Meeting (Salt Lake City, US), 3 papers (including 2 invited papers)

## **A-3. Off-campus activities**

### ***Membership in academic societies (roles)***

Nishio, Y.: The Cellulose Society of Japan (Vice President), The Society of Fiber Science and Technology, Japan (Councilor), Wood Technological Association of Japan; Wood-Plastic Composite Materials Committee (Trustee of Kansai Branch; Academic Advisory Panel of Wood-Plastic Composite Materials Committee)

Yoshioka, M.: The Japan Wood Research Society (Member of Editorial Board, Member of Committee for Strengthening and Setting up the Studies of The Japan Wood Research Society, Member of Working Group for Formulation of Educational Contents), The Society of Materials Science, Japan (Councilor, Referee commissioner, General Organizer of Polymer Materials Section Committee), Wood Technological Association of Japan



(Academic Advisory Panel of the Wood-Plastic Composite Materials Committee, Organizer of the Plywood Committee), The Society of Polymer Science, Japan (Member of Steering Committee for Research Group of Ecological Materials)

### ***Research grants***

Monbu-Kagakusho/JSPS Research Grants:

Grant-in-Aid for Scientific Research (A), Novel Nano-to-meso Structural Control and Modern Functionalization of Cellulosic Polysaccharides (Head, Nishio)

Others:

Yoshioka, M: Trust Research via Bio-oriented Technology Research Advancement Institution, Japan / Agrifuture Joetsu Co.,Ltd, “Functional plasticization of biomass and its application”

## **A-4. International cooperations and overseas activities**

### ***International cooperations***

Nishio, Y.: Member of Editorial Board of the Journal “*Cellulose*”

### ***International meetings (roles)***

Nishio, Y.: 237th American Chemical Society, Cellulose & Renewable Materials Division, Anselme Payen Award Symposium, (invited speaker)

Teramoto, Y.: 237th American Chemical Society, Cellulose & Renewable Materials Division, Anselme Payen Award Symposium, (invited speaker)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Forest and Biomaterials Science II (in part; Nishio), Polymer Synthetic Chemistry (Nishio), Physical Properties of Polymers (Nishio), Materials Chemistry of Biomass Composites (Yoshioka), Laboratory Course in Forest and Biomaterials Science II (in part; Nishio, Yoshioka, Teramoto), Laboratory Course in the Basic Forest and Biomaterial Chemistry (in part; Nishio, Yoshioka, Teramoto), Laboratory Course in the Biomaterials Chemistry II (in Part; Nishio, Yoshioka, Teramoto)

Graduate level: Chemistry of Composite Materials I (Yoshioka), Laboratory Course in Chemistry of Composite Materials (Nishio, Yoshioka, Teramoto), Seminar in Chemistry of Composite Materials (Nishio, Yoshioka, Teramoto),

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Yoshioka, M.: High school of Nishiyamato gakuen (Super science high school lecture, “A way to the biomass new material”)

## **C. Other Remarks**

Nishio, Y.: Committee Member of Exploratory Committee of the Availability of Bio-based Monomers for Synthetic Fiber Production (Ministry of Economy, Trade and Industry)

Yoshioka, M.: [Inside campus] Member of Environment / Security / Hygiene Committee in

Graduate School of Agriculture; Poisonous Material Management Chief in Division of Forest and Biomaterials Science; Member of Energy-Saving Subcommittee in Graduate School of Agriculture, Contact Counselor for Harassment in Graduate School of Agriculture

## 2.2.13 Laboratory of Chemistry of Biomaterials

*Staff      Professor                      : Nakatsubo, Fumiaki, Dr. Agric. Sci.*

*Associate Professor: Takano, Toshiyuki, Dr. Agric. Sci.*

*Assistant Professor : Kamitakahara, Hiroshi, Dr. Agric. Sci.*

*Students and research fellows*

*JSPS Research fellow   : (1)*

*Doctor's Program : (3)*

*Master's Program : (8)*

*Undergraduate        : (4)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Chemical syntheses of oligo- and polysaccharides and their function

Research in our laboratory encompasses the development of photo-current cellulosic materials for a new artificial photosynthesis system, the synthesis of reducing end modified cellulose derivative and its properties, the syntheses of regio-substituted oligosaccharides and their surfactant abilities, the preparation of enzyme immobilized amino-cellulose and its properties, immobilization of tannin component to cellulose, and the evaluation system of peeling reaction using cello-oligosaccharides.

##### b) Reactivity of lignin

The elucidation of peculiar behavior of sinapyl alcohol in the dehydrogenative polymerization (lignin formation) using  $\gamma$ -substituted monolignol derivatives, and the analysis of the products in the dehydrogenative polymerization of alkyl ferulate are currently being investigated to obtain fundamental knowledge of the dehydrogenative polymerization of lignin. The electronic oxidation of lignin model compounds for pretreatment of Kraft pulping, the synthesis of  $\beta$ -5 type lignin oligomers are also being investigated.

##### c) Chemical syntheses of the extractive and their utilization

Other targets of current interest include preparation of condensed-tannin from taxifolin, which is one of the components in heart wood of Larix species, and evaluation of its anti-oxidant. We are developing a new functional polymer with galloyl group as a pendant.

##### d) Chemical modification of wood

A chemical modification method of wood using super-critical carbon dioxide as a green process is also being investigated.

#### A-2. Publications and presentations

##### a) Publications

###### *Original papers*

Tobimatsu Y., Takano T., Kamitakahara H. and Nakatsubo F.: Studies on the dehydrogenative polymerizations of monolignol beta-glycosides. Part 3: Horseradish peroxidase-catalyzed polymerizations of triandrin and isosyringin. J Wood Chem Technol **28**(2); 69-83, 2008.

- Tobimatsu Y., Takano T., Kamitakahara H. and Nakatsubo F.: Studies on the dehydrogenative polymerizations (dhps) of monolignol beta-glycosides: Part 4. Horseradish peroxidase-catalyzed copolymerization of isoconiferin and isosyringin. *Holzforschung* **62**(5); 495-500, 2008.
- Tobimatsu Y., Takano T., Kamitakahara H. and Nakatsubo F.: Studies on the dehydrogenative polymerization of monolignol beta-glycosides: Part 5. Uv spectroscopic monitoring of horseradish peroxidase-catalyzed polymerization of monolignol glycosides. *Holzforschung* **62**(5); 501-507, 2008.
- Takano T., Murakami T., Kamitakahara H. and Nakatsubo F.: Formaldehyde adsorption by karamatsu (*Larix leptolepis*) bark. *J. Wood Sci.* **54**(4); 332-336, 2008.
- Takano T., Murakami T., Kamitakahara H. and Nakatsubo F.: Mechanism of formaldehyde adsorption of (+)-catechin. *J. Wood Sci.* **54**(4); 329-331, 2008.
- Kamitakahara H., Koschella A., Mikawa Y., Nakatsubo F., Heinze T. and Klemm D.: Syntheses and comparison of 2,6-di-O-methyl celluloses from natural and synthetic celluloses. *Macromolecular Bioscience* **8**(7); 690-700, 2008.
- Kamitakahara H., Yoshinaga A., Aono H., Nakatsubo F., Klemm D. and Burchard W.: New approach to unravel the structure-property relationship of methylcellulose. Self-assembly of amphiphilic block-like methylated cello-oligosaccharides. *Cellulose*, **15**(6); 797-801, 2008.
- Sakakibara, K.; Nakatsubo, F.: Fabrication of anodic photocurrent generation systems by use of 6-O-dihydrophytylcellulose as a matrix or a scaffold of porphyrins. *Cellulose* **15**(6); 825-835, 2008.
- Adelwohrer, C.; Yoneda, Y.; Takano, T.; Nakatsubo, F.; Rosenau, T.: Synthesis of the perdeuterated cellulose solvents N-methylmorpholine N-oxide (NMMO-d11 and NMMO-15N-d11), N,N-dimethylacetamide (DMAc-d9 and DMAc-15N-d9), 1-ethyl-3-methylimidazolium acetate (EMIM-OAc-d14) and 1-butyl-3-methylimidazolium acetate (BMIM-OAc-d18). *Cellulose*, **16**(1); 139-150, 2009.
- Karrasch, A.; Jaeger, C.; Karakawa, M.; Nakatsubo, F.; Potthast, A.; Rosenau, T.: Solid-state NMR studies of methyl celluloses. Part 1: regioselectively substituted celluloses as standards for establishing an NMR data basis. *Cellulose*, **16**(1); 129-137, 2009.

## ***Reports***

- Kamitakahara, H. and Nakatsubo, F. (2008) Cellulosic polymers: potential application to ongoing research in the area of flat panel display. *Material Stage*, **8** (6), 43-45.
- b) Conference and seminar papers presented
- 235<sup>th</sup> ACS meeting, Anselme Payen Award Symposium honoring Prof. Fumitaka Horii, (New Orleans, USA, 2008.04.06) 3 papers
- The 15<sup>th</sup> Annual Meeting of the Cellulose Society of Japan (Kyoto, 2006.7.10-7.11), 3 papers
- 10th European Workshop on Lignocellulosics and Pulp (KTH, Royal Institute of Technology, Stockholm, Sweden, August 25-28, 2008) 4 papers
- 8<sup>th</sup> International Symposium "Alternative Cellulose – Manufacturing, Forming and Properties" (Rudolstadt, Germany, 03. - 04. September 2008) 1 paper
- The 53<sup>th</sup> Lignin Symposium (Tokyo, 2008.10.30-10.31) 4 papers
- 237<sup>th</sup> ACS meeting, Anselme Payen Award Symposium honoring Prof. Fumiaki Nakatsubo, (Salt

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Nakatsubo, F.: The Japan Wood Research Society (A member of Education-promotion committee); The Cellulose Society of Japan (President); Wood Technical Association of Japan (Councilor), International Academy of Wood Science (Fellow and Executive Board), Cellulose (Editorial committee), J. Wood Chem. Technol. (Editorial committee)

Takano, T.; The Cellulose Society of Japan (Kansai regional committee)

#### ***Research grants***

Monkasho Research Grant:

Nakatsubo, F.: Basic Research (B) General “Molecular design of the photo-induced electron transfer super material from cellulose and its development for utilization” (Nakatsubo: head, Takano, Kamitakahara: coworker)

Takano, T.: Basic Research (C) General “Preparations of new functional DHPs from  $\gamma$ -substituted monolignol derivatives.” (Takano: head, Nakatsubo, Kamitakahara: coworker)

Kamitakahara, H.: Young Scientists (A) “Preparation of nano-particles from cello-oligosaccharaides and their dynamic functionalities.”

NEDO grant:

Nakatsubo, F.: Funding for the practical application of the university outcomes, Development of the technology for the production of modified bio-nanofibers and their utilization, (Co-researcher)

Nakatsubo, F.: Grant for the production of organic electronics devices (Investigator)

Nakatsubo, F., Takano, T.: Survey of wearable organic thin solar cell (Investigators)

JST grant:

Takano T: Sheeds research “Chemical modification of wood in supercritical carbon dioxide.”

JSPS grant:

Kamitakahara, H.: JSPS Bilateral Joint Project between Japan and Germany “Development of novel pathway for cellulose derivatives with both regiospecific and blockwise substitutions and their structure-property relationships”

### **A-4. International cooperations and overseas activities**

#### ***International meetings***

#### ***Memberships in international academic societies***

International Academy of Wood Science (Fellow and Executive Board), Cellulose (Editorial committee), J. Wood Chem. Technol. (Editorial committee)

#### ***International joint research, overseas research surveys***

Takano, T: JSPS Researcher Exchange Program FY2008 (Austria (long-term)) (Vienna) (2008.4.28-2008.10.11)

Kamitakahara, H.: JSPS Bilateral Joint Project between Japan and Germany “Development of novel pathway for cellulose derivatives with both regiospecific and blockwise

substitutions and their structure-property relationships” (Jena) (2008.8.23-9.22; 2009.3.4-3.12)

Nakatsubo F, Takano T: NEDO Survey of wearable organic thin solar cell (Austria, Switzerland, German) (2008.11.17-11.23)

Nakatsubo F, Takano T: NEDO Survey of wearable organic thin solar cell (USA) (2008.12.08-12.13)

### ***Scholars from abroad***

Research fellows (Friedrich-Schiller University of Jena, Germany: 2 persons; University of Natural Resources and Applied Life Sciences, Vienna, Austria: 1 person)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Basic Forest and Biomaterials Sciences II (Nakatsubo), Cellulose Chemistry (Nakatsubo), Biomass Chemistry (Takano), Laboratory Course in Forest and Biomaterials Science II (Takano, Kamitakahara), Laboratory Course in the Basic Forest and Biomaterial Chemistry (Takano, Kamitakahara), Laboratory Course in Biomaterials Chemistry I (Takano, Kamitakahara)

Graduate level: Biomaterials Chemistry II (Takano), Scientific writing and presentation in English (Takano, Kamitakahara), Seminar in Biomaterials Chemistry (Nakatsubo, Takano, Kamitakahara), Laboratory Course in Biomaterials Chemistry (Nakatsubo, Takano, Kamitakahara)

### **B-2. Off-campus teaching, etc.**

#### ***Open seminar***

Next-Generation Supercomputer Project Grand Challenges in Next-Generation Integrated Nanoscience sixth open seminar (Okazaki, 2009.01.29)

Pre-symposium of ACS Cellulose & Renewable Materials Division Symposia (Uji, 2009.02.03) (Nakatsubo, Takano)

## **C. Other remarks**

Nakatsubo F.: Anselme Payen Award for 2008, Cellulose and Renewable Materials Division, ACS  
Kamitakahara H.: The Cellulose Society of Japan Progress Award for 2008

## **2.2.14 Laboratory of Forest Information**

*Staff*      *Professor*                      : *Takahito, Yoshioka, Dr. Sci.*  
                 *Associate Professor: Shiba, Masami, Dr. Agric. Sci.*  
                 *Lecturer*                            : *Nakashima, Tadashi, Dr. Agric. Sci.*  
                 *Assistant Professor: Sakanoue, Nao, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program* : (2)

*Master's program* : (1)

*Undergraduate*    : (1)

### **A. Research Activities (2008.4-2009.3)**

#### **A-1. Main subjects**

##### **a) Material cycles in forested watersheds**

Surveys on effects of changes in forest environments on watershed environments have been conducted from the viewpoint of the dynamics of material cyclings in the forest, soil and aquatic ecosystems. In order to elucidate characteristics on water discharge and soil/sand erosion from a naturally regenerated forest, temporal and yearly variations in inorganic and organic particles flowing down in streams were observed with a weir and particle traps. Relationship between organic matter and nutrient salts concentrations were used for analyzing the material cyclings in the forest-soil-stream systems.

##### **b) Management of forest resources and timber trade strategies**

Taking the sustainable management of forest resources into consideration, the importance of the precise evaluation and monitoring for forest resources is increasing. We conducted integrative and practical surveys on the quantitative evaluation of multi-functions of forest and on the development of forest resource management strategies and timber production technologies. Strategic surveys on the forest certification and those on the timber production, processing and trades, and the forest resource monitoring system based on GIS/image processing have been investigated.

##### **c) Interactions between humans and natures**

Relationships between multifunction of an environment and people's value judgment have been investigating in order to clarify interactions between humans and natures. Results of the choice experiment on people's preferences on tree cutting scenarios were analyzed, and a scenario workshop on future environment was conducted at Horokanai Town, Hokkaido, Japan. This study is a collaborative project supported by the Research Institute for Humanity and Nature.

## A-2. Publications and presentations

### a) Publications

#### *Books*

Nakashima, T. : 4-1-2 Practices of field education, Entomological Science and its Perspective  
Fujisaki et al eds., Kyoto University Press(in Japanese), p.489-497, 2009

#### *Original papers*

Chiba, T., Itaya, A., Ishikawa, T. and Shiba, M.: Widths of riparian management zone considering  
Japanese topography and impact for forest- case of Miyagawa forest in Mie prefecture.  
Cyubu Shinrin Kenkyu 57:215-218, 2008 (in Japanese)

Fujihira, K., K. Osuka, T. Yoshioka and N. Hayashi: An Educational Methodology for Sustainable  
Development Applying Control Theory and Confirming its Validity. Environmental  
Education, 18:17-28 (in Japanese), 2008.

Sakamoto, T., Shiba, M. and Kawamura, M.: Current conditions and changes in adopting the  
Hiyoshi-style integrated forest management. J. Jpn. For. Soc., 23(1):3-10, 2008. (in  
Japanese)

Shiba, M.: Confronting Sustainable Forestry in an Era of Uncertainty and Change? Invited Paper  
for DAAD Summer School Program in TUM:1-8, 2008

Takano, K., Y. Ishikawa, H. Mikami, S. Igarashi, S. Hino and T. Yoshioka: Fungal infection for  
cyanobacterium *Anabaena smithii* by two chytrids in eutrophic region of large reservoir  
Lake Shumarinai, Hokkaido, Japan. Limnology, 9:213-218, 2008

#### *Reports*

Nakashima, T. and K. Fukushima: The summer open seminar in Kamigamo Experimental Forest  
Station, The report of Kyoto University Forests 2007, p.27-35, 2008

Shiba, M.: Tidings from Asiu:4-11. Information for university workers union, No.70-77, 2008 (in  
Japanese)

Shiba, M.: Guidebook for university of science and technology, AIM infogate. p.2-3, 2008

Yoshioka, T.: Linkages in forested watershed environments. "Sustainability on Food, Feed, Fiber,  
Water, Energy: Science, Technologies, and Global Strategies", Proceedings of the  
International Conference on Sustainability on Food, Energy and Industry 2008,  
International Council of Sustainable Agriculture (ICSA), p.145-150, 2008

Yoshioka, T.: Conservations of Japanese Sika deer and vegetation. Proceedings of the 5th Clock  
Tower Open Seminar, the FSERC and CER, Kyoto University, p.34-39, 2008

### b) Conference and seminar papers presented

The 120th Annual Meeting of Japan Forest Society: 8

Annual Meeting of The Japanese Society of Fisheries Science: 1

Annual Meeting of The Japanese Forest Economic Society: 1

Annual Meeting of Society of Environmental Science, Japan 2008: 2

Annual Branch Meeting of Japan Forest Society: 1

International society meeting/world conference: 3

The 73rd Annual Meeting of the Japanese Society of Limnology: 1

The 81st Annual Meeting of the Japan Sociological Society: 1

Annual Meeting of the Japan Society of Hydrology and Water Resources: 1



The 19th Annual Meeting of the Japanese Society of Environmental Education: 1

The Japan Geoscience Union Meeting 2008: 1

The Scientific Forum of the Seto Inland Sea in Fukuoka:1

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

Shiba, M.: Kyoto University Branch of JFTA (Chief), The Japan Forest Engineering Society (Director), Branch of Japanese Forest Society (Editorial board member)

Yoshioka, T.: The Japan Forest Society (Administrative committee for the 120th Annual Meeting)

#### ***Research grants***

### **A-4. International cooperations and overseas activities**

#### ***International meetings(roles)***

Shiba, M.: IUFRO ALL-3 Conference, Hokkaido (Chairperson/presenter), DAAD Summer School Program in TUM Germany (Chairperson/presenter)

Yoshioka, T.: International Council of Sustainable Agriculture (Presenter) , The 3rd RIHN International Symposium (Presenter)

#### ***International academic society and/or organizational officers***

Shiba, M.: IUFRO S3.06 Coordinator, IUFRO S3.06.02 Duty coordinator, International Editorial Board for International Journal of Forest Engineering, USA, International Member of Council on Forest Engineering COFE, USA, FSC International (Japanese member), ISTVS (Japanese member), FSC forest certifiers (Japanese adjudicator)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Forest Management System & Applied Technology (Shiba, M. and Sakanoue, N.), Practice Course in Forest Science IV (Shiba, M.), Integrated Practice and its Method on Forest Science (Shiba, M., Nakashima, T. and Sakanoue, N.), Practice in Research Forest I (Shiba, M.), Practice in Research Forest III (Sakanoue, N. and others), Forest Environmental Sciences (Yoshioka, T. and Nakashima, T.), Basic Forest Science IV (Yoshioka, T. and others), Forest Science (Shiba, M., Nakashima, T., Yoshioka, T. and others), Ecological Interactions between Forests and Coastal Areas (Shiba, M., Nakashima, T., Yoshioka, T. and others), Pocket Seminars (Siba, M., Nakashima, T., Yoshioka, T.), Practice on Ecological Interactions between Forests and Coastal Areas (A: Shiba, M. and others, C: Yoshioka, T., Sakanoue, N. and others), Practice on Environment of Winter Season in Warmtemperate Snowfall Region (Nakashima, T.)

Graduate level: Special lecture on Forest Information Science I (Yoshioka, T. and Nakashima, T.), Seminar on Forest Information Science (Yoshioka, T., Shiba, M., Nakashima, T. and Sakanoue, N.), Laboratory course in forest information (Yoshioka, T., Shiba, M., Nakashima, T. and Sakanoue, N.)

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Nakashima, T.: Kyoto University of Education (Practice of Cultivation and Breeding II)

Shiba, M.: Faculty of Agriculture, Kyoto Prefecture University (Biosphere resource management),  
Faculty of Agriculture, Lecture for review meeting of Shikoku Regional Forest Office  
(Promotion of regional timber supply)

Yoshioka, T.: University of Human Environments (Basic biology A and B), Nara University of  
Education (Special lecture on Ecological Science)

### ***Open seminar***

Nakashima, T.: Kyoto University Junior Campus 2008 (Lecturer)

Sakanoue, N.: Woods Science, Arida Chuo High School, Wakayama (Lecture), Forest Studies,  
Ogawa Elementary School, Arida (Lecture), Open Seminar “Structure and Function of  
Forests”, FSERC, Kyoto Univ. (Lecture)

Shiba, M.: Open Seminar “Structure and function of Forests”, FSERC, Kyoto Univ. (Lecturer),  
Nature experience class of elementary schools in Miyama (Lecture), University local  
open special project (Lecture), Forest experience practice program of Kitakuwada high  
school (Lecture), Senior campus (Lecture), ANA “Aozora-juku: Watashi no  
Aozora(Lecture), Nature observation in Asiu forests (Lecture)

Yoshioka, T.: Open Seminar “Structure and Function of Forests”, FSERC, Kyoto Univ. (Chief  
organizer), Open Seminars of ANA “Aozora-juku: “Yaotsu Forest” and “Forest of  
Asahi” (Lecturer), The 4<sup>th</sup> Clock Tower Open Seminar (Panelist)

## **C. Other remarks**

### **C. Other remarks**

Shiba, M.: Mie Prefecture Environmental Conservation Agency (Technical advisor), World Wide  
Fund For Nature, Japan (Council member of forest management system), NPO Forsta  
(Director), FSC National Initiative, Forest and Forestry Exchange research review board  
member of Kinki-Cyugoku Regional Forest Office, Administrative board member of  
Sakamoto Foundation, Award committee member of Society of University Forests

Yoshioka, T.: Cooperative Researcher in the Research Institute for Humanity and Nature, Japan  
Wildlife Research Center (Working group member for the Monitoring Site 1000 for  
freshwater ecosystem)

## 2.2.15 Laboratory of Silviculture

*Staff Professor : Shibata, Shozo, Dr. Agric. Sci.*

*Associate Professor : Ando, Makoto, Dr. Agric. Sci.*

*Associate Professor : Tokuchi, Naoko, Dr. Agric. Sci.*

*Associate Professor : Hasegawa, Hisashi, Dr. Agric. Sci.*

*Assistant Professor : Sakimoto, Michinori, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (6)*

*Master's program : (7)*

*Undergraduate : (2)*

### **A. Research Activities (2007.4-2008.3)**

#### **A-1. Main subjects**

##### **a) Studies on forest management and harvest**

Present Japan's managed forests like artificial forest, Satoyama etc. are not under well-managed condition because of the decline of forestry. We notice these forests as the target to restore their management, ecosystem and biodiversity and to develop new harvest systems. To consider these theses, researches of harvest systems of woody products, monitoring of environmental characteristics of managed woodlands, discussion of restoration methods of Satoyama including ecological research of bamboo forest etc. are practiced.

##### **b) Regeneration and dynamics of forest**

The establishment of forests and the distribution of tree species are influenced by climate, soil and topography, or natural disaster, artificial disturbance, animal, insect, disease, and the like. Main theme of this study is to clarify the relationship between various environmental factors and dynamics of forest by long-term research of stand structure, diversity, growth and regeneration for natural forest, secondary forest, man-made forest and urban forest of warm-temperate zone, cool-temperate zone and subarctic zone in Japan.

##### **c) Nitrogen cycling**

Nitrogen is the limiting factor for plant growth. N dynamics is important for forest, especially in plant-soil system. Nitrogen dynamics is described the typical Japanese vegetation which belongs to Field Science and Education Center, Kyoto University.

##### **d) Studies on dynamics, maintenance mechanisms of biological diversity, and life historical strategies of plant species in forests.**

Natural forests are heterogeneous in time and space, and are composed of various many plant species. Those plant species have their own specific life history strategies. To develop the methods for ecological management and conservation of forests, we are engaged in analyzing spatial structure, dynamics mechanisms of diversity, and reproductive ecology and demography of plant species in natural forests.

##### **e) Studies on precision forestry for sustainable use of forest resources.**

Site-adapted forest management with precision forestry technologies is essential for highly sustainable utilization of diverse forest functions. Therefore, (1) monitoring forest resources by using remote-sensing data, (2) GPS performance under tree canopies, (3) development of silvicultural process for extensive forestry with early intensive thinning, (4) developing a precise forest harvesting models using system

dynamics, and (5) relationship between construction costs of forest roads and terrain, were discussed.

## **A-2. Publications and presentations**

### **a) Publications**

#### ***Book***

- Shibata, S.: Understandings of bamboo as resource (Second Chapter), Basic Science and High-technological Utilization of Bamboo (edited by Fujii), pp. 17-34, CMC Publisher, Tokyo, 2008 (in Japanese)
- Fukushima K, Tokuchi N, Tateno R, Katsuyama M.: Water yield and nitrogen loss during regrowth of Japanese cedar forests after clearcutting. From Headwaters to the Ocean: Hydrological Change and Watershed Management (edited by Taniguchi M, Fukushima Y, Burnett WC, Haigh M, Umezawa Y.). p. 97-104, Taylor & Francis, London, 2009.
- Tokuchi N, Fukushima K, Katsuyama M.: Factors controlling stream water chemistry in ten small forested watersheds with plantation forests of various proportions and ages in central Japan. T From Headwaters to the Ocean: Hydrological Change and Watershed Management (edited by Taniguchi M, Fukushima Y, Burnett WC, Haigh M, Umezawa Y.). p. 75-82, Taylor & Francis, London, 2009.
- Katsuyama M, Fukushima K, Tokuchi N.: Effects of various rainfall-runoff characteristics on streamwater stable isotope variations in forested headwaters. From Headwaters to the Ocean: Hydrological Change and Watershed Management (edited by Taniguchi M, Fukushima Y, Burnett WC, Haigh M, Umezawa Y.). p. 51-56, Taylor & Francis, London, 2009.

#### ***Original papers***

- Shibata, S., K. Ikeda, C. Lulmuanpuia, Y. Suyama, T. Saito, H. Hasegawa, A. Nishiwaki, and A. Makita: Mautam – *Melocanna baccifera* flowering – Ecological characteristics and influence to the juhm agriculture. Proc. Intl. Conf. Improvement of Bamboo Productivity and Marketing for Sustainable Livelihood; 155-163, 2008
- Katsuyama M, Fukushima K, Tokuchi N.: Comparison of rainfall-runoff characteristics in forest catchments underlain by granitic rock and sedimentary rock with various forest age. Hydrological Research Letters 2; 14-17, 2008.
- Koyama L, Tokuchi N, Fukushima K, Terai M, Yamamoto Y.: Seasonal changes in nitrate use by three woody species: the importance of the leaf expansion period. Trees 22; 851-859, 2008.
- Fukushima K, Tokuchi N.: Factors controlling the acid-neutralizing capacity in Japanese cedar forest watersheds of various stand ages and topographic characteristics. Hydrol. Process 23; 259-271, 2009.
- Tokuchi N, Fukushima K.: Long-term influence of stream water chemistry in Japanese cedar plantation after clear-cutting using the forest rotation in central Japan. For. Ecol. Manage. 257; 1768-1775, 2009.
- Matsuyama, S., Sakimoto, M. (2008) Allocation to reproduction and relative reproductive costs in two species of dioecious Anacardiaceae with contrasting phenology. *Annals of Botany* 101: 1391-1400.
- Hirayama, K., Sakimoto, M. (2008) Clonal growth and diversity of *Cryptomeria japonica*

- along a slope in a cool-temperate, old-growth mixed forest in the snowy region of Japan. *Canadian Journal of Forest Research* 38: 2804-2813.
- Ueda, M.U., N. Tokuchi, R. Ogawa: High nitrate reductase activity in sprouts of *Phyllostachys pubescens*. *J For Res* 14; 55-57, 2009
- Tateno R, Fukushima K, Fujimaki R, Shimamura T, Ohgi, M, Arai H, Ohte N, Tokuchi N, Yoshioka T.: Biomass allocation and nitrogen limitation in a *Cryptomeria japonica* plantation chronosequence. *J. For. Res.* (in press).
- Fukushima K, Tokuchi N.: The influences of deer overbrowsing on nutrient cycling in forest ecosystems: Preliminary study of streamwater chemistry. *For. Res. Kyoto* 77; 77-87, 2008. (in Japanese with English summary)
- Fukushima K, Tokuchi N.: Effects of forest clearcut and afforestation on streamwater chemistry in Japanese cedar (*Cryptomeria japonica*) forests: comparison among watersheds of various stand ages. *J. Jpn. For. Soc.* 90: 6-16, 2008. (in Japanese with English summary)
- Nakanishi, A., Y. Inagaki, H. Fukada, S. Shibata and N. Osawa: Effects of soil properties and high intensity thinning on male flower production in hinoki cypress (*Chamaecyparis obtusa* Endlicher) forests. *Japanese Journal of Forest Environment* 50(2); 167-173, 2008 (in Japanese with English abstract)
- Motoe, M., M. Fujihara, S. Yamamoto, T. Oyabu, N. Mino and S. Shibata: The expansion of bamboo stands and its management in northern part of Awaji Island, Hyogo Prefecture, Western Japan. *Hikobia* 15; 193-204, 2008 (in Japanese and English Abstract)
- Terai, Y., S. Shibata and T. Hino: Effects of herbivorous mammals on aboveground and underground parts of *Sasa nipponica* – The results of the 4<sup>th</sup> year after the enclosure. *J. Japanese Society of Revegetative Technology* 34(3); 516-523, 2009
- Fukui R., Sugimoto K., Otsuka K., Hasegawa H., and Maeda T.: The possibility of using synthetic rope in yarding operation. *Jpn. For. Eng. Soc.* 23(4): 255-258, 2008 (in Japanese)
- Otsuka K., Hasegawa H., and Nobuchi T.: A study on the multiple evaluation of heavy thinning for production of large-diameter medium-quality logs of *Cryptomeria japonica* in Tokushima. *Forest Research*, 77: 109-121, 2008 (in Japanese)
- Tachiki, Y., Yoshimura Y., Hasegawa H., Sakai T. and Nakamura F.: DeltaForest: a navigation system for the forest resources monitoring project using PDA and GPS. *Jpn. For. Eng. Soc.* 23(2): 41-52, 2008

### **Reports**

- Shibata, S.: Trial of Satoyama restoration by the case of bamboo forests. *Proc. Symposium of ERI*, 2008; 4-8, 2008
- Shibata, S.: Biodiversity in bamboo forest. *Digests of Environmental Reports of Kyoto University*, 2008
- Shibata, S.: *Melocanna baccifera*; tropical bamboo flowered every 48 years with unique fruits. *Bamboo* 105; 21, 2008
- Muranaga, Y. and S. Shibata: Vegetation landscape of mountain agro-ecosystem in Hong Ha, central Vietnam. *Proceedings of the 4<sup>th</sup> International Conference on Landscape and Ecological Engineering*; 152, 2008
- Matsuo, A., Y. Suyama, T. Saito, C. Sumiyoshi, S. Saito, Y. Isagi, S. Shibata, J. Suzuki, A. Nishiwaki and A. Makita: Gene diversity of gregarious flowering population of *Sasa veitchii* var. *hirsuta*. *Proc. 56th Mtg.*

Ecological Soc. Japan, 2009

Suyama, Y., T. Saito, A. Nishiwaki, A. Makita and S. Shibata: Molecular ecological analysis of flowering and regenerating *Melocanna baccifera* distributing in Mizoram, India. . Proc. 56th Mtg. Ecological Soc. Japan, 2009

Nakanishi, A., Y. Inagaki, S. Shibata, H. Fukada and N. Osawa: Influence of C-N Ratio of soil and thinning to nitrogen utilization of *Chamaecyparis obtusa*. Proc. 120th Mtgs. Japan Forest Society, 2009

Sumiyoshi, C., Y. Isagi, A. Matsuo, Y. Suyama, T. Saito, S. Saito, S. Shibata, A. Nishiwaki, J. Suzuki and A. Makita: Gene move of gregarious flowering *Sasa veitchii* var. *hirsuta* population. Proc. 120th Mtgs. Japan Forest Society, 2009

Saito, S., Y. Isagi, C. Sumiyoshi, S. Shibata, Y. Suyama, A. Matsuo, A. Makita and A. Nishiwaki: Comparison of genetic composition with different gregarious flowering year of *Sasa veitchii* var. *hirsuta* *Sasa veitchii* var. vegetations. Proc. 120th Mtgs. Japan Forest Society, 2009

Ando, M. and M. Yamasaki: Report of Vegetation Research of Forest around Hacchou-daira swamp in 2008. Kyoto City, 1-69, 2009

Ando, M.: Recovery of the forest landscape around Kyoto City (lecture), Proc. 3rd Shii-noki Symposium, 2008

Nakamura, S., C. Wu and M. Ando: Regeneration after cutting a *Castanopsis* forest in Higashiyama, Kyoto, Trans. 120<sup>th</sup> Annual Meeting of the Japanese Forest Society Pa3-27 , 2009

Morishita, K., Sakimoto, M.: Coexistence of forest three shrub species with different establishing substrate and crown architecture. Abstract of the 40-th annual meeting of the Species Biology, 25, 2008

Matsuyama, S., Sakimoto, M.: Reproductive allocation and costs of a dioecious tree, *Rhus trichocarpa*, under different light conditions in a natural forest. Abstract of the 56<sup>th</sup> annual meeting of the Ecological Society of Japan, PB2-645, 2009.

Kuninaga, T., Hirayama, K., Sakimoto, M., Takahara, H.: The regeneration process of *Fagus crenata* in a natural cool-temperate conifer-hardwood forest. Abstract of the 56<sup>th</sup> annual meeting of the Ecological Society of Japan, PB1-301, 2009.

Sakimoto, M., Akita, Y., Hirai, T., Oonomi, K., Nakashima, T.: Spatial patterns of trees in a natural warm-temperate broad-leaved forest. Abstract of the 120<sup>th</sup> annual meeting of the Forest Society of Japan, Pc3-28, 2009.

Morishita, K., Hirayama, K., Sakimoto, M.: Site decision for *Cryptomeria japonica* plantation based on the distributions of shrub species along slope topography in a snowy region. Abstract of the 120<sup>th</sup> annual meeting of the Forest Society of Japan, Pa3-37, 2009.

Shibata, S. (ed.): Ecological research of gregarious flowering of Muli in Mizoram, India (Report of Grant-in Aid for Scientific Research: Basic Research (A) (No. 17255007). 102pp, 2009

Hasegawa, H., K. Sugimoto and S. Niinaga: Development of forest harvesting models using system dynamics with consideration of tree size. Proceedings of IUFRO All-D3-Conference, 2008

Hasegawa H., Aruga K., Itaya A., Iwaoka M., Sakurai R., Sasaki T., Suzuki H., Suzuki Y., Nitami T., Nose M., and Yamaguchi H.: Report on the IUFRO All-D3-Conference 2008 "Pathways to Environmentally

Sound Technologies for Natural Resource Use" (research meeting section). Jpn. For. Eng. Soc. 23(2): 207-214, 2008 (in Japanese)

Hasegawa H.: Report on the field meeting of the 16<sup>th</sup> Workshop on Forest Production System. Jpn. For. Eng. Soc. 24(1): 19-21, 2009 (in Japanese)

Hasegawa H.: Report on the symposium of the 16<sup>th</sup> Workshop on Forest Production System. Jpn. For. Eng. Soc. 24(1): 22-34, 2009 (in Japanese)

Hasegawa H. and Yoshimura T.: Effects of GPS antenna height on positional accuracy and ambiguity success rate under tree canopies. Trans. J. For. Soc. 120, 2009 (in Japanese)

Otsuka K., Hasegawa H., and Maeda T.: Cost estimation of reforestation using conifer containerized seedlings. Trans. J. For. Soc. 120, 2009 (in Japanese)

Yoshimura, T., H. Hasegawa and T. Sakai: Accuracy variation of GPS measurements by using an extendable GPS antenna pole under forest canopy, Proceedings of the 31st Annual Meeting of the Council on Forest Engineering: Addressing Forest Engineering Challenges For the Future, 2008

Yoshimura, T., H. Hasegawa and T. Sakai: Accuracy variation of dual-frequency GPS surveying under forest canopy by using an extendable GPS antenna pole, Proceedings of the 29th Asian Conference on Remote Sensing, 2008

b) Conference and seminar papers presented

Shibata, S.: The 120<sup>th</sup> Annual meeting of Japan Forest Society (3), The 56<sup>th</sup> Annual meeting of Ecological Society of Japan (2), Cooperative meeting of ERI (1), Annual meeting of Japanese Society of Tropical Ecology (1)

Ando, M.: The 120<sup>th</sup> Annual Meeting of the Japanese Forest Society (1)

Tokuchi, N.: AGU Fall Meeting (1), The 7<sup>th</sup> International Symposium of Subsurface Microbiology (1), HydroChange 2008 (3), The 120<sup>th</sup> Annual meeting of Japan Forest Society (7), The 56<sup>th</sup> Annual meeting of Ecological Society of Japan (3), Japan Soil Science and Plant Nutrition 2008 (1), Hydrology and Water Resources 2008 (1), Japan Geoscience Union Meeting 2008 (2)

Hasegawa H.: The 120<sup>th</sup> annual meeting of Japan Forest Society (3), The 15<sup>th</sup> annual meeting of Japan Forest engineering Society (1), The 56<sup>th</sup> annual meeting of Ecological Society of Japan (1), IUFRO All-D3-Conference(1), The 31<sup>st</sup> annual meeting of the Council on Forest Engineering(1), The 29<sup>th</sup> Asian Conference on Remote Sensing(1)

Sakimoto M.: The 40<sup>th</sup> Annual Meeting of Species Biology (1), The 56<sup>th</sup> Annual Meeting of Ecological Society of Japan (2), The 120<sup>th</sup> Annual Meeting of Japanese Forest Society (2)

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

Shibata, S.: Jpn. Inst. Landscape Architecture (Director, Organizer of Kansai Branch, International committee member), Jpn. Soc. Revegetation Technol. (Director, Chairman of environmental forest section, Member for the selection of award, International community committee member), Japan Forest Society (Councilor), Ecological Society of Japan (Editorial member of Japanese Journal of Conservation Ecology)

Ando, M.: Hokkaido Branch of the Japanese Forest Society (Councilor)

Hasegawa H.: Japan Forest Engineering Society (Director, Editorial member), Japan Society of Forest Planning (Project Planner), Society of Forest Production System (Executive), Society of Forest

***Membership in Science Council of Japan, etc.***

Shibata, S.: Jpn. Bamboo Soc. (Councilor, Editorial member), Soc. Study of Bamboo (Rep.), Center for Support of Forest regeneration (Councilor), Foundation for the promotion of bamboo culture (Councilor), Consortium for Bamboo Resources Effective Uses (Advisor), CDM Network in Osaka (Advisor), Research institute of development of environmental resources (Vice-chairman)

***Research grants***

Shibata, S.: Grant-in Aid for Scientific Research: Basic Research (A) (1); Influence of bamboo gregarious flowering in Mizoram, India to the local ecosystem and local shifting cultivation agriculture (Head), Grant-in Aid for Scientific Research: Basic Research (B) (1); Solution of actual condition of sluggish hazard around local unfortunate people and regional recovery mechanism in Indochina area (Member), Grant-in Aid for Scientific Research: Basic Research (A) (2); Academic research of scientific estimation , restoration methods and abstraction of important ecosystems (Member)

Ando, M.: Grant-in Aid for Scientific Research: Basic Research (C); Recovery of the forest landscape behind world's cultural heritage in Kyoto (Head), Kyoto City Grant: Vegetation Research of Forest around Hacchou-daira swamp, 2008 (Head)

Tokuchi, N : Grant-in Aid for Scientific Research: Basic Research (B); Mechanism of nitrogen saturation with forest development and its evaluation by PnET-CN (Head) , Grant-in Aid for Scientific Research: Basic Research (B) (2); Evaluation method of environmental influences in forested ecosystem Using model of stream water chemistry (Member), RISH Mission Project (Head)

Hasegawa H.: Grant-in Aid for Scientific Research: Basic Research (A) (1); Ecological study of gregarious flowering of bamboo, *Melocanna baccifera* in North-east India (Member)

**A-4. International cooperations and overseas activities**

***International meetings (roles)***

Shibata, S.: International Conference of Improvement of Bamboo Productivity and Marketing for

Sustainable Livelihood (presentation)、 International Conference of Sustainability on Food, Feed, Fiber, Water, Energy: Science, Technologies, and Global Strategies (presentation) 、 4th International Conference on Landscape and Ecological Engineering (presentation)

Hasegawa H.: IUFRO-All-D3 (executive, presentation)

***Membership in international academic societies***

Shibata S.: World Bamboo Organization (Board member)

Hasegawa H.: International Union of Forest Research Organizations, Council on Forest Engineering

***International joint researches, overseas research surveys***

Shibata, S.: Survey of flowering *Melocanna baccifera* forests (India), Arrangement of the site in natural



history museum, Tribhuvan Univ. (Nepal), Survey of bamboo resources in central Taiwan (Taiwan)

Hasegawa H.: Survey of flowering *Melocanna baccifera* forests (India)

## **B. Educational activities**

### **B-1. On-campus teaching**

#### **a) Courses given**

*Undergraduate level*:: Planting design for landscaping (Shibata, Morimoto), Silvology (Sakimoto), Silviculture (Shibata, Sakimoto, Hasegawa, Tokuchi), Forest Botany (Ando), Laboratory Course in applied Forest and Biomaterials Science (Ando), Practice of University Forest III (People and Nature of East Hokkaido) (Ando), Practice of University Forest IV (Natural Environment of Cold Winter Period of East Hokkaido) (Ando, Hasegawa), Basic Science for Forest and Biomaterials II (Ando, Sakimoto), Practice of Biological and Environmental Science I (Sakimoto, Ando), Science of Biosphere - Life, Food and Environment (Ando and Tokuchi), Regeneration and Dynamics of Forests (Ando), Exercises in Ecological Interactions between Forest and Coastal Area C (Ando), Exercises in Ecological Interactions between Forest and Coastal Area B (Tokuchi), Forest Science (Ando), Training of Research Method I (Kawamura, Ando), Practice of Biological and Environmental Science I (Sakimoto), Pocket seminar “Learning in “Afin’s forest” of C. W. Nikol” (Shibata, Hasegawa), Pocket seminar “Creation of woody school buildings – Restoration of woody culture” (Shiba, Shibata, Kobayashi), Pocket seminar “What the woods give us” (Tokuchi), Linkage of forest, human, and coastal ecosystems (relayed), Forestry (relayed), Basic forest science IV (Osawa, Isagi, Yoshioka, Shibata),

*Graduate level*: Seminar in Silviculture (Ando, Shibata, Tokuchi, Hasegawa, Sakimoto), Practice Course in Silviculture (Ando, Shibata, Tokuchi, Hasegawa, Sakimoto), Landscape ecology and planning (Morimoto, Shibata), Regeneration of woodland in countryside (Shibata), Practice of field works in forests (Shibata), Insistence of global environmental studies (Shibata et al.), Extended Lecture of Silviculture (Shibata, Hasegawa)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Shibata, S.: Ryukyu University (Special course II: Environmental Forest Products), Kyoto College of Art (Correspondence course, Landscape Design and Nature conservation)

Hasegawa H.: Nagoya University (Theory of Precision Forestry)

#### ***Open seminar, etc***

Shibata, S.: Symposium “To make a society living with timber resources” (lecture), Spring open seminar of Kamigamo Experimental Station (lecture), Spring action of Bamboo Linkage Project of Kyoto University (lecture), Lecture in Osaka Industrial College (lecture), General meeting of Association of Creating the clear streams in Shizuoka city(keynote speech), ANA Blue Sky Lecture in Okayama (lecture), Memorial lecture of Bamboo High-technological Utilization Research Center of Doshisya University (keynote speech), Study meeting in annual meeting of Japan Bamboo Society (lecture), Satoyama step-up course of Osaka Environmental Preservation Association (lecture), 2nd political venture workshop, Kyoto Prefecture (speech), Center of support of forest restoration symposium (paneling), International Cooperation Station 2008

(speech), Forum of Suita City Museum (lecture), Cultural School of Kochi Newsletter (lecture), 5th open dialog meeting in Kyoto University Clock Tower (chair), Autumn action of Bamboo Linkage Project of Kyoto University (lecture), ANA Blue Sky Lecture in Miyakejima Island (lecture), 3rd Junior School of Eco; Field study (lecture), Younger forum of 49th annual meeting of Japan Bamboo Association (adviser), Panel discussion of 49th annual meeting of Japan Bamboo Association (coordinator), Autumn open seminar of Kamigamo Experimental Station (lecture), Study workshop of Mitoyo City for bamboo resource use (lecture), Senior Nature College 2008 (lecture), Kick-off meeting of woody culture project of FSERC, Kyoto Univ. (host), Workshop for bamboo use of Woody Energy Industry Network (lecture), 1st International symposium “City planning with Fuga” (comment), Coordinating seminar of agriculture, commerce and industry in Kyoto Pref. (lecture)

Sakimoto: Open Seminar in Ashiu Forest Research Station (Lecture), Open Campus for Students of Senior High School

Ando, M.: The 3rd Shii-noki Symposium (lecture)

Hasegawa H.: The 5<sup>th</sup> Clock Tower Open Seminar (Planning and Conductor), Spring Open Seminar of Kamigamo E.F.S. (Lecture), Autumn Open Seminar of Kamigamo E.F.S. (Lecture), Open Seminar in Ashiu Forest Research Station (Lecture), Hokubu-campus tour for Kyoto University alumni (Lecture), Forest and Forestry Symposium in Kyoto Prefecture (Coordinator), Forest and Forestry Symposium in Hyogo Prefecture (Coordinator), Workshop on low-cost thinning in Wakayama (Coordinator, Lecture), Workshop on reformation of Japanese forestry IV (Panelist), Training Course of low-cost forest operation in Hyogo Prefecture (Lecture)

### **B-3. Overseas teaching**

#### ***Students and research fellows from abroad***

foreign student: 1 doctor's course student (China), 1 master's course student (Brazil)

### **C. Other remarks**

Shibata, S.: Committees: Member of committee to consideration of policy for green public works (Kyoto Prefecture), Member of committee for the preservation of cultural landscape of Residential woodland in Tonami (Agency of Cultural Affairs), Member of committee for evaluation of research project (Forestry and Forest Products Research Institute, Kansai Branch), President of CENEED (Centre for Nepal of Environmental and Educational Development) Supporting Group, Member of committee for building-up of bamboo forest management system (Agency of Forestry), Member of city planning committee of eastern hill area of Katsushika (Organization of Kansai research city), Chairman of committee of unutilized natural resources in Mifune town (Mifune Town, Kumamoto), Newspaper interview: Kyoto Newspaper (2008.6.15), Journal interview: Journal of the Japan Expo memorial Organization No. 13

Ando, M.: Special Committee of the Meeting for the Promotion of the Forest of Traditional Culture in Kyoto, Director of Sakamoto Shougakkai, Committee of Forest Promotion in Shibeche-cho, Committee of Revegetation in Shibeche-cho

Hasegawa H.: Committee of forest planning in Hyogo Prefecture (Member), Promotion Project for Low-cost Forestry in Wakayama Prefecture (Advisor), Executive Committee of Forest Owners database in Northeast Okayama Prefecture (Chairman), Committee of Forest Biomass Utilization in Kyoto City (Member)

# Chair of Wood Biomass Science

2.2.16 Laboratory of Biomass Morphogenesis and Information  
(Research Institute for Sustainable Humansphere)

*Staff*                      *Professor:*                      *Junji Sugiyama*  
*Associate Professor:* *Tomoya Imai*  
*Assistant Professor:* *Kei'ichi Baba*  
*Postdoctoral fellows:*    *Rie Endo, Yue Wang, Tomomi Kaku, Yoshiki Horikawa,*  
    *Misao Yokovama*

### Students and research fellows

*Doctor's program: ( 1 )*

*Master's program: ( 3 )*

*Research student: ( 1 )*

### A. Research Activities (2008.4-2009.3)

### A-1. Main subjects

## a) Structure, Formation and Function of Plant Macromolecules

Biogenesis, structure and function of plant macromolecules, especially cellulose, are studied by using state of art of electron microscopy together with molecular biology. Purification of cellulose synthesizing activity and *in vitro* synthesis of cellulose with it are conducted for understanding the mechanism of cellulose biosynthesis. Studies toward structural biology of cellulose synthase is in progress as well.

b) Fine structure in biomass

Structure of wood cell walls is understood not enough for thinking its formation, degradation, mechanical properties, and utilization. We are intensely studying its microstructure from the view of utilization as resources, which will leads to efficient energy conversion from biomass and development of new materials.

### c) Physiology of Growth in Forest Trees

Trees are distinguished from herbs or grasses by their longer life, larger size and slower maturity. Physiological mechanisms characterizing trees are studied by the methods on anatomy, histochemistry, cytochemistry, biochemistry and molecular biology. Now, we are targeting the response of xylem differentiating tissue against inclination stimulus and formation of tension wood.

d) Wood/Human Science Based on Wood Anatomy

Identification of wood used in cultural assets like sculptures and constructions is carried out with conventional anatomical analysis using light microscopy. As well, novel techniques for wood identification are in operation: (i) X-ray CT for visualizing anatomical features in small wood pieces, (ii) computational identification by image analysis and (iii) odorant analysis by portable mass-spectrometry. Multidisciplinary researches are driven with the xylarium database: wood conservation, wood decaying, and the relation ship between tree-rings and earth/solar activities.

## A-2. Publications and presentations

a) Publications

***Original papers***

- S. Hartati, E. Sudarmonowati, W. P. Yong, T. Kaku, R. Kaida, K. Baba and T. Hayashi : Overexpression of poplar cellulase accelerates growth and disturbs the closing movements of leaves in sengon. *Plant Physiol.* 147; 552-561, 2008
- Y. Horikawa, J. Sugiyama : Accessibility and size of Valonia cellulose microfibril studied by combined deuteration/rehydrogenation and FTIR technique. *Cellulose* 15; 419-424, 2008
- T. Kanzaki, Y. Horikawa, A. Makino, J. Sugiyama and S. Kimura : Nanotube and three-way nanotube formation with nonionic amphiphilic block peptides. *Macromolecular Bioscience* 8; 1026-1033, 2008
- K. Kojiro, Y. Furuta, M. Ohkoshi, Y. Ishimaru, M. Yokoyama, J. Sugiyama, S. Kawai, T. Mitsutani, H. Ozaki, M. Sakamoto and M. Imamura : Changes in micropores in dry wood with elapsed time in the environment. *Journal of Wood Science* 54; 515-519, 2008
- I. Nakamura, A. Makino, J. Sugiyama, M. Ohmae and S. Kimura : Enzymatic activities of novel mutant endoglucanases carrying sequential active sites. *Int.J.Biol.Macromol.* 43; 226-231, 2008
- K. Nakashima, J. Sugiyama and N. Satoh : A spectroscopic assessment of cellulose and the molecular mechanisms of cellulose biosynthesis in the ascidian *Ciona intestinalis*. *Marine Genomics* 1; 9-14, 2008
- T. Taniguchi, Y. Ohmiya, M. Kurita, M. Tsubomura, T. Kondo, Y. W. Park, K. Baba and T. Hayashi : Biosafety assessment of transgenic poplars overexpressing xyloglucanase (AaXEG2) prior to field trials. *Journal of Wood Science* 54; 408-413, 2008

b) Conference and seminar papers presented

- The 59<sup>th</sup> Annual meeting of the Japan Wood Research Society (15)
- The 15<sup>th</sup> Annual meeting of the Cellulose Society of Japan (5)
- The 50<sup>th</sup> Annual meeting of Japan Society of Plant Physiologist (2)
- The 22<sup>nd</sup> Annual meeting of Japanese Society for Biological Sciences in Space (1)
- The 37<sup>th</sup> COSPAR Scientific Assembly (1)
- The 1<sup>st</sup> Symposium for Space Environment and Utilization (1)
- The 235<sup>th</sup> ACS National Meeting and Exposition (2)
- The 237<sup>th</sup> ACS National Meeting and Exposition (1)
- Joint Meeting of COST Action IE0601 and the European Society for Wood Mechanics (3)
- Summer School for Sustainable Humanosphere Science (1)

**A-3. Off-campus activities**

***Membership in academic societies***

Sugiyama Junji: Cellulose society of Japan (Executive board, branch head, Editor), The Japanese Society of Microscopy (Council, Regional manager, Regional Council), Japan Wood Research Society (member of future planning committee, public information committee)

### ***Research grants***

Sugiyama Junji: Accelerated Technology Development for Biofuel: Basic R&D on Enzymatic Saccharification of Cellulosic Biomass and Biofuel Production. NEDO (coordinator of Study Group of Material Structure)

Sugiyama Junji: Medium- and Long-Term Development Technology: Development of Highly Efficient Saccharification of Unused Woody Biomass (Bark). NEDO (co-researcher)

Sugiyama Junji: Grant-in-Aid for Scientific Research (A) “*In vitro* synthesis of cell wall polysaccharides and their characterization” (coordinator)

Sugiyama Junji: Funding for the practical application of the university outcomes, Development of the technology for the production of modified bio-nanofibers and their utilization, NEDO(Co-researcher)

Sugiyama Junji: Grant for the production of organic electronics devices, Industrial-University Comprehensive Alliance (Investigator)

Imai Tomoya: Grant-in-Aid for Scientific Research (A) “*In vitro* synthesis of cell wall polysaccharides and their characterization” (co-researcher)

Baba Keiichi: Grant-in-Aid for Scientific Research (C) “Cell wall ultrastructure of transgenic poplar for some glycosyl hydrolases” (coordinator)

Baba Keiichi: Medium- and Long-Term Development Technology: Converting Fast-Growing Tropical Trees into Feedstock for Cellulosic Ethanol. NEDO (co-researcher)

### **A-4. International cooperations and overseas activities**

#### ***Membership in international academic societies***

Sugiyama, J.: Cellulose (editorial board)

#### ***International joint researches, overseas research surveys***

Sugiyama J.: Biomechanics of Trees (France).

Baba K.: Molecular Breeding of Tropical Trees (Indonesia and Malaysia)

#### ***Scholars from abroad***

1 Postdoctoral fellow

1 Visiting professor

6 Foreign co-researchers (Nanjing Forest University, the National Museum of Natural History of France, etc.)

## **B. Educational Activities (2007.4-2008.3)**

### **B-1. On-campus teaching**

a) Courses given

Graduate level: Biomass Morphogenesis and Information I, Graduate school of Agriculture (Sugiyama), Diagnostics and Control of the Humanosphere, Kyoto Sustainability Initiative (Sugiyama)

### **B-2. Off-campus teaching**

a) Part-time lecturer

Graduate level: Graduate School of Life & Environmental Sciences, Tsukuba University (Baba)

b) Extension courses

Lecture at seminar by Technical Information Institute Co. Ltd. (Sugiyama)

Coordinator of Wood Culture & Science VIII (Sugiyama)

Lecture at Research Meeting about the investigation of “Sumiya” at Shimabara, Kyoto.  
(Sugiyama)

Lecture at Open Seminar of Molecular Physiology and Ecology at Tsukuba University. (Baba)

### **B-3. Overseas teaching**

Nothing

### **C. Other remarks**

Sugiyama, J.: Committee member for public information of the university

Sugiyama, J.: Committee member for the home page administration

Sugiyama, J.: A head of X-ray operations in the institute

## 2.2.17 Laboratory of Active Bio-based Materials (Research Institute for Sustainable Humanosphere)

*Staff      Professor                      : Yano, Hiroyuki*  
*Associate Professor: Morooka, Toshiro*  
*Associate Professor: Tanaka, Fumio*

*Students and research fellow*

*Post doctoral research fellow : (6)*

*Doctor's program                      : (1)*

*Master's program                      : (4)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

- a) Extraction of cellulose nanofibers from wood and agricultural wastes
- b) Development of cellulose nanocomposites
- c) Production of high performance materials based on bacterial cellulose
- d) Utilization of cellulose nanofiber for organic electronic devices
- e) Investigation of the moisture adsorption properties of wood and related materials
- f) Studies on house climate

Regulation mechanism of temperature and humidity in wooden house is investigated.

- g) Molecular design of high-performance polysaccharides

New high-performance materials based on polysaccharide derivatives are designed using molecular simulation technique.

#### A-2. Publications and presentations

- a) Publications

##### ***Books***

Nogi, M. and H. Yano: Optically transparent low thermal expansion composites reinforced by bio-nanofibers, Value add electronics materials, p229-242, CMC publishing, Tokyo, 2009  
Yano H.: Cellulosenanofibers composites、Cutting-edge technology for cellulose utilization, p.258-266, CMC publishing, Tokyo, 2009

##### ***Original papers***

Nakagaito, A. N. and H. Yano: Toughness enhancement of cellulose nanocomposites by alkali treatment of the reinforcing cellulose nanofibers. Cellulose, 15(2), 323-331, 2008  
Nogi, M. and H. Yano: Transparent nanocomposites based on cellulose produced by bacteria offer potential innovation in electronics device industry. Advanced Materials, 20, 1849-1852, 2008  
Iwamoto, S., K. Abe and H. Yano: The effect of hemicelluloses on wood pulp nano-fibrillation and nanofiber network characteristics. Biomacromolecules, 9, 1022-1026, 2008  
Hsieh, Y.-C., H. Yano, M. Nogi and S.J. Eichhorn: An estimation of the Young's Modulus of bacterial cellulose filaments. Cellulose, 15(4), 507-513, 2008  
Nakagaito, A. N. and H. Yano: The effect of fiber content on the mechanical and thermal properties of biocomposites based on microfibrillated cellulose. Cellulose, 15(4), 555-559,

2008

- Iwatake, A., M. Nogi and H. Yano: Cellulose nanofiber-reinforced polylactic acid. *Composites Science and Technology*, 68(9), 2103-2106, 2009
- Md. Iftekhhar Sham and H. Yano: Development of selectively densified surface laminated wood based composites. *Eur. J. Wood Prod.*, 67, 169-172, 2009
- Md. Iftekhhar Shams and H. Yano: A new method for obtaining high strength phenol formaldehyde (PF) resin impregnated wood composites at low pressing pressure. *Journal of Tropical Forest Science*, 21(2), 175-180, 2009
- Nogi, M., S. Iwamoto, A.N. Nakagaito and H. Yano: Optically transparent nanofiber paper. *Advanced Materials*, 21(16), 1595-1598, 2009
- Okahisa, Y., A. Yoshida, S. Miyaguchi and H. Yano: Optically transparent wood-cellulose nanocomposite as a base substrate for flexible Organic Light-Emitting Diode displays. *Composites Science and Technology*, in press
- Suryanegara, L., A. N. Nakagaito and H. Yano: The effect of crystallization of PLA on the thermal and mechanical properties of microfibrillated cellulose-reinforced PLA composites. *Composites Science and Technology*, 69, 1187-1192, 2009
- Nakagaito, A. N., Fujimoto, Hama and H. Yano: Production of microfibrillated cellulose (MFC)-reinforced polylactic acid (PLA) nanocomposites from sheets obtained by a papermaking-like process. *Composites Science and Technology*, 69(7-8), 1293-1297, 2009
- Ifuku, S., M. Nogi, K. Abe, M. Yoshioka, M. Morimoto, H. Saimoto and H. Yano: Preparation of chitin nanofibers with a uniform width as  $\alpha$ -chitin from crab shells. *Biomacromolecules*, 10(6), 1584-1588, 2009

### ***Reviews***

- Nogi, M. and H. Yano: Optically transparent composites reinforced by bio-nanofibers, *Expected Materials for the Future*, 8(10), 6-9, 2008
- Nogi, M. and H. Yano: Optically transparent substrates for display reinforced by bacterial cellulose, *Microoptics News* 26(2), 23-28, 2008
- Yano H.: Cellulosic nanocomposites, *J. Jpn Materials Science* 57(3) ; 310-315, 2008
- Yano H.: Bio-nanofiber for the future materials, *Chemical Engineering*, 53(1), 46-51, 2008
- Yano H.: Cellulose nanofiber-based materials, *Wood Industry*, 63(10), 450-455, 2008
- Yano H.: Bio-nanofiber for the future materials, *Earth environment*, No.473 ; 66-67, 2008
- Yano H.: Production of bio-nanofibers and their utilization, *Chemistry and Chemical Industry*, 83(3), 90-95, 2009
- Yano H.: Development of bio-nanofiber materials, *plastics* 63-68, 2009

### ***Reports***

- Yano H.: Report on NEDO FY 2008 Eco-innovation program 「Development of the light weight materials for automotive from sustainable natural resources」, NEDO, March 2009
- Yano H.: Foreword of special issue, *Functional materials*, 29(3), p5, CMC publishing, Tokyo, 2009
- Tanaka F.: Estimation of the elastic modulus of cellulose I  $\alpha$  crystal, *Bulletin of the Supercomputer Laboratory, Institute for Chemical Research, Kyoto University*, p.94, 2009

### ***Articles, News paper and TV program***



Yano H.: 「Development of bionanofiber reinforced composites」 2007 May 21<sup>st</sup>, The Chemical Daily  
 Yano H.: 「Development of bionanofiber materials」 2007 March 10<sup>th</sup>, Nikkei Shimbun  
 Yano H.: 「Cellulosic nanofiber materials」 2008 September 23<sup>th</sup>, Science Zero  
 Yano H.: 「Nano materials from plant」 2008 August 31<sup>st</sup>, NHK radio2・cultural lecture  
 Yano H.: 「Introduction of Kyoto university symposium」, Yomiuri Shimbun

b) Conference and seminar papers presented

The 59<sup>th</sup> Annual Meetings of the JWRS (9 presentations, Yano, H.)  
 15<sup>th</sup> Annual meeting of cellulose society of Japan (3 presentations, Yano, H., Tanaka, F.)  
 Gordon Research Conference Composites (1 presentation, Yano, H.)  
 Annual meeting of the Society of Fiber Science and Technology, Japan (2 presentations, Yano)  
 The 22<sup>nd</sup> Annual Meeting of Japanese Society for Chitin and Chitosan (1 presentation, Yano, H.)  
 237<sup>th</sup> ACS National meeting (6 presentations, Yano, H.)  
 235<sup>th</sup> ACS National meeting (1 presentation, Yano, H.)  
 IWGC-5 Fifth International Workshop on Green Composites (1 presentation, Yano, H.)  
 COST Action E50: Cell wall macromolecules and reaction wood (2 presentations, Yano, H.)

### A-3. Off-campus activities

#### *Membership in academic societies*

Yano H.: Member of The Japan Wood Research Society, Member of The Wood Technological Association of Japan, Member of The Society of Materials Science, Member of the Cellulose Society of Japan, Member of The Chemical Society of Japan  
 Morooka T.: Member of The Japan Wood Research Society, Member of The Society of Materials Science, Japan, Member of the Society of Rheology, Japan  
 Tanaka F.: Member of The Society of Polymer Science, Japan, Member of The Society of Fiber Science and Technology, Japan, Member of the Crystallographic Society of Japan, Member of Society of Computer Chemistry, Japan, Member of The Japanese Society of Carbohydrate Research, Member of The Cellulose Society of Japan, Member of The Society of Cyclodextrins, Japan

#### *Research grants*

Yano H.: Funding for the practical application of the university outcomes, Development of the technology for the production of modified bio-nanofibers and their utilization, NEDO(Head Investigator)  
 Grant-in-aid for Scientific Research (B), Fundamental study for the extraction of uniform nanofibers from plant resources (Head Investigator)  
 Kyoto university ICC post-alliance (Development of flexible substrate) (Investigator)  
 NEDO Eco-innovation program 「Development of the light weight materials for automotive from sustainable natural resources」 (Head Investigator)  
 Grant-in-aid for JSPS postdoctoral fellowship for Foreign Researchers 「Selective densification of wood composites」 (Head Investigator)  
 Morooka T.: Grant-in-Aid for Scientific Research (C) (2), Moisture adsorption of wood above 100C (Head Investigator)

## **A-4. International cooperations and overseas activities**

### ***International joint researches, overseas research surveys***

Yano H.: 10th International Conference on Progress in Biofibre Plastic Composites (Invited speaker) (2007.5.12-14)

### ***Scholars from abroad***

1 JSPS postdoctoral fellow

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Wood Composite Products (Yano)

Graduate level: Bio-based Materials Physics I (Yano, Morooka, Tanaka), Seminar in Bio-based Materials Physics (Yano, Morooka, Tanaka), Laboratory course in Bio-based Materials Science (Yano, Morooka, Tanaka), Science for Creative Research and Development of Humanosphere (Yano et al)

### **B-2. Off-campus teaching, etc.**

#### ***Open seminar, etc***

Yano H.: The 108<sup>th</sup> seminar of microoptics group (Lecturer), Special lecture at polymer pigment study group (Lecturer), The 4<sup>th</sup> photonics technology forum (Lecturer), Study group for next generation photo devices (Lecturer), Kyoto University Forum for Environment (Lecturer), Symposium of kobunshi douyuukai (Lecturer), Annual meeting of study group of sustainable lignocellulosic resource industry (Lecturer), Special lecture of fiber division of kinki branch, The Institution of Professional Engineer (Lecturer), Omron culture forum (Lecturer), Sustainable humanosphere symposium on bio-materials (Lecturer), Focused session at symposium on macromolecules (Lecturer), NEDO forum (Lecturer), Symposium for advanced technology (Lecturer), Annual meeting of filler study group (Lecturer), Special lecture at Murata Seisakusyo (Lecturer), Special lecture of Chuugoku branch, the Jpn society of polymer science (Lecturer), G-COE paradigm study group seminar (Lecturer), Microsymposium of cellulose society (Lecturer), Special seminar of cellulose research group (Lecturer), Annual meeting of display study group, the Jpn society of polymer science (Lecturer), JST Science and technology forum in fukui region (Lecturer), Wood research society Emachyu special lecture (Lecturer), The 4<sup>th</sup> kyoto university institute and center symposium (Lecturer)

### **B-3. Overseas teaching**

#### ***Lectures and seminars***

Yano H.: "Cellulose nanocomposites", VTT (Finland, Lecturer)

Morooka T. "Mechanical properties of wood at high temperature", Beijing Forestry University (China, Lecturer)

#### ***Student and research fellows from abroad***

Doctor's program: 1 (Indonesia)

## 2.2.18 Laboratory of Sustainable Materials (Research Institute for Sustainable Humanosphere)

*Staff Professor : Kawai, Shuichi , Dr. Agric. Sci.*

*Assistant Professor : Umemura, Kenji, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (0)*

*Research fellow : (3)*

*Master's program : (4)*

*Resercher : (1)*

### **A. Research Activities (2008.4-2009.3)**

#### **A-1. Main subjects**

The laboratory aims to establish the sustainable cycle of forest and forest products by developing the production, utilization and recycling/desposal system of wood biomass. New wood based materials harmonized with both global and regional environment are being developed by making use of the functions of wood as a cellular solid, and integrated projects in the interdisciplinary fields are being carried out to confirm the sustainability of production/utilization system of wood biomass.

The research projects are as follows:

#### **1. Development of New Wood Based Materials**

- a) Continuous production process of cylindrical LVL by using spiral winding method.
- b) Numerical analysis of mechanical properties of cylindrical LVL and paper pipe.
- c) Development of plant fiber reinforced composites by using plant fibers
- d) Development of bamboo carbon composites
- e) Rapid curing technology of cement bonded particleboard
- f) Development of ultra-low density fiberboard

#### **2. Adhesive Resins/ Durability of Adhesion**

- a) Durability of isocyanate resin adhesives
- b) Application of polysaccharides as adhesives
- c) Development of chitosan-based adhesives
- d) Characterization of bonding mechanism of binderless board and its application to wood adhesives
- e) Development and utilization of lignin binder
- f) Production of high durable wood adhesives from bark of fast growing trees

#### **3. Integrated Projects**

- a) Analysis of material cycle in large-scale industrial plantation
- b) Total processing and utilization system of domestic small-diameter low-grade logs
- c) Preservation of wooden cultural properties –thermal treatment of wood for the color and property control–
- d) Aging of wood and prediction of service life of wood

#### **A-2. Publications and presentations**

- a) Publications

*Original Papers*

- Mori T, Umemura K, Sasada M, Norimoto M: Development of drift pins and plates made from bamboo fiber for timber structures. J. Society Material Science Jpn., 57 (4) , 328-332, 2008
- Umemura K., Kawai S.: Preparation and characterization of maillard reacted chitosan films with hemicellulose model compounds. J. Appl. Polym. Sci., 108(4), 2481-2487, 2008
- Umemura K., Yamauchi H., Ito T., Shibata M., Kawai S.: Durability of isocyanate resin adhesives for wood V. Changes of color and chemical structure in photo degradation. J. Wood Science, 54(4), 289-293, 2008
- Munawar S.S. Umemura K., Kawai S.: Manufacture of oriented board using the mild steam treated some plant fiber bundles. J. Wood Science, 54(5), 369-376, 2008
- Kojiro K, Furuta Y, Ohkoshi M, Ishimaru Y, Yokoyama M, Sugiyama J, Kawai, S, Mitsutani T, Ozaki H, Sakamoto, Imamura M: Changes in micropores in dry wood with elapsed time in the environment, J. Wood Science, 54(6), 515-519, 2008.

### ***Patents***

- Patent application 2008-174290, "Composite cured by heating and pressing" Inovetor: Umemura K., Applicant: Kyoto University, 7/3 2008

### ***Reviews***

- Uemura K.: Possibility of wood adhesives using non-fossile resources, Converttech, 118-122, No.421, 2008
- Umemura K.: Chareacterization of PMDI as wood adhesive, Wood processing technical digest, Vol.26 (1), 12-20, 2008

### ***Reports***

- Kenji Umemura: Reactivity of Chitosan with Glucose, Bulletin of Research Institute for Sustainable Humanosphere Kyoto University, No4, p.8, 2008

### **b) Conference and seminar papers presented**

59<sup>th</sup> Annual Meetings of the Japan Wood Reserch Society: 9 presentations

46<sup>th</sup> Annual Meeting of the Adhesion Society of Japan: 1 presentaion

The Sixth Conference of the Pacific Rim Termite Research Group : 1 presentaion

International Symposium on Wood Science and Technology. : 2 presentaions

Wood CulTher COST Symposium : 2 presentaions

49<sup>th</sup> atmospheric environment Society: 1 presentation

The Second International Conference of Kyoto University Global COE Program:2 presentatons

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Kawai, S.: The Japan Wood Research Society (Member of directors board) The Society of Materials Science, Japan (General clerk, Members of the Committees of Wood Composite materials and Referee), The Japanese Forest Society, The Forest, Wood, and Environment Academy ((Member of directors board, Member of Steering Committee), The Wood Technological Association of Japan (Member of directors

board), The Japan Wood Preserving Association (Head of LCA Committee), The Adhesion Society of Japan,

Umemura, K.: The Wood Technological Association of Japan (Member of planning committee and officer of the Kansai Branch, Member of officer of the Plywood Section, Member of advisory committee of the WPC Section), The Japan Wood Research Society (Member of Editorial Board), The Adhesion Society of Japan (Member of Editorial Board).

***Membership in Science Council of Japan, etc.***

Kawai, S. : Associate Member of the Science Council of Japan

***Research grants***

Kawai, S.: Grants-in-Aid for Scientific Research (A) (Principal): Database of properties on the members from historical wooden buildings. Grants-in-Aid for Scientific Research (B) (Collaborator): Evaluation of the durability of wood based panels from outdoor exposure Grants-in-Aid for Scientific Research (C) (Collaborator): Development of high-performance adhesive without using fossil resources. Grants-in-Aid from Tostem Buildign material Industry Funding (Principal): Fundamental and applied research on air purification of sugi timber.

Umemura, K.: Grants-in-Aid for Scientific Research (C): Development of high-performance adhesive without using fossil resources. Grants-in-Aid for Scientific Research (A) (Collaborator): Database of properties on the members from historical wooden buildings. The Agriculture, Forestry and Fisheries Research Council Project: Development of manufacture technology of biomass materials., NEDO Young Researcher Grant: Development of environmental friendly high performance engineered wood and its evaluation system.

**A-4. International cooperation and overseas activities**

***International meetings (roles)***

Kawai, S.: VTT-RISH Joint Symposium(99<sup>th</sup> Humanosphere Symposium), Kyoto, (Invitation lecture), China North-East Forestry University Special Lecture, Harbin (Invitation lecture), IAWPS2008, Harbin (Keynote address), Wood CulTher COST Symposium (Invitation lecture), The Second International Conference of Kyoto University Global COE Program In Search of Sustainable Humanosphere in Asia and Africa, Kyoto (Participation)

Umemura, K.: International Symposium on Wood Science and Technology. Harbin (Participation)

***Membership in international academic societies***

Kawai, S.: International Academy of Wood Science (Fellow)

Umemura, K.: The Japan Wood Research Society (Member of Editorial Board).

***International joint researches, overseas research surveys***

Kawai, S.: Evaluation of wood biomass in large-scale plantation forest and effective utilization of tropical fast growing trees (Indonesia and Malaysia)

Research and Development for Non-wood Lignocellulosic Materials (China)

Umemura, K.: Research survey of wood industry using eucalyptus (China), Research survey of wood industry using rubber wood and falcata (Indonesia)

***Scholars from abroad***

Dr. Zhang Ming: Prof. of Zheng Jian Forestry College

Dr. Ma Lim Fei: Prof. of Zheng Jian Forestry College

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Wood Composites (Kawai, Yano), Science for Sustainable Humanosphere (Kawai)

Graduate Level: Seminar in Sustainable Materials (Kawai, Umemura).

Laboratory Course of Sustainable Materials (Kawai, Umemura).

Sustainable Materials II (Kawai)

Lecture of Kyoto Sustainable Initiative (Kawai)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Kawai S: Tokyo University of Agriculture and Technology (Faculty of Environment and Resource Science)

#### ***Open seminar, etc***

Kawai, S.: San-sai gakurin Seminar (Lecturer), Seminar of the Forum on Green, Habitat, and Environment (Lecturer), New Business Association of chugoku area (Lecturer), Kansai Chemical Industry Association (Lecturer), Symposium on Japan Wood Technological Association, Kansai Branch (Lecturer), Seminar of Kyoto Prefectural Forestry Association (Lecturer), NPO Sainoki Seminar (Lecturer), Seminar of Japan Paper Industry (Lecturer), Second Nagoya International Forum (Coordinator), Symposium of the Association of Japanese Agricultural Scientific Societies (Lecturer), Moku no kai Seminar (Lecturer), Seminar of Chubu Wood Machinery Association (Lecturer), 25<sup>th</sup> Wood Based Materials Symposium (Lecturer), Wood School (Lecturer), G-COE Initiative III Seminar (Lecturer)

Umemura, K.: Wood Science Seminar (Lecturer), 25<sup>th</sup> Wood-based boards and Wood-based Composites Symposium (Coordinator)

### **B-3. Overseas teaching**

#### ***Lectures and seminars***

Kawai, S.: China North-East Forestry University Special Lecture (China)

Umemura, K.: The Humanosphere Science School 2008 (Indonesia)

#### ***Students and research fellows from abroad***

Researcher: 1 person (Indonesia)

## **C. Other remarks**

Kawai, S.: Secretary of the association of the research institutes for Inter-university collaborations, Director of the Research Inst. for Sustainable Humanosphere, Member of education and research council, Kyoto Univ., Sub-committee member of JSPS Grant-in-Aid Committee, Councilor of Forest and Forest Products Lab. Japan,

Councilor of Forest Management of Kyoto Prefecture, Adviser of Okayama Pref.  
Wood Technology Center, Sub-committee member of University Establishment  
(MEXT)

## 2.2.19 Laboratory of Innovative Humano-habitability (Research Institute for Sustainable Humanosphere)

*Staff*      *Professor*                      : *Imamura, Yuji, Dr. Agric. Sci.*  
                 *Associate Professor: Tsunoda, Kunio, Dr. Agric. Sci.*  
                 *Associate Professor: Yoshimura, Tsuyoshi, Dr. Kyoto Univ. (Agric. Sci.)*  
                 *Lecturer*                              : *Hata, Toshimitsu, Dr. Kyoto Univ. (Agric. Sci.)*  
                 *Postdoctoral fellow* : *Kawasaki, Tamami*  
                 *Postdoctoral fellow* : *Nakayama, Tomoe*

### *Students and research fellows*

<i>Doctor's program</i>	: (3)	<i>Research fellow</i>	: (2)
<i>Master's program</i>	: (3)	<i>Foreign visiting scientist</i>	: (4)
<i>Foreign collaborative researcher</i>	: (3)		

## A. Research Activities (2008.4-2009.3)

### A-1. Main subjects

The laboratory aim is to establish the society with proper resource recycle system in the future humanosphere. Fundamental and innovative investigations are being conducted with emphasis on the symbiotic relations with forest and wood resources.

- a) Comprehensive study on the improvement of durability of wood, wood-based materials for long-lasting wooden constructions

The improvement of durability of wood and wood-based materials, and the long service life of wooden constructions with the horizon to the environmental conservation and the prevention of the global warming.

- b) Integrated termite management on the basis of fundamental research

Role of symbiotic micro-organisms in the cellulose metabolism of termite; Synthetic route of termite trail-following pheromone; Biological control of termites by entomogenous fungi; Estimation of populations and foraging territories of subterranean termites and application of environmentally sound means such as bait system to termites.

- c) Application of low-toxicity wood preservatives and novel treatment methods to the wood preservation

Development of low-toxicity wood preservatives based on laboratory screening tests of various chemicals and field evaluation; Mode of actions of wood preservatives; Detoxifying pathways of chemicals under various conditions; Application of supercritical fluid to the preservative treatment of wood and wood-based composites.

- d) Durability assessment of wooden houses and development of the reliable maintenance system

Assessment of the durability of wooden houses by means of various integrated techniques including the non-destructive detection of degradation/deterioration, and development of the reliable maintenance system.

- e) Improvement of properties of timbers and wood-based composites by various treatments

Development of high performance wood products by chemical modification, impregnation of polymerizing materials and complex of wood, inorganic chemicals and other possible substances

- f) Conservation of wooden cultural properties



Conservation technology for wooden cultural properties and waterlogged wood.

g) Bioremediation by microorganisms related to wood degradation/deterioration

Bioremediation of environment with decay fungi and termite-symbionts; biological treatments of stable waste materials and insulation materials, and development of new energy options by wood deteriorating organisms.

h) Faunal and floral assessments of tropical plantation forests on wood-deteriorating agents

Biodiversity assessment of wood-deteriorating organisms, such as termites and decay fungi, in tropical plantation forests to maintain sustainability of ecosystem

i) Wood deterioration and development of electrical conductive wood in the space environment

Wood deterioration in the space environment consisting of radiations, heat cycles etc and electrical conductive wood used as a body of monitoring environment in the space.

j) Development of advanced high functional biomass carbon materials by thermal conversion.

Based on the fundamental study on the structure of carbonized biomass, high functional carbonized materials such as SiC nanorods, nanotubes and graphite are developed with or without catalyst of SiO<sub>2</sub> or Al<sub>2</sub>O<sub>3</sub> by thermal conversion such as pulse current sintering method or flush pyrolysis.

k) Micro-structural analysis of wood carbons and their application to electro-chemical devices

Application of wood carbons to electro-chemical devices, such as lithium-batteries and fuel cells, by detailed micro-structural analyses

l) Development of purification or recycling technology from preservative-treated wood wastes

Development of novel technology for purification and recycling preserved wood wastes with pyrolysis or chemical extraction. Electron microscopic study is conducted for clarifying the mechanism of pyrolysis of CCA (chromate copper arsenate)-treated wood. Selective separation of components of CCA, purification and recycling technique of preserved wood wastes.

m) Development for improving fire-resistant performance of wood composites.

Reduced scale fire resistance tests on traditional timber-frame soil walls are studied.

## A-2. Publications and presentations

a) Publications

**Books**

**Original papers**

Kubota, S., Y. Shono, N. Mito and K. Tsunoda: Termiticidal efficacies of fenobucarb and permethrin against Japanese subterranean termites *Coptotermes formosanus* and *Reticulitermes speratus* (Isoptera: Rhinotermitidae). Jpn Environ Entomol Zool 19; 31-37, 2008

Kubota, S., Y. Shono, N. Mito and K. Tsunoda: Lethal dose and horizontal transfer of bistrifluron, a benzoylphenylurea, in workers of the Formosan subterranean termite (Isoptera: Rhinotermitidae). J Pestic Sci 33; 243-248, 2008

Katsumata, N., K. Tsunoda, A. Toyouni, T. Yoshimura and Y. Imamura: Feeding preference of *Coptotermes formosanus* (Isoptera: Rhinotermitidae) for gamma-irradiated wood impregnated with benzoylphenylurea compounds under laboratory conditions. J Econ Entomol 101; 881-884, 2008

Kakitani, T., T. Hata, T. Kajimoto, H. Koyanaka and Y. Imamura: Characteristics of a bioxalate chelating extraction process for removal of chromium, copper and arsenic from treated

- wood. Journal of Environmental Management 90; 1918-1923, 2009
- Sulistyo, J. T. Hata, M. Fujisawa, K. Hashimoto, Y. Imamura and T. Kawasaki: Anisotropic thermal conductivity of three-layer laminated carbon-graphitic composites from carbonized wood. J Mater Sci 44; 734-744, 2009
- Fujisawa, M., T. Hata, H. Kitagawa, P. Bronsveld, Y. Suzuki, K. Hasezaki, Y. Noda and Y. Imamura: Thermoelectric properties of porous SiC/C composites. Renewable Energy 33; 309-313, 2008
- Kartal, S. N., W. J. Hwang and Y. Imamura: Combined effect of boron compounds and heat treatments on wood properties - Chemical and strength properties of wood. J Mat Process Technol 198; 234-240, 2008
- Indrayani, Y., T. Yoshimura and Y. Imamura: A novel control strategy for dry-wood termite *Incisitermes minor* infestation using a bait system. J Wood Sci 54; 220-224, 2008
- Miyauchi, T., M. Mori and Y. Imamura: Leaching characteristics of homologues of benzalkonium chloride from wood treated with ammoniacal copper quaternary wood preservative. J Wood Sci 54; 225-232, 2008
- Erwin, S. Takemoto, W. J. Hwang, M. Takeuchi, T. Itoh and Y. Imamura: Anatomical characterization of decayed wood in standing light red meranti and identification of the fungi isolated from the decayed area. J Wood Sci 54; 233-241, 2008
- Erwin, W. J. Hwang and Y. Imamura: Micromorphology of abnormal and decayed xylem in rubberwood canker. J Wood Sci 54; 414-419, 2008
- Kartal, S. N., C. Kose1, B. Tarakanadha and Y. Imamura: Adsorption of copper, chromium, and arsenic from chromated copper arsenate (CCA) treated wood onto various adsorbents. The Open Waste Manage J 1; 11-17, 2008
- Kartal, S. N., T. Yoshimura and Y. Imamura: Modification of wood with Si compounds to limit boron leaching from treated wood and to increase termite and decay resistance. Int Biodeter. & Biodeg 63; 187-190, 2009
- Indrayani, Y., T. Yoshimura and Y. Imamura: A novel control strategy for dry-wood termite *Incisitermes minor* infestation using a bait system. J Wood Sci 54; 220-224, 2008
- T. Kajimoto, K. Tachibana, M. Maeda, S. Kubota, T. Hata and Y. Imamura: Characterization of the Pulp-Like Fibers Separated from Sugi with L-Lactic Acid. Mokuzai Gakkaishi 54; 319-326, 2008 (in Japanese)
- Y. Tsujimoto and Y. Imamura: Development of an evaluation method of photo-stability for house interior materials III. Indoor exposure test of wood-based materials for house interiors by transmitted sunlight through window-sash. Mokuzai Gakkaishi 55; 45-50, 2009 (in Japanese)
- Y. Iwamoto, A. Sakai, K. Masuda, T. Ito and Y. Imamura: Vapor phase reaction of wood with maleic anhydride (IV) Assessment of biological resistance by field exposure tests. Mokukuzai Hozon 35(1); 9-15, 2009 (in Japanese)
- Noguchi, M., T. Yoshimura and K. Miyazawa: Compression strength of termite-infested timbers. J Structural Engineering 8; 171-176, 2008 (in Japanese)

## ***Reviews***

## ***Reports***

Imamura, Y.: Development of Japanese planted wood for public works,  
Shinrin-gijutsu, No.794; 36-37, 2008 (in Japanese)

Imamura, Y.: Prevention of global warming and architectures of temples and  
shrines, Bulletin of Architectural Research Association, No.14;5-6,  
2008 (in Japanese)

Imamura, Y.: Role of wood preservation and recent issues, News of Japan  
Association of Wood Preservatives Industries, No.22; 1-2, 2008 (in  
Japanese)

Imamura, Y.: Recommendation of DM, Mokuzai Kogyo (Wood Industry), 63; 295,  
2008 (in Japanese)

Imamura, Y.: Use class (Green keywords), Shinrin-gijutsu, No.800; 9, 2008 (in  
Japanese)

b) Conference and seminar papers presented

The 24<sup>th</sup> Annual Meeting of Japan Wood Preservation Association: 3 presentation

The 2008 Annual Meeting of Architectural Institute of Japan: 1 presentations

The 59<sup>th</sup> Annual Meeting of the Japan Wood Research Society: 11 presentations

The 20 Years Anniversary Conference of the Japanese Society of Environmental Entomology  
and Zoology: 4 presentations

The 35<sup>th</sup> Annual Meeting of Carbon Materials: 3 presentations

The 6th Annual Meeting of the Wood Carbonization Research Society: 2 presentation

The 6th Conference of Pacific Rim Termite Research Group: 5 presentations

The Spring Meeting of E-MRS IUMRS ICEM 2008: 1 presentation

The 120<sup>th</sup> Annual Conference of the Japanese Forestry Society: 1 presentation

The International Carbon Conference 2008, CARBON 2008 : 4 presentations

The 39<sup>th</sup> Annual Conference of International Research Group on Wood Protection: 1 presentation

VTT-RISH Joint Symposium: Sustainable utility of wood biomass: 3 presentation

The 1<sup>st</sup> International Conference on Hazardous Waste Management: 1 presentation

Symposium on Advanced Technological Development of Biomass Utilization in Southeast Asia- 1  
presentation

IUMRS-ICA 2008, The IUMRS International Conference in Asia 2008 : 1 presentation

A “Wood Intelligence” conference and a Chemistry for a sustainable development Project : 1  
presentation

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Imamura, Y.: Japan Wood Research Society (Trustee), Japanese Association of Wood Technology  
(Trustee, Chair of Kansai branch), Japan Wood Preserving Association (President),  
Japanese Society of Environmental Entomology and Zoology (Vice president), Wood  
Carbonization Research Society (Vice president)

Tsunoda, K.: Japan Wood Preserving Association (Chairman of the Committee for the  
International Collaborative Affairs)

Yoshimura, T.: Japanese Society of Environmental Entomology and Zoology (Trustee), Material  
Research Society, Japan (Editorial board), Japan Termite Control Association (Council,  
Editor-in chief, President of Kansai Branch), Japan Wood Preserving Association

(Editorial board)

Hata, T.: Wood Carbonization Research Society (Member of the steering committee and technical and editorial committee)

### ***Research grants***

Imamura, Y.: Grant-in-aid for Scientific Research (B), Wood deterioration under the extreme environment (Head investigator), Grant-in-aid for Scientific Research (Exploratory), Development of the termite detector with a smell sensor (Head investigator), Grant-in-aid for Scientific Research (B), Development of new type of lithium battery from carbonized wood with multiwall carbon (Fellows), Grant-in-aid for Scientific Research (Exploratory), Development of carbonized-wood substrate for diffusing heat in solar power satellite (Fellows), Grant-in-aid for Scientific Research (B), Development of thermal conversion technology of wood biomass to carbon nano-tubes (Fellows), Grant-in-aid for Scientific Research (C), The development of wood-nano-capsule containing metals by fast heating system (Head investigator), Grant-in-Aid for Scientific Research (B) Non-destructive survey of wooden cultural products with AE and radar technologies and inspection of treatments (Fellows), Grant-in-aid for Scientific Research (Exploratory), Development of wood-based space materials(Fellows)

Tsunoda, K.: Wood deterioration under the extreme environment (Fellows), Manufacturing processes to protect wood-based and wood-polymer composites from biological attacks (Fellows)

Yoshimura, T: Grant-in-aid for Scientific Research (B) Evaluation of biodiversity of wood-deteriorating organisms in tropical plantation forests and a proposal of sustainable management (Head investigator), Grant-in-aid for Scientific Research (B) Non-destructive survey of wooden cultural products with AE and radar technologies and inspection of treatments (Fellows), Grant-in-aid for Scientific Research (B) Wood deterioration under the extreme environment (Fellows), Grant-in-aid for Scientific Research (Exploratory), Grant-in-aid for Scientific Research (Exploratory), Interaction between termites and white rot fungi and its applicability to termite control (Fellows), Grant-in-aid for Scientific Research (Exploratory), Development of the termite detector with a smell sensor (Fellows)

Hata, T.: Grant-in-aid for Scientific Research (B), Development of new type of lithium battery from carbonized wood with multiwall carbon nanotubes (Head investigator), Grant-in-aid for Scientific Research: (Exploratory) Development of carbonized-wood substrate for diffusing heat in solar power satellite (Head investigator), Grant-in-aid for Scientific Research: (C) Utilization and Application of meso-porous carbons with crystal characteristic for electrodes (Fellows), Grant-in-aid for Scientific Research (B) Wood deterioration under the extreme environment (Fellows), Grant-in-aid for Scientific Research (Exploratory), Development of wood-based space materials(Fellows)

## **A-4. International cooperation and overseas activities**

### ***International meetings (roles)***

Imamura, Y.: Symposium on Advanced Technological Development of Biomass Utilization in Southeast Asia (Plenary), VTT-RISH Joint Symposium: Sustainable utility of wood biomass (Invited)

Tsunoda, K.: The 6<sup>th</sup> Conference of Pacific-Rim Termite Research Group, Kyoto, Japan (President)  
Yoshimura, T.: The 6<sup>th</sup> Conference of Pacific-Rim Termite Research Group, Kyoto, Japan  
(Secretary general)

***Membership in international academic societies***

Imamura, Y.: The International Research Group on Wood Protection

Tsunoda, K.: Pacific Rim Termite Research Group (President), IUFRO Working Party 5.03.05  
(Moderator), The International Research Group on Wood Protection

Yoshimura, T.: Pacific Rim Termite Research Group (Secretary general)

***International joint researches, overseas research surveys***

Imamura, Y.: Joint research on deterioration of wood by outdoor exposure (Indonesia), Joint  
research on wood preservation and recycling system of waste treated wood (Turkey),  
Joint research on heat-treatment of wood (Finland)

Tsunoda, K.: Joint researches on Durability of sill plates under service conditions (USA, Canada),  
and termite biology (Australia)

Yoshimura, T.: Joint research on the colony structure of *Coptotermes formosanus* (Australia),  
Joint research on the novel natural wood preservatives (Finland), Joint research on  
termite resistance of tropical timbers (Malaysia), Joint research on biodiversity of  
wood-deteriorating organisms in tropical plantation forests (Indonesia, Malaysia,  
Vietnam)

Hata, T.: Microstructural investigation of wood based carbon materials (The Netherlands),  
Development of Application in Electrochemistry from carbonized wood (France)

***Scholars from abroad***

Visiting scientists: 4 (Universiti Sains Malaysia • Malaysia, University of Georgia • USA, CSIRO  
Entomology • Australia, Bogor Agricultural University • Indonesia)

Collaborative researchers: 3 (Istanbul University • Turkey, Duzce University • Turkey, Semarang  
State University • Indonesia)

**B. Educational Activities (2008.4-2009.3)**

**B-1. On-campus teaching**

a) Courses given

Undergraduate level: Wood Preservation (Imamura and Yoshimura), Science for  
Humanosphere-[Development of science and technology through biomass and solar  
power satellite research toward a solar energy society] (Imamura, Yoshimura and Hata),  
Science for Humanosphere-[Development of technology and materials for cyclic  
utilization of bio-based resources] (Hata)

Graduate level: Innovatibe Humano-habitability I (Imamura and Yoshimura), Seminar on  
Innovatibe Humano-habitability (Imamura, Tsunoda, Yoshimura and Hata), Laboratory  
Course of Innovatibe Humano-habitability (Imamura, Tsunoda, Yoshimura and Hata),  
Lecture in Kyoto University Sustainable Initiative (Imamura)

**B-2. Off-campus teaching, etc.**

***Part-time lecturer***

Imamura, Y.: Nara Edicational University (undergraduate level), Shizuoka University

(undergraduate level)

### **B-3. Overseas teaching**

#### ***Lecture***

Imamura, Y.: Humanosphere Science School in Indonesia, 2009 (Lecture)

#### ***Students and research fellows from abroad***

Foreign students: Doctor's Program: 2 (Indonesia)

Postdoctoral fellow: 1 (Turkey)

### **C. Other remarks**

Imamura, Y.: Kyoto University (Council member of Kyoto University Rakuyukai, Council member of Center for Ecological Research), ISO/TC Wood Preservation Committee (Member), Japan Housing and Wood Technology Center (Council member), Nara Prefecture (Member of Forestry Research Council), Kumiyama Town (Member of Town Planning Council), Japan Housing & Wood Technology Center (Council member), Architectural Research Association (Council member)

Yoshimura, T.: Japanese Agency for the Evaluation of Wood Preservatives (Member of technical committee), The Japan Termite Control Association (Members of Committee on general affairs, Committee on certification for termite control operators, Committee on authorizing drugs, Committee on developing new termite control strategies, Special committee on dry-wood termites and Special committee on 50 years anniversary of the association)

Hata, T.: Society for the Study of Functional Wood-based New Materials (Member of Professional Technical Committee), 2008 Grant-in-aid Demonstration for Unused Biomass Energy, "Feasibility Study of Power Generation and Thermal availability system by Pyrolysis Gasification of CCA-treated Waste Wood for that uses waste of CCA treated wood" (Member of Technical Committee)

## 2.2.20 Laboratory of Structural Function

*Staff*      *Professor*                      : *Komatsu, Kohei, Dr. Agric. Sci.*  
                 *Assistant Professor* : *Takino, Shinjiro, Dr. Agric.Sci.*  
                 *Assistant Professor* : *Mori, Takuro, Dr. Engr..*

*Students and research fellows*

*Overseas special research fellows* : (1)  
*Doctor's program*                                      : (3)  
*Master's program*                                      : (2)

### A. Research Activities (2007.4-2008.3)

#### A-1. Main subjects

In order to develop reliable wooden structures, it is important to select the optimum joint methods having high joint efficiency for both stiffness and strength. We are developing various engineered timber joints or/and structural units and analyzing their behaviors through full-scale experiments as well as theoretical modeling on the basis of timber engineering, wood science and technologies, and structural engineering.

##### 1. Development of Engineered Timber Joint for Medium or/and Large Scale Timber Construction.

###### a) Research and development of large finger jointed glulam frame corners.

There is a jointing method called as "Large Finger Joint (LFJ)" to make glulam beams and columns glued joint on-site directly. As this joint method is completed by gluing literally large fingers joint on-site, it requires less steel connectors, is low-cost and has high initial stiffness. But the failure mode is quite brittle. Especially in the case where two members are jointed having finite angle, the joint part tends to fail in brittle manner, especially by the mode of tension perpendicular to the grain subjected to open mode moment. In this research subject, we are investigating strength expression mechanism and developing improvement methods for preventing brittle failures.

###### b) Evaluation of pull-out capacity of Lagscrewbolt and its application to glulam frame structures.

We developed screw-in type connector called as 'Lagscrewbolt (LSB)' as an innovating fastener using minimum steel and high aesthetic concealed joint, and are investigating its strength expression mechanism. At the same time, we are developing structural design method as well as recognizing safety of LSB by full-scale experiments in order to applying LSB to the actual glulam portal frame structures, thus we expect LSB would be used more widely in general wooden constructions.

###### c) Development of High Ductility and High Strength Wooden Portal Frames Using Mixed Species Glulam.

Mixed species glulam is constituted by domestic Sugi inner laminae whose mechanical properties are relatively inferior to others and imported Douglas fir outer laminae whose mechanical properties are relatively superior. We are developing glulam portal frames which are composed of mixed species glulam for all members and their beam-column joints and leg joints are assembled by using steel gusset plates with flange parts though where embedment stresses can be transmitted to the glulam members so as to utilize stronger properties of outer

laminae.

## 2. Development of Wooden Post & Beam Dwelling House by Utilizing Natural Building Materials.

In order to propose a long duration and low environmental load wooden post & beam dwelling house to be built using Kyoto prefecture grown Sugi timber which are pre-dried by Hagarashi treatment then dried under about 40°C low temperature with moisture removing system so as to keep hart wood extractives having high anti-fungy or/and anti-termite function,we are developing hevty timber housing system which shall be comosed of 15cm square timber with pith for continuous column, 12cm square timber with pith for short post and 12cmx 24cm rectangular timebr for beams, roof girder, and horizontal girders.

## 3. Estimation and Analyses of Mechanical Properties of Various Wooden Structural Components

### a) Estimation of various wooden shear walls, floor system and semi-rigid frames.

We are estimating strength ratio (multiplier) of various shear walls and floor systems composed of such materials as plywood, oriented strand boards or mud shear wall, and braces made of sawn timbers cooperating with commercial based companies. In addition to this, we are also developing optimum evaluation system for timber semi-rigid frame systems by cooperating with independent estimation organization.

### b) Investigation on the mechanism of stiffness and strength in ductile moment-resisting joints focused on the role of traditional Nuki or Kusabi joints.

Nuki or Kusabi is important structural component in traditional wooden structures. Its initial stiffness, however, is relatively low so that its application to modern wooden constructions seems to be difficult if traditional style is rigorously applied. In this research subject, we intend to develop a new ductile, stiff and strong moment-resisting joint based on traditional timber joint mechanism by mixing latest technology while keeping advantage points of traditional joint, which is essentially ductile.

### c) Structural utilization of Sugi compressed dowels.

Compressing relatively low density Sugi timber up to 30 to 50 % of the original volume can easily produce high-density joint supplemental material. In this research subject, we are developing innovating timber joint method with less stress relaxation function by making use of both characteristics of 'high strength properties' and volume recovering with water absorption. Actually, we are investigating applicability of Sugi compression timber to Kusabi (wedge) or Syachi (shear connector).

### d) Development of wooden blocks shear wall system

We are developing a new type of shear wall by using wooden block, which has grooves around each side face to interlock with other wooden blocks. Diamond shape Sugi compression wood keys were inserted into spaces, which were born by cutting off triangular area on each corner of the wooden blocks, to make in-plane stiffness of shear wall higher.

## A-2. Publications and presentations

### a) Publications

#### ***Books***

Kohei Komatsu : Wooden Semi-Rigid Frame and It's Joints. 【Build residential houses by wooden semi-rigid frame system】 Kenchiku-Gijutsu, 115-120、 May, 2007. (in Japanese)

#### ***Original papers***

Kiho Jung, Akihisa Kitamori and Kohei Komatsu : Development of Joint System using



- Compressed Wooden Fastener Part1, Evaluation of pull-out and rotation performance for column and sill joint, *Journal of Wood Science*, DOI 10.1007/s10086-009-1027-3, 2009
- Wen-Shao Chang, Jonathan Shanks, Akihisa Kitamori and Kohei Komatsu : The structural behaviour of timber joints subjected to bi-axial bending, *Earthquake Engineering and Structural Dynamics*, Vol.38, 739–757, 2009
- Ivon Hassel, Pierre Berard and Kohei Komatsu : Development of wooden blocks' shear wall -Improvement of stiffness by utilizing elements of densified wood -, *Holzforschung*, Vol.62, 5, 584-590, 2008
- Kweonhwan Hwang, Eeding Wong and Kohei Komatsu : Flexural, in-plane shear and nail shear properties of falcataria-rubberwood laminated veneer board for flooring, *Holzforschung*, Vol.62, 731-736, 2008
- Jonathan Shanks, Wen-Shao Chang, Kohei Komatsu : Experimental study on mechanical performance of all-softwood pegged mortice and tenon connections , *Biosystems Engineering*, doi:10.1016/j.biosystemseng, 2008.03.012, 2008
- Kiho Jung, Akihisa Kitamori and Kohei Komatsu : Evaluation on structural performance of compressed wood as shear dowel, *Holzforschung*, Vol. 62, 461-467, 2008
- Takeshi Shiratori, Kohei Komatsu, Adrian Leijten : Modified traditional Japanese timber joint system with retrofitting abilities, *Structural Control and Health Monitoring*, Published Online: Feb 8 2008 1:18PM, DOI: 10.1002/stc.240, 2008
- Kinsaku Nakata, Kohei Komatsu: Development of Timber Portal Frames Composed of Compressed LVL Plates and Pins II Strength properties of compressed LVL joints as moment resisting joints. (in Japanese)
- Kohei Komatsu, Yasuo Kataoka, Takuro Mori, Shinjiro Takino, Kiho Jung, Akihisa Kitamori, Takeshi Shiratori, Munekazu Minami: Concept of Proposed House and Outline for Structural Performance. – Development of Wooden Post & Beam Construction by Utilizing Natural Construction Materials (Part 1) –, *AIJ J. Technol. Des.* Vol. 14, No. 28, 447-452, Oct., 2008 (in Japanese)
- Makoto Nakatani, Takuro Mori, Kohei Komatsu : Study on the Beam-Column Joint of Timber Frame Structures using Lagscrewbolts and Special Connectors, *Journal of Structural and Construction Engineering*, Transactions of AIJ, No.626, 599-606, 2008. (in Japanese)
- Kohei Komatsu, Shinjiro Takino, Takuro Mori, Youji Ito and Ryoji Kataoka : Lateral Shear Performance of Nailed Plywood Sheathed Shear Wall with Opening and Portal Frame with Nailed Plywood Sheathed hanging Wall, *Journal of Structural Engineering*, Vol.54B, 119-128, 2008. (in Japanese)
- Takuro Mori, Kenji Umemura, Masahiko Sasada, Misato Norimoto: Development of Drift Pins and Plates Made from Bamboo Fiber for Timber Structures, *Journal of the Society of Materials Science*, Vol.57, No.4, pp.328-332, Apr.2008(in Japanese)
- Hidemaru Shimizu, Takuro Mori, Shingo Murase, Kazuki Tachibana, Hiroshi Isoda, Kohei Komatsu, Sheiichi Yoshikawa, Yasuhiro Fukuda: Weight Appraisal of Newly Built Wood House -Weight measurement of full scale wood house-, *AIJ J. Technol. Des.* Vol. 15, No. 29, 115-120, Feb, 2009(in Japanese)
- Takuro Mori, Makoto Nakatani, Kohei Komatsu: Development on the Structural Performance of One Directional Timber Frame using Lagscrewbolts having an External Thread, *Journal*

***Reports***

- Kohei Komatsu, Mitsushi Akagi, Chiori Kawai, Takuro Mori, Shingo Hattori, and Kiyoshi Hosokawa : Improved Column-Beam Joint in Glulam Semi-Rigid Portal Frame, 10th World Conference on Timber Engineering, June.2-5, Miyazaki, 2008
- Akihisa Kitamori, Kiho Jung, Munekazu Minami and Kohei Komatsu:Improvement of Shear Resistance on Traditional Lattice Shear Wall, 10th World Conference on Timber Engineering, June.2-5, Miyazaki, 2008
- Satoru Murakami, Tomihiko Tamaoka, Hidenobu Kadowaki and Kohei Komatsu : The Improvement of Single-Braced Shear Wall System, 10th World Conference on Timber Engineering, June.2-5, Miyazaki, 2008
- Maryoko Hadi, Bambang Subiyanto, Anita Firmanti and Kohei Komatsu : The Braced Frame Shear Wall made of Acacia Mangium Fastened by nails for Anti-Seismic Wooden House, 10th World Conference on Timber Engineering, June.2-5, Miyazaki, 2008
- Makoto Nakatani, Takuro Mori, and Kohei Komatsu : Design method for Moment-Resisting Joint Composed by Multiple Lagscrewbolts, 10th World Conference on Timber Engineering, June.2-5, Miyazaki, 2008
- Munekazu Minami, Akihisa Kitamori, Kiho Jung and Kohei Komatsu : Development of floor system using Japanese cedar plank, 10th World Conference on Timber Engineering, June.2-5, Miyazaki, 2008
- Kiho Jung, Akihisa Kitamori, Munekazu Minami and Kohei Komatsu : Development of Joint System using by Compressed Wooden Fastener, 10th World Conference on Timber Engineering, June.2-5, Miyazaki, 2008
- Ying H. Chui, Kohei Komatsu, Kiho Jung, Yasunobu Noda, Yoshinori Ohashi and Masahiko Toda : Reinforcement of Wood I-joists with Natural Fibres, 10th World Conference on Timber Engineering, June.2-5, Miyazaki, 2008
- Makoto Nakatani, Takuro Mori, and Kohei Komatsu : Design method for Moment-Resisting Joint Composed by Multiple Lagscrewbolts, 10th World Conference on Timber Engineering, June.2-5, Miyazaki, 2008
- Yasunobu Noda, Takuro Mori, and Kohei Komatsu : Experimental Study on the Moment Transmitting Performance of Large Finger Joint, 10th World Conference on Timber Engineering, June.2-5, Miyazaki, 2008
- Shigeaki Kawahara, Takushi Nakashima, Takeshi Shimizu, Makoto Nakatani, Takuro Mori and Kohei Komatsu : Introduction of Joint System and Timber Constructions Composed of Lagscrewbolt(LSB), 10th World Conference on Timber Engineering, June.2-5, Miyazaki, 2008
- Atsushi Tabuchi, Yoshihiro Murata, Takuro Mori, and Kohei Komatsu : Development of an Aesthetic and Strong Shear Wall using Kitayama-maruta Logs, 10th World Conference on Timber Engineering, June.2-5, Miyazaki, 2008
- Takuro Mori, Makoto Nakatani, Shigeaki Kawahara, Takeshi Shimizu, and Kohei Komatsu : Influence of the Number of Fastener on Tensile Strength of Lagscrewbolted Glulam Joint, 10th World Conference on Timber Engineering, June.2-5, Miyazaki, 2008

Kiho Jung, Akihisa Kitamori and Kohei Komatsu : Evaluation for column-sill Joint Using Compressed Wooden、International Symposium on Wood Science and Technology (IAWPS 2008)、Sep.27-29、Harbin、China、2008

Takuro Mori, Makoto Nakatani, and Kohei Komatsu : Development of high ductility column base joint for bending using Lagscrewbolts、International Symposium on Wood Science and Technology (IAWPS 2008)、Sep.27-29、Harbin、China、2008

Akihisa Kitamori , Kiho Jung, Takuro Mori, and Kohei Komatsu : The Evaluation on Mechanical Properties of Compressed Wood in accordance with the Compression Rate、International Symposium on Wood Science and Technology (IAWPS 2009)、Sep.27-29、Harbin、China、2008

Takuro Mori, Hidemaru Shimizu, Shingo Murase, Kazuki Tachibana, Hiroshi Isoda, Kohei Komatsu, Seiichi Yoshikawa, and Yasuhiko Fukuda : An experimental study on full scale shaking table test of conventional wood house by E-defense、14th World Conference on Earthquake Engineering、Oct.12-16、Beijin、China、2008

Takuro Mori, Akihiro Kosoku, Yoshiyuki Yanase, Kohei Komatsu: Fundamental Study on Presumption for Residual Strength of Wood Attacked by Termites Part2, Proceedings of the 12<sup>th</sup> Technical Meeting of Japan Timber Engineering Society, 21-24, Tokyo, 2008. (in Japanese)

b) Conference and seminar papers presented

The 2008 Annual Meeting of Arch. Inst. of Jap. (18-20, September, 2008): 7 papers

The 2008 Annual Meeting of Arch. Inst. of Jap. on Kyushu branch (8-9, March, 2009): 2 papers

The 2008 Annual Meeting of the Japanese Enviromental Entomology and Zoology Society (16-17, November, 2008): 1 paper

The 2008 Annual Technical Meeting of the Japan Timber Engineering Society (1-2, December, 2008): 4 papers

The 2009 Annual Meeting of the Japan Wood Research Society (15-17, March, 2009): 7 papers

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Kohei Komatsu: Architectural Institute of Japan (Committee Member of Timber Structure, Chief of Sub-Committee for Design of Timber Joints), The Society of Materials Science (Reviewer), The Japan Wood Research Society (Award Winner Selection Committee Member), Japan Timber Engineering Society(Board member)

Shinjiro Takino.: The Japan Wood Research Society, Architectural Institute of Japan

Takuro Mori: Architectural Institute of Japan (Secretary in Kansai branch), The Society of Materials Science Japan(Committee Member in Wood Based Materials), The Japan Wood Research Society, Wood Technological Association of Japan, Japan Timber Engineering Society

#### ***Research grants***

Kohei Komatsu(Chief), Shinjiro Takino & Takuro Mori(Sub): Research Grant of Japan Society for the Promotion of Science (B2), Development New Innovative Wooden Post & Beam Structures Taken Material's Characteristics As Much As Possible and Analysis of It's Strength Expression Mechanism

Kohei Komatsu(Chief), Shinjiro Takino & Takuro Mori(Sub):Development of Low Environment Load and Resource Sustainable Wooden Dwelling Houses Made of Natural Materials Typical to Kyoto, Research Grant for Developing Construction Technique, Ministry of Land, Infrastructure, Transport and Tourism

Kohei Komatsu and Takuro Mori(Sub): Research Grant of Japan Society for the Promotion of Science (S), Research on Development of Seismic Design Method of Traditional Wooden Structures Based on their Structural Details.

Takuro Mori(Chief): TOSTEM Foundation for Construction Materials Industry Promotion, Research Grant, Investigate the damage of the beam material for termite.

Takuro Mori: Saneyoshi Foundation, Research Grant for Oversea Travel, Board Shear Wall

## **A-4. International cooperation and overseas activities**

### ***International meetings (roles)***

Takuro Mori: IAWPS2008, 27-30<sup>th</sup> September 2008, Harbin, China, (Presenter and session chairman)

### ***International joint researches, overseas research surveys***

Kohei Komatsu, Shinjiro Takino and Takuro Mori : (1<sup>st</sup> April to 30<sup>th</sup> June 2007)Cooperative research with Professor Y.H. Chui, Director of Wood Science and Technology Research Center of New Brunswick University, Canada, on “Improvement of I-beam performance” while he was an invited professor of RISH(10<sup>th</sup> Jan. to 30<sup>th</sup> June 2007)

Kohei Komatsu: (25<sup>th</sup> to 29<sup>th</sup> November 2007, RIHS, Bandung, Indonesia) Cooperative research on Development of Anti-Earthquake Wooden Dwelling Houses Composed of Engineered Wood Products Made of Tropical Fast Grown Timber.

## **B. Educational Activities (2007.4-2008.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Science for Sustainable Humanosphere - Development of Technology and Materials for Cyclical Utilization of Bio-based Resources (Komatsu), Architecher design (Mori)

Graduate Level: Wooden Structural Function II (Komatsu), Lecture for Kyoto Sustainable Initiative Course(Komatsu)

Seminar in Structural Functions (Komatsu, Takino, Mori).

Laboratory Course of Structural Functions (Komatsu, Takino, Mori)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Undergraduate level : Architecture and Society (Cyuubu University, Komatsu)

Graduate level : Glulam Structures (Cyuubu University, Komatsu)

Lecturer: Timber structures (Kagoshima Industrial Research Center, Komatsu)

#### ***Open Lectures***

Kohei Komatsu: Kyoto University Open Campus (Lecture), RISH 98<sup>th</sup> Symposium (Lecture), RISH 72<sup>nd</sup> Symposium (Lecture)

### **B-3. Overseas teaching**

#### ***Overseas Lectures and Open Lectures***

Kohei Komatsu: 73<sup>rd</sup> Symposium on Sustainable Humanosphere - RISH-LAPAN-LIPI International Symposium, Science for Sustainable Humanosphere, International Collaborative Programs in Indonesia, 25<sup>th</sup> July 2007 (LAPAN, Bandung, Indonesia)

Kohei Komatsu : Special lecture at timber structure course in Nanjing Forestry University, 11<sup>th</sup> to 14<sup>th</sup> November 2007(Nanjing Forestry University, Nanjing, China)

Kohei Komatsu : Keynote Speaker: Indonesian National Seminar on System of Preparing Quality Timber for Construction, 26<sup>th</sup> November 2007 (RIHS, Bandung, Indonesia)

#### ***Students and research fellows from abroad***

RISH Invited Professor: 1 (Canada)

Foreign cooperative researcher :0

### **C. Other remarks**

Kohei Komatsu: Technical Committee Member of General Building Research Cooperation of Japan, Estimator for FFPRI Project, Committee Member of Japan Housing and Wood Technology Center for ISO-TC-165, Committee Member for JSPS, 10<sup>th</sup> WCTE Advisory Committee Member, Visiting Research Fellow in Kagoshima Industrial Research Center

Takuro Mori: WG member of Kansai-branch on Architectural Institute of Japan, Higashi-Honganji-Temple Project Member, Secretary of Wood and Wood-Based Materials Committee on the Society of Materials Science Japan, Committee Member of Japan Housing and Wood Technology Center for Utilization of domestic timber.

## 2.3 DIVISION OF APPLIED LIFE SCIENCES

Division of Applied Life Sciences was established in 1997 by merging Department of Agricultural Chemistry (founded in 1924), Department of Food Science and Technology (founded in 1967), and a part of Pesticide Research Institute (founded in 1963). In 2001, it was divided into the two current divisions; Division of Applied Life Sciences and Division of Food Science and Biotechnology.

The present division focuses on sciences and technologies concerning microorganisms, animals, and plants, both from basic and applied aspects. Educational and research programs in the fields of physical chemistry, organic chemistry, biochemistry and molecular biology are given.

Professor Sakayu Shimizu of Laboratory of Fermentation Physiology and Applied Microbiology, Chair of Applied Microbiology, retired on 31 March, 2009.

# Chair of Applied Biochemistry

## 2.3.1 Laboratory of Cellular Biochemistry

*Staff      Professor                      : Ueda, Kazumitsu, Ph.D.*

*Associate Professor: Kioka, Noriyuki, Ph.D.*

*Assistant Professor : Matsuo, Michinori, Ph.D.*

*Assistant Professor : Kimura, Yasuhisa, Ph.D.*

*Postdoctoral fellow : Kodan, Atsushi, Ph. D.*

*Nagata, Koh, Ph. D,*

*Students and research fellows*

*Doctor's program: (6)*

*Master's program: (12)*

*Undergraduate : (5)*

### A. Research activities (2008.4-2009.3)

#### A-1. Main subjects

a) ABC proteins: their physiological functions and molecular mechanisms

ATP-binding cassette superfamily proteins (ABC proteins) are membrane protein family, which have two highly conserved ATP binding domains in a molecule. ABC proteins are important for various cellular functions, which are involved in host defense mechanisms, glucose homeostasis, and lipid homeostasis. ABC proteins have divergent functions and can be classified as transporters, channels, and receptors, although their predicted secondary structures are very much alike. We are studying physiological functions of ABC proteins and molecular mechanisms of their functional diversity.

b) Molecular mechanism of xenobiotic efflux pumps MDR1, MRP1, and MRP2

MDR1/P-glycoprotein is a physiologically important ABC protein in limiting the uptake of toxic compounds from the gastrointestinal tract, stimulating their excretion from the liver, kidney, and intestine, and moreover protecting the brain by functioning as a blood-brain barrier. MRP1 and MRP2 are also physiologically important ABC proteins, which extrude xenobiotics after conjugated with glutathione and glucuronate. To understand the mechanism of drug efflux by these ABC proteins and to overcome multidrug resistance of cancer cells by preventing their function, we are studying molecular mechanisms how these ABC proteins transport a wide variety of compounds and how they carry their substrates across membranes by using the energy of ATP hydrolysis.

c) Molecular mechanism of ATP-sensitive potassium channels

Pancreatic  $\beta$ -cell ATP-sensitive potassium ( $K_{ATP}$ ) channels play an important role in the regulation of glucose-induced insulin secretion. The  $\beta$ -cell  $K_{ATP}$  channel comprises two subunits, the sulfonylurea receptor SUR1, a member of ABC proteins, and Kir6.2, a channel pore subunit. We have analyzed properties of the two NBFs of SURs and proposed that SUR1 is not a transporter but a switch, like a G-protein, and is a sensor monitoring changes in intracellular

ADP concentration. We are analyzing ATP hydrolysis properties of SURs and comparing with those of other ABC proteins to reveal how  $K_{ATP}$  channels are regulated by intracellular ATP and ADP concentrations.

d) ABC proteins involved in fatty acid and cholesterol homeostasis

Many ABC proteins are involved in lipid homeostasis. ABCA1 mediates release of cellular cholesterol and phospholipids to form high density lipoprotein (HDL). Cholesterol is not catabolized in the peripheral cells and therefore mostly released and transported to the liver for conversion to bile acids to maintain cholesterol homeostasis. Although it is clear that ABCA1 plays a critical role in HDL generation, the molecular mechanism of ABCA1 remains unclear. We are analyzing ATP hydrolysis properties and post-transcriptional regulation of ABC proteins involved in lipid homeostasis to reveal physiological roles of ABC proteins in lipid homeostasis.

e) Functional analysis of focal adhesion proteins on cell migration, cell proliferation and tumor metastasis.

Cell adhesion to extracellular matrix regulates various cellular events, including cell proliferation, survival, differentiation, and migration, in a coordinated manner with growth factor signaling. We have shown that a focal adhesion protein vinexin is involved in regulation of cell adhesion, cytoskeletal organization, and anchorage-dependent cell signaling. Our goal is to understand this coordination of cell adhesion and growth factor signaling using methods of molecular biology and cell biology.

## A-2. Publication and presentations

a) Publications

***Original papers***

- Azuma, Y., M. Takada, H-W. Shin, N. Kioka, K. Nakayama and K. Ueda : The retroendocytosis pathway of ABCA1/apoA-I contributes to HDL formation. *Genes Cells* 14; 191-204, 2009
- Hirata, T., M. Okabe, A. Kobayashi, K. Ueda and M. Matsuo: Molecular mechanisms of subcellular localization of ABCG5 and ABCG8. *Biosci Biotechnol Biochem* 73; 619-626 (2009)
- Hozoji, M., Y. Munehira, Y. Ikeda, M. Makishima, M. Matsuo, N. Kioka and K. Ueda: Direct interaction of nuclear receptor LXR with ABCA1 modulates cholesterol efflux. *J Biol Chem* 283; 30057-30063, 2008
- Tanaka, AR., F. Kano, A. Yamamoto, K. Ueda and M. Murata: Formation of cholesterol-enriched structures by aberrant intracellular accumulation of ATP-binding cassette transporter A1. *Genes Cells* 13; 889-904, 2008
- Tanaka, AR., F. Kano, K. Ueda, and M. Murata: The ABCA1 Q597R mutant undergoes trafficking from the ER upon ER stress. *Biochem Biophys Res Commun* 369(4); 1174-1178, 2008
- Momma, K., Y. Masuzawa, N. Nakai, M. Chujo, A. Murakami, N. Kioka, Y. Kiyama, T. Akita and M. Nagao: Direct interaction of Cucurbitacin E isolated from *Alsomitra macrocarpa* to actin filament. *Cytotechnology* 56; 33-39, 2008

b) Conference and seminar paper presented

The 31th annual meeting BMB 2008 : 1 symposium, 9 papers



The 2008 Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry: 6 papers

The 8th Annual Meeting of the Protein Science Society of Japan: 1 symposium, 2 papers

The 40th Annual Meeting of the Japan atherosclerosis Society: 1 invited symposium lecture

### **A-3. Off-campus activities**

#### ***Memberships of Academic Societies***

Ueda, K.: The Japan Society for Bioscience, Biotechnology, and Agrochemistry (a member of the board of directors)

Ueda, K.: The Japanese Cancer Association (Councilor)

Ueda, K.: The Japanese Biochemical Society (Executive board member)

#### ***Research grants***

Monbukagakusho research grants: Scientific Research (S): Physiological substances and functions of ABC proteins involved in lipid transport (Ueda, K.) Scientific Research (B): Physiological function of focal adhesion proteins as an environmental sensor and an environmental controller (Kioka, N.) Priority Area: Mutual regulation of lipid transporters and membrane environments (Matsuo, M.) Grant-in-Aid for Young Scientists (B): Structural analysis of the receptor of the sulfonylurea drugs. (Kimura, Y.)

The Pharmaceutical and Medical Devices Agency: Basic Research Promotion Project (Ueda, K.)

NEDO project: Structural-guided Drug Development. (Kimura Y)

Research grant from Mishima Kaiun Memorial Foundation (Kioka, N.)

Kyoto University step-up grant for young scientists: Molecular basis of lipid efflux by ABCG proteins (Matsuo, M.)

### **A-4. International cooperations and overseas activities**

#### ***International meetings (roles)***

Ueda, K.: American Society for Biochemistry and Molecular Biology (invited lecture)

#### ***Membership in international academic societies***

Ueda, K.: Active member of American Association for Cancer Research

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Course given

Undergraduate level: New Strategy of Agricultural Biotechnology (Ueda, K.), Biochemistry I (Ueda, K), Molecular cellular Biology I (Ueda, K. Kioka, N), Molecular Biology II (Ueda, K. Kioka, N), Introductory lecture and laboratory course in Molecular Biology (Kioka, N. Matsuo, M. Kimura, Y.)

Graduate level: advanced Molecular Biology (Ueda, K.), Biochemistry Seminar (Ueda, K. Kioka, N), Experimental Course of Biochemistry (Ueda, K. Kioka, N).

### **B-3. Overseas teaching**

Matsuo, M.: Heritage Medical Research Centre, University of Alberta (lecture)

## 2.3.2 Laboratory of Biomacromolecular Chemistry

*Staff      Professor                      : Ueda, Mitsuyoshi, Dr. Engineering*

*Associate Professor: Kuroda, Kouichi, Dr. Engineering(2009.1.1~, Assistant Professor~  
2008.12.31)*

*Assistant Professor: Morisaka, Hironobu(2009.1.1~)*

*Students and research fellows*

*Doctor's program : (7)*

*Undergraduate : (5)*

*Master's program : (16)*

*Research fellow : (2)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

a) Creating the life sciences of the future through exploration and analysis of fundamental biological phenomena

Biological phenomena are among the most important and fascinating research themes in the life sciences. We approach our research from the perspective of biochemistry, both basic and applied, which means that we take a chemically based view of biological phenomena and attempt to explain them in chemical terms. Our aim is to uncover the essence of the diverse and complex phenomena observed in humans and other high-level eukaryotic organisms. To do this we use the latest methods to systematically investigate the genes and proteins enclosed in the cellular envelope which are the vehicles of life, the intracellular transmission of various kinds of biological data, and the mechanisms involved in interactions between cells, proteins, and genes. We are also active in applied biotechnology research, which seeks to advance the development and wellbeing of humankind by rapidly converting basic research findings into practical uses.

b) Using genomic information and the latest techniques to analyze complex biological phenomena at molecular level

Biological data transmission systems, which in high-level eukaryotic organisms underpin biological phenomena such as morphogenesis and development, rely on an interdependent series of complex physical and chemical processes involving huge numbers of molecules. Introducing new and systematic analytical techniques alongside conventional biochemical methodology, we attempt to elucidate complex biological processes at molecular level by studying cells from yeasts, *Arabidopsis thaliana*, zebra fish, mouse, and other model eukaryotic organisms in which genomic decoding is advancing.

c) Expanding biological functions through bio- and nano-technology

In order to exploit the functions of living organisms in a wide range of fields, we undertake research which utilizes an understanding of the basic principles of bio-phenomena to modify genomic information and thereby access latent capabilities in living organisms or endow them with novel functions. We led the world in the development of cell-surface engineering, a relevant technique which makes use of the address (signal sequence) information contained in proteins and whose revolutionary approach has allowed the creation of many new cell types. This development has continued with the establishment of a completely new field in biochemistry known as combinatorial bioengineering and through fusion with nanotechnology and other fields to create the concept of nano-biotechnology. Through these, we look forward to creating new

bioactive proteins and cells which transcend the limitations of known genomic information.

## A-2. Publications and presentations

### a) Publications

#### *Original papers*

- Fukuda, T., M. Kato, K. Kuroda, M. Ueda and S. Suye: Improvement in enzymatic desizing of starched cotton cloth using yeast codisplaying glucoamylase and cellulose-binding domain. *Appl Microbiol Biotechnol* 77(6); 1225-1232, 2008
- Kaya, M., J. Ito, A. Kotaka, K. Matsumura, H. Bando, H. Sahara, C. Ogino, S. Shibasaki, K. Kuroda, M. Ueda, A. Kondo, and Y. Hata: Isoflavone aglycones production from isoflavone glycosides by display of beta-glucosidase from *Aspergillus oryzae* on yeast cell surface. *Appl Microbiol Biotechnol* 79(1); 51-60, 2008
- Kotaka, A., H. Bando, M. Kaya, M. Kato, K. Kuroda, H. Sahara, Y. Hata, A. Kondo and M. Ueda: Direct ethanol production from barley beta-glucan by sake yeast displaying *Aspergillus oryzae* beta-glucosidase and endoglucanase. *J Biosci Bioeng* 105(6); 622-627, 2008
- Kadonosono, T., M. Kato and M. Ueda: Alteration of substrate specificity of rat neurolysin from matrix metalloproteinase-2/9-type to -3-type specificity by comprehensive mutation. *Protein Eng Des Sel* 21(8); 507-513, 2008
- Matsui, K., S. Teranishi, S. Kamon, K. Kuroda and M. Ueda: Discovery of a modified transcription factor endowing yeasts with organic-solvent tolerance and reconstruction of an organic-solvent-tolerant yeast. *Appl Environ Microbiol* 74(13); 4222-4225, 2008
- Kotaka, A., H. Sahara, Y. Hata, Y. Abe, A. Kondo, M. Kato, K. Kuroda and M. Ueda: Efficient and direct fermentation of starch to ethanol by sake yeast strains displaying fungal glucoamylases. *Biosci Biotechnol Biochem* 72(5); 1376-1379, 2008
- Shibasaki, S., J. Okada, Y. Nakayama, T. Yoshida and M. Ueda: Isolation of bacteria which produce yeast cell wall-lytic enzymes and their characterization. *Biocontrol Science* 13(3); 91-96, 2008
- Kuroda, K., S. Hirakawa, M. Suzuki, K. Shinji, K. Ogasa, T. Uraji, T. Amachi and M. Ueda: Growth acceleration of plants and mushroom by erythritol (dedicated to Dr. Kazuya Yoshida). *Plant Biotechnol* 25; 489-492, 2008
- Tang, Y. Q., S. Y. Han, H. Zheng, L. We, M. Ueda, X. N. Wang and Y. Ling: Construction of cell surface-engineered yeasts displaying antigen to detect antibodies by immunofluorescence and yeast-ELISA. *Appl Microbiol Biotechnol* 79(6); 1019-1026, 2008
- Shibasaki, S., K. Sakata, J. Ishii, A. Kondo and M. Ueda: Development of a yeast protein fragment complementation assay (PCA) system using dihydrofolate reductase (DHFR) with specific additives. *Appl Microbiol Biotechnol* 80(4); 735-743, 2008
- Kato, M. and M. Ueda: Novel application of yeast molecular display system to analysis of protein functions. *J Biol Macromolec* 8(1); 3-10, 2008

### b) Conference and seminar papers presented

Annual Meeting of the Society for Biotechnology, Japan 2008: 4 reports

International Annual Meeting of the JBS and MBSJ: 5 reports

Annual Meeting of Japan Society for Bioscience, Biotechnology and Agrochemistry 2009: 10 reports

International HPLC Conference 2008 in Kyoto: 1 report

Annual Symposium of Biomedical and Analytical Science: 1 report  
International Congress on Biocatalysis: 2 reports  
International Conference of Combinatorial Bioengineering: 5 reports

#### **A-4. International cooperations and overseas activities**

##### ***International meetings (roles)***

Ueda, M.: International Conference of Combinatorial Bioengineering (President)

Ueda, M.: International Workshop of Biomass (President)

#### **B. Educational Activities (2008.4-2009.3)**

##### **B-1. On-campus teaching**

###### **a) Courses given**

Undergraduate level: General Biomacromolecular Chemistry (Ueda), Structure and Function of Biomacromolecules (Ueda), Applied Life Sciences (Ueda), Experiments of Biomacromolecular Chemistry (Ueda and Kuroda)

Graduate level: Biomacromolecular Chemistry (Ueda), Experiments of Biomacromolecular Chemistry (Ueda, Kuroda, and Morisaka)

### 2.3.3 Laboratory of Bioregulation Chemistry

Staff      Professor                      : Miyagawa, Hisashi, Dr. Agric. Sci.

Associate Professor: Nakagawa, Yoshiaki, Dr. Agric. Sci.

Assistant Professor : Miyashita, Masahiro, Dr. Agric. Sci.

Research fellow        : Ichiki, Yayoi, Dr. Agric. Sci.

:Ogura, Takehiko, Dr. Agric. Sci.

Students   Doctor's program: (2)      Master's program: (4)      Undergraduate : (3)

#### A. Research Activities (2008.4-2009.3)

##### A-1. Main subjects

###### a) Structure-Activity Relationships of Ecdysone Agonists

The molting process is regulated by a molting hormone, 20-hydroxyecdysone, in most invertebrates. However, it has been reported that ecdysone (E), makisterone A (MaA), and ponasterone A (PonA) work as the molting hormone in a few insects and some crustaceans. Scorpions grow by repeating molting, but very few studies have been done for the molting. In this study, we could identify 20-hydroxyecdysone from the first instar scorpions *Liocheles australasiae* just before molting using tandem mass spectrometry (LC/MS/MS), but not in other stage. E, MaA and PonA were not detected in scorpions. The binding affinity of 20E to the molting hormone receptor of scorpions was equivalent to that against insects. Periods between moltings after the second instar were varied from one individual to the next.

###### b) Chemistry of bioactive peptides.

i) Plants induce various defense responses when they are attacked by pathogens. These defense responses are triggered by a variety of molecules (elicitors). We previously discovered a novel small peptide, which can activate defense reactions in tobacco cells, from random hexapeptide libraries. In this study, in order to investigate the mechanism of action of this peptide, defense responses affected by the peptides were examined. As a result, phytoalexin biosynthesis was significantly activated, but no hypersensitive reaction was observed.

ii) A novel insecticidal peptide, LaIT2, was isolated from the venom of the Japanese scorpion *Liocheles australasiae*, and its N-terminal amino acid sequence was determined by Edman degradation. Based on this sequence, full-length cDNA encoding an LaIT2 precursor was cloned. The deduced amino acid sequence indicated that LaIT2 is composed of 59 amino acid residues with 3 disulfide bridges, and shares the sequence similarity with the scorpion  $\beta$ KTx peptides. This is the first report of insect toxins in this family.

###### c) Metabolism of Plant Hormone Auxin

Indole-3-acetic acid (IAA) is a plant hormone auxin that plays an important regulatory role in plant growth and development. Close examination of the metabolites in rice seedlings clarified that the formation of indole-3-carboxylic acid as well as hydroxyindole-3-carboxylic acid followed by the conjugation with glucose is one of the major pathways. Significant amounts of 3-hydroxy-2-oxo-IAA and its aspartate and glutamate conjugates were also detected.

##### A-2. Publications and presentations

###### a) Publications

## Reviews

- Fujita, T. and Y. Nakagawa: SAR and QSAR Analyses of substituted dibenzoylhydrazines for their mode of Action as ecdysone agonists. In *Endocrine Disruption Modeling* (Devillers, J., ed.), Taylor & Francis Group, Boca Raton, FL, pp359-379, 2009
- Nakagawa, Y., R. E. Hormann and G. Smagghe: SAR and QSAR studies for in vivo and in vitro activities of ecdysone agonists. In *Ecdysones: Structures and Functions* (Smagghe, G., ed.), Springer, pp. 475-509, 2009
- Nakagawa, Y: Molting mechanism in insects – Search for new insect control “Entomological Science and Its Perspective” (Fujisaki, K., Nishida, R., and Sakuma, M., Eds), pp. 271-298, 2009
- Miyashita, M and Y. Nakagawa: Studies of toxins of scorpions in Japan. “Entomological Science and Its Perspective” (Fujisaki, K., Nishida, R., and Sakuma, M., Eds), pp. 304-306, 2009

## Original papers

- Arai, H., B. Watanabe, Y. Nakagawa and H. Miyagawa: Synthesis of ponasterone A derivatives with various steroid skeleton moieties and evaluation of their binding to the ecdysone receptor of Kc cells. *Steroids* 73; 1452-1464, 2008
- Harada, T., Y. Nakagawa, R. W. Wadkins, P. M. Potter and C. W. Wheelock: Comparison of benzil and trifluoromethyl ketone (TFK)-mediated carboxyesterase inhibition using classical and 3D-quantitative structure-activity relationship analysis. *Bioorg Med Chem* 17; 149-164, 2009
- Hormann, R. E., G. Smagghe and Y. Nakagawa: Multidimensional quantitative structure-activity relationships of diacylhydrazine toxicity in *Spodoptera exigua*, *Chilo suppressalis*, and *Leptinotarsa decemlineata*. *QSAR Comb Sci* 27; 1098-1112, 2008
- Ichimaru, N., M. Murai, N. Kakutani, J. Kako, A. Ishihara, Y. Nakagawa, T. Nishioka, T. Yagi and H. Miyoshi: Synthesis and characterization of new piperazine-type inhibitors for mitochondrial NADH-ubiquinone oxidoreductase (complex I). *Biochemistry* 47; 10816-10826, 2008
- Ishihara, A., Y. Hashimoto, C. Tanaka, J. G. Dubouzet, T. Nakao, F. Matsuda, T. Nishioka, H. Miyagawa and K. Wakasa: The tryptophan pathway is involved in the defense responses of rice against pathogenic infection via serotonin production. *Plant J* 54; 481-495, 2008
- Ishihara, A., Y. Hashimoto, H. Miyagawa and K. Wakasa: Induction of serotonin accumulation by feeding of rice striped stem borer in rice leaves. *Plant Signaling & Behavior* 3; 714-716, 2008.
- Mizuno, T, Miyashita M, Miyagawa H: Cellular internalization of arginine-rich peptides into tobacco suspension cells: a structure-activity relationship study. *J Pept Sci* 15; 259-263, 2009
- Morita, D., K. Katoh, T. Harada, Y. Nakagawa, I. Matsunaga, T. Miura, A. Adachi, T. Igarashi and M. Sugita: Trans-species activation of human T cells by rhesus macaque CD1b molecules. *Biochem Biophys Res Commun* 377; 889-893, 2008
- Mosallanejad, H., T. Soin, L. Swevers, K. Iatrou, Y. Nakagawa and G. Smagghe: Non-steroidal ecdysteroid agonist chromafenozide: Gene induction activity, cell

proliferation inhibition and larvicidal toxicity. *Pestic Biochem Physiol* 92: 70-76, 2008

Yamada, T., F. Matsuda, K. Kasai, S. Fukuoka, K. Kitamura, Y. Tozawa, H. Miyagawa, K. Wakasa: Mutation of a Rice Gene Encoding a Phenylalanine Biosynthetic Enzyme Results in Accumulation of Phenylalanine and Tryptophan. *Plant Cell* 20: 1316-1329, 2008

b) Conferences and seminar papers presented

The 34th Annual Meeting of Pesticide Science Society of Japan: 7 reports

Annual Meeting of the Japan Society for Bioscience, Biotechnology, and Agrochemistry 2009: 4 reports

Japan Society for Bioscience, Biotechnology, and Agrochemistry (Kansai Branch Meeting): 4 report

The 56th Annual Conference on Mass Spectrometry: 1 report

The 22nd Naito Conference: 1 report

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Miyagawa, H.: Japan Society for Pesticide Science (chief editor), Japan Society for Bioscience, Biotechnology, and Agrochemistry (councilor of Kansai branch).

Nakagawa, Y.: The Division of Structure-Activity Studies, The Pharmaceutical Society of Japan (board member, treasurer), Japan Society for Pesticide Science (editorial board member, councilor), Japan Society for Bioscience, Biotechnology, and Agrochemistry (editorial board member), Japan Society for Bioscience, Biotechnology, and Agrochemistry-Kansai Branch (general officer),

Miyashita, M.: The Mass Spectrometry Society of Japan (training planning committee member, journal editorial member),

#### ***Research grants***

Monbukagakusho Research Grant: Encouragement of Young Scientists (B): Screening for plant defense activating peptides from combinatorial peptide Libraries (Miyashita).

Others: Development of the highly sensitive mass spectrometer and the analysis of endocrine disruptor (Miyashita, member). The 21st century COE program for Innovative Food and Environmental Studies Pioneered by Entomomimetic Sciences, from the Ministry of Education, Culture, Sports, Science and Technology of Japan (Nakagawa, Miyagawa, member). Naito foundation (Miyashita)

### **A-4. International cooperations and overseas activities**

#### ***International joint researches, overseas research surveys***

Nakagawa, Y.: Structure-activity Relationship of Ecdysone Agonists (Belgium, Greece, USA)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Bioorganic Chemistry I (Miyagawa, Nakagawa), Organic Reaction Mechanism II (Nakagawa), Laboratory Course in Bioorganic Chemistry (Miyagawa,

Nakagawa, Miyashita), Structure Analysis of Organic Compounds (Miyagawa), Food Safety II (Miyagawa), Experimental Course in Division of Applied Life Sciences (Nakagawa, Miyashita)

Graduate level: Bioregulation Chemistry Seminar (Miyagawa, Nakagawa, Miyashita), Experimental Course in Bioregulation Chemistry (Miyagawa, Nakagawa, Miyashita). Bioregulation Chemistry (Miyagawa, Nakagawa, Miyashita)

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Miyagawa, H.: School of Life and Environmental Sciences, Osaka Prefecture University (Molecular design), Faculty of Biotechnology, Fukui Prefectural University (Pesticide Chemistry)

Nakagawa, Y.: Faculty of Agriculture, Kyoto Prefectural University (Industrial organic chemistry)

## **C. Other Remarks**

Miyagawa, H.: Chief Manager of Radio Isotope Experiments at College of Agriculture; Member of the Advisory Committee of Radio Isotope Center, Kyoto University.



## 2.3.4 Laboratory of Chemical Ecology

Staff      Professor                      : Nishida, Ritsuo, D. Agric. Sci.

Associate Professor: Mori, Naoki, D. Agric. Sci.

Assistant Professor : Ono Hajime, D. Agric. Sci.

Students and research fellows

Doctor's program: (2)

Master's program: (8)

Undergraduate : (5)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) New attractants for pest fruit flies

The solanaceous fruit fly, *Bactrocera latifrons* (Diptera: Tephritidae), infests various solanaceous fruits including eggplant and chili peppers. We found that a freshly cut fruit of an eggplant cultivar selectively attracted and provoked voracious feeding behavior in adult *B. latifrons* males. One of the male-specific attractants/feeding stimulants was identified as 3-hydroxy- $\alpha$ -ionone. Sexually mature males that fed on the eggplant pulp selectively accumulated a series of 3-oxygenated  $\alpha$ -ionone/ $\alpha$ -ionol analogs in the rectal gland, a suspected pheromone reservoir in male flies. These results suggest that the sequestrates may serve as a sex pheromone similar to other *Bactrocera* species that use rectal volatiles to attract conspecific females.

##### b) The active role of fatty acid amino acid conjugates in nitrogen metabolism by *Spodoptera litura* larvae

Since the first fatty acid amino acid conjugate (FAC) was isolated from regurgitant of *Spodoptera exigua* larvae in 1997 [volicitin: *N*-(17-hydroxylinolenoyl)-L-glutamine], their role as elicitors of induced responses in plants has been well documented. However, studies of the biosyntheses as well as the physiological role of FACs in the insect have been minimal. By utilizing <sup>14</sup>C-labeled glutamine, glutamic acid and linolenic acid in feeding studies of *S. litura* larvae, it was strongly suggested that FACs play an active role in nitrogen assimilation in Lepidoptera larva and that glutamine containing FACs in the gut lumen may function as a form of storage of glutamine, a key compound of nitrogen metabolism.

##### c) Developmental timing regulated by the insect hormones in *Drosophila melanogaster*

In insects, developmental transitions, such as molting and metamorphosis, are regulated by the insect steroid hormones, ecdysteroids. Of the ecdysteroids, 20-hydroxyecdysone (20E) has been characterized as the principal molting hormone in insects. Besides, its precursor ecdysone has been considered to be relatively inactive compound. However, evidences for possible specific roles of ecdysone have been obtained. To characterize biological function of ecdysone, biosynthesis pathway from ecdysone to 20E was genetically manipulated in *Drosophila melanogaster*. The manipulation results in developmental delay and larval lethal phenotype. Application of ecdysone to wild type larvae results in precocious pupariation. These results indicate that ecdysone is essential for molting and metamorphosis at correct timing and ecdysone regulates larval molting and pupariation that differs from 20-hydroxyecdysone in *Drosophila melanogaster*.

## A-2. Publications and presentations

### a) Publications

#### **Book**

- Nishida, R.: Harmony between insects and plants. Entomological Sciences and its Perspective (edited by K. Fujisaki, R. Nishida and S. Sakuma), pp. 191-220, Kyoto University Press, Kyoto, 2009 (in Japanese)
- Katsumata, A. and R. Nishida: Insect chemical sensors. Entomological Sciences and its Perspective (edited by K. Fujisaki, R. Nishida and S. Sakuma), pp. 321-341, Kyoto University Press, Kyoto, 2009 (in Japanese)
- Mori, N., N. Yoshinaga and T. Aboshi: Chemical interactions between herbivores and plants. Sciences and its Perspective (edited by K. Fujisaki, R. Nishida and S. Sakuma), pp. 165-189, Kyoto University Press, Kyoto, 2009 (in Japanese)
- Mori, N. and Y. Kuwahara: Oribatid mites as a major source for alkaloids in poison frogs. Sciences and its Perspective (edited by K. Fujisaki, R. Nishida and S. Sakuma), pp. 248-251, Kyoto University Press, Kyoto, 2009 (in Japanese)
- Mori, N. and Y. Kuwahara: Induction of allergic contact dermatitis by astigmatid mite-derived monoterpene. Sciences and its Perspective (edited by K. Fujisaki, R. Nishida and S. Sakuma), pp. 468-471, Kyoto University Press, Kyoto, 2009 (in Japanese)

#### **Original papers**

- Ishida, T., H. Enomoto, and R. Nishida: New attractants for males of the solanaceous fruit fly *Bactrocera latifrons*. J Chem Ecol 34; 1532-1535, 2008
- Shelly, T. E., J. Edu, E. Pahio, S.L. Wee and R. Nishida: Re-examining the relationship between sexual maturation and age of response to methyl eugenol in males of the oriental fruit fly. Entomol Exp Appl 128; 380-388, 2008
- Tsuchihara, K., T. Wazawa, Y. Ishii, T. Yanagida, R. Nishida, X.G. Zhen, M. Ishiguro, K. Yoshihara, O. Hisatomi and F. Tokunaga: Characterization of chemoreceptive protein binding to an oviposition stimulant using a fluorescent micro-binding assay in a butterfly. FEBS Letters 583; 345-349, 2008
- Nishida, R., H. Enomoto, T.E. Shelly and T. Ishida: Sequestration of 3-oxygenated  $\alpha$ -ionone derivatives in the male rectal gland of the solanaceous fruit fly, *Bactrocera latifrons*. Entomol Exp Appl 131; 85-92, 2009
- Wada-Katsumata, A., M. Ozaki, F. Yokohari, M. Nishikawa and R. Nishida: Behavioral and electrophysiological study on the sexually biased synergism between oligosaccharides and phospholipids in gustatory perception of nuptial secretion by the German cockroach. J Insect Physiol; accepted, 2009
- Yoshinaga, N., T. Aboshi, H. Abe, R. Nishida, H. T. Alborn, J. H. Tumlinson and N. Mori: Active role of fatty acid amino acid conjugates in nitrogen metabolism in *Spodoptera litura* larvae. Proc Natl Acad Sci USA; 105, 18058-18063, 2008
- Sasai, T., Y. Hirano, S. Maeda, I. Matsunaga, A. Otsuka, D. Morita, R. Nishida, H. Nakayama, Y. Kuwahara, M. Sugita and N. Mori: Introduction of allergic contact dermatitis by astigmatid mite-derived monoterpene,  $\alpha$ -acaridial. Biochem Biophys Res Commun; 375, 336-340, 2008
- Matsunaga, I., T. Komori, A. Ochi, N. Mori and M. Suigita: Identification of antibody responses to the serotype-nonspecific molecular species of glycopeptidolipids in *Mycobacterium avium* infection. Biochem Biophys Res Commun 377; 165-169, 2008

### ***Patent***

Patent pending/applied for

Patent no. 2008-128415 'Attractants, feeding stimulants and their substrates for the pest fruit flies' inventors: Nishida, R., H. Enomoto, and T. Ishida, patentee: Kyoto University, registration date: May 15, 2008

b) Conference and seminar papers presented

The 25<sup>th</sup> ISCE Annual Meeting, University Park, USA (2008): 4 papers

The annual meeting for Environmental Entomology and Zoology (2008): 1 paper

The 53<sup>th</sup> The Japanese Society of Applied Entomology and Zoology (2008): 3 papers

Japan Society for Bioscience, Biotechnology, and Agrochemistry (2009): 3 papers

## **A-3. Off-campus activities**

### ***Membership in academic societies (roles)***

Ritsuo Nishida: Japanese Society of Applied Entomology and Zoology (councilor), Japan Society for Bioscience, Biotechnology, and Agrochemistry, Kansai Division (councilor)

Naoki Mori: Japanese Society of Applied Entomology and Zoology (editor), Japanese Society of Environmental Entomology and Zoology (managing editor), The Acarological Society of Japan (executive committee, editor)

### ***Research grants***

Monbukagakusho Research Grant: Integrated Research (B) (2), (Nishida: representative), Molecular chemical ecological approach for coevolutionary process between insects and plants (Nishida: representative). Research Grant: Integrated Research (C) (2), Insect-produced elicitor, volicitin - Physiological functions in insects - . (Mori: representative). Research Grant: Integrated Research (C) (2), Molecular basis of counter-adaptation by agricultural pests against chemical defense of host plants. (Mori: member). Grant-in-Aid for Young Scientists (Start-up) (Ono: representative).

21st Century COE program: COE for Innovative Food and Environmental Studies Pioneered by Entomomimetic Sciences (Nishida, Mori)

## **A-4. International cooperations and overseas activities**

### ***Membership in international academic societies (roles)***

Nishida, R.: Asia-Pacific Association of Chemical Ecologists (President), "Biochemical Systematics and Ecology" (Editorial advisory board), "Chemoecology" (Editorial advisory board)

### ***International cooperation***

Nishida, R.: Chemical ecology on fruit fly attractants (Malaysia, Thailand, Laos, Papua New Guinea, USA)

Mori, N.: Biosynthesis of insect-derived elicitors (USA), Physiological changes induced by insect-derived elicitors in plants (New Zealand)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

Undergraduate level: Bioorganic chemistry III (Nishida, Mori), Organic Reaction Mechanisms I (Mori), Structure analyses of organic compounds (Nishida), Laboratory Course in Bioorganic Chemistry (Mori, Ono).

Graduate level: Laboratory Course in Chemical Ecology (Nishida, Mori, Ono), Chemical Ecology Seminar (Nishida, Mori, Ono)

## **B-2. Off-campus teaching**

### ***Part-time lecturer***

Nishida, R.: Kyoto University of Education (Natural product chemistry)

# Chair of Molecular and Cellular Sciences

## 2.3.5 Laboratory of Plant Nutrition

*Staff      Professor                      : Matoh, Toru, Dr. Agric. Sci.*

*Associate Professor : Kobayashi, Masaru, Dr. Agric. Sci.*

*Assistant Professor : Ochiai, Kumiko, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (3)*

*Master's program : (4)*

*Undergraduate     : (4)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

a) Function of inorganic constituents in plant cell walls.

Boron and calcium are the major inorganic elements in cell walls, and they are likely to contribute to cell wall integrity. We have demonstrated that B cross-links two pectic chains at the rhamnogalacturonan II (RG-II) regions, and that Ca strengthens the bonding together. We will study the function of cell walls in terms of the function of inorganic elements which are localized there.

Tolerance mechanism of rice plants toward excessive B in soils is also our subject. Genetic difference between rice varieties tolerant to and sensitive to excessive B has been examined.

b) Nitrogen-use efficiency of rice plants.

We have studied the mechanism underlying difference of the nitrogen use efficiency among rice varieties to breed an efficient variety which is suitable for sustainable agriculture.

c) Sustainable agriculture.

We are trying to find out a suitable chemical fertilizer to develop sustainable, low-input and consumer-conscious farming. We also try to establish a method to evaluate the quality of fermented manure.

#### A-2. Publications and presentations

a) Publications

##### ***Original papers***

Ochiai, K., S. Uemura, A. Shimizu, Y. Okumoto and T. Matoh: Boron toxicity in rice (*Oryza sativa* L.). I. Quantitative trait locus (QTL) analysis of tolerance to boron toxicity. *Theor Appl Genet* 117; 125-133, 2008

Koshiba, T., M. Kobayashi, and T. Matoh: Boron nutrition of tobacco BY-2 cells. V. Oxidative damage is the major cause of cell death induced by boron deprivation. *Plant Cell Physiol* 50; 26-36, 2009

##### ***Books and review articles***

Matoh, T.: *Agronomy and food production science*. 47; 77, 2009

b) Conference and seminar papers presented

Annual Meeting of the Japanese Society of Plant Physiologists, 2009: 2 reports

Annual Meeting of Japanese Society of Soil Science and Plant Nutrition, 2008: 5 reports

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Matoh, T.: Japanese Society of Soil Science and Plant Nutrition (Board member, Chairperson of the 4th Committee, Editor), Japan Society for Bioscience, Biotechnology, and Agrochemistry (Vice president of Kansai branch)

Kobayashi, M.: Japanese Society of Plant Physiologists (Treasurer)

#### ***Research grants***

Matoh, T.: Grant-in-Aid for Scientific Research (B) (2) Environmental evaluation of the export-oriented farming in the tropical countries, Grant-in-Aid for Scientific Research (B) (2) Molecular breeding of an excessive-B tolerant rice.

Kobayashi, M.: Grant-in-Aid for Scientific Research (C), Analysis of boron deprivation response in plants. Grant-in-Aid for Scientific Research on Priority Areas (Plant Nutrition and Transport), Role for plant cell walls in nutrient uptake (research member).

### **A-4. International cooperations and overseas activities**

#### ***International joint researches, overseas research surveys***

Matoh, T.: Grant-in-Aid for International Scientific Research, Sustainable development of Chaopraya delta farming (Kasetsart University), Studies of sustainable development in the mountain area of Laos.

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Course given

Undergraduate level: Biochemistry 2 (Matoh), Plant Nutrition (Matoh), Plant Biochemistry (Kobayashi, Matoh), Laboratory Course in Plant Biochemistry (Kobayashi), Stress Physiology in Plants (Matoh)

Graduate level: Experimental Course in Plant Nutrition (Matoh, Kobayashi), Plant Nutrition Seminar (Matoh, Kobayashi)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Matoh, T.: Faculty of Agriculture, Kyoto Prefectural University (Plant Nutrition 1,2)

### **B-3. Overseas teaching**

#### ***Students and reseach fellows from abroad***

Foreign students: Master's program (1) (Thailand), Doctor's program (2) (China, Thailand)

## **C. Other Remarks**

Matoh, T.: Advisory member for Committee for Promoting Sustainable Agriculture, Survey Committee for Dioxins (Kyoto City), Technical advisor of the Kyoto Organic Farmers'

Association

Kobayashi, M.: Member of open campus committee (Kyoto University)

## 2.3.6 Laboratory of Molecular Microbiology

**Staff**      **Professor**                      : Kita, Keiko, Dr. Agric. Sci.  
                 **Associate Professor**: Inoue, Yoshiharu, Dr. Agric. Sci.  
                 **Assistant Professor** : Izawa, Shingo, Dr. Agric. Sci.

### **Students**

**Doctor's program**: (2)  
                 **Master's program**: (3)  
                 **Undergraduate** : (3)

## **A. Research Activities (2008.4-2009.3)**

### **A-1. Main subjects**

#### a) Structure and function analysis of restriction endonucleases

We aimed to determine the crystal structure of EcoT38I restriction endonuclease isolated from *Escherichia coli* TH38 to understand molecular mechanism of DNA recognition and catalysis. Crystals were obtained by the hanging-drop vapor diffusion method. Diffraction data were collected at SPring-8 BL38B1 beam line. The crystals belonged to a space group of P3<sub>1</sub>21 and one molecule of EcoT38I was estimated to be present in an asymmetric unit. EcoT38I molecule is composed by two domains: the N domain contains six helices and two short 3<sub>10</sub>-helices and shares structural similarity with the putative DNA-binding domain of an archaeal Cdc6 ortholog, whereas the C domain contains seven helices and one five-stranded beta-sheet and shares structural similarity with the similar subdomains of the FokI DNA-cleavage domain.

#### b) Methylglyoxal induces phosphorylation of eIF2 $\alpha$ in yeast

On the initiation of translation in eukaryotic cells, the small 40S ribosomal subunit associates with the GTP-bound form of translation initiation factor 2 (eIF2), a trimeric GTPase, and the charged initiator methionyl-tRNA to form the 43S preinitiation complex, which in turn recruits mRNA at either the 5' end or internal binding sites, scans the initiator codon, and then associates with the 60S ribosomal subunit to initiate translation. Phosphorylation of Ser51 of the  $\alpha$  subunit of eIF2 in *Saccharomyces cerevisiae* is induced by several types of environmental stress, and subsequently, overall protein synthesis is reduced due to the impairment of the formation of a translation initiation complex. We found that methylglyoxal, an intermediate derived from glycolysis, activates the protein kinase Gcn2 to phosphorylate eIF2 $\alpha$ . The transcription factor Gcn4 is a master regulator of gene expression under conditions of amino acid starvation and some environmental stresses, the level of which is regulated by Gcn2. We found that adaptation to methylglyoxal was impaired in *gcn4 $\Delta$*  cells, indicating the expression of certain genes regulated by Gcn4 to be important for the adaptive response to methylglyoxal.

#### c) Effect of heat shock and ethanol stress in 3' processing of mRNA in yeast

Under conditions of environmental stress, a selective export of mRNA from the nucleus occurs in yeast cells, which seems an efficacious strategy of yeast cells to adapt rapidly to stress. Although ethanol stress (10%, v/v) as well as heat shock blocks the export of bulk poly(A)(+) mRNA, the differences and/or similarity between heat shock and ethanol stress in the mechanisms of selective mRNA export still remain to be clarified. We found that ethanol stress induced transcriptional activation of a subset of yeast *HSP* genes; however, intriguingly, most



such transcripts remained in the nucleus in a hyperadenylated state and, as a consequence, were not translated into HSPs. Elimination of ethanol resulted in a rapid shortening of the poly(A) tails of *HSP* mRNAs, loss of their nuclear retention, and the coincidental synthesis of the respective HSPs. Since *HSP* mRNAs are selectively exported from the nucleus in heat-shocked cells, yeast cells respond differently to ethanol stress and heat shock in the 3'-processing and transport of *HSP* mRNAs. Furthermore, these results also suggest that hyperadenylation and nuclear retention of mRNAs might be used as a means to control eukaryotic gene expression under stressed conditions.

## **A-2. Publications and presentations**

### **a) Publications**

#### ***Original papers***

Nomura, W., K. Maeta, K. Kita, S. Izawa and Y. Inoue: Role of Gcn4 for adaptation to methylglyoxal in *Saccharomyces cerevisiae*: methylglyoxal attenuates protein synthesis through phosphorylation of eIF2 $\alpha$ . *Biochem Biophys Res Commun* 376(4): 738-742, 2008

Izawa, S., T. Kita, K. Ikeda and Y. Inoue: Heat shock and ethanol stress provoke distinctly different responses in 3'-processing and nuclear export of HSP mRNA in *Saccharomyces cerevisiae*. *Biochem J* 414(1): 111-119, 2008

### **b) Conference and seminar papers presented**

The 41st Meeting of Yeast Genetics and Molecular Biology, Japan: 5 papers

The Annual Meeting of the Society for Biotechnology 2008, Japan: 1 paper

Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry 2009: 6 papers

The 18th Meeting of the Japan Maillard Reaction Society: 1 paper

BMB2008: 3 papers

## **A-3. Off-campus activities**

### ***Membership in academic societies***

Kita, K.: Japan Society of Bioscience, Biotechnology, and Agrochemistry (Councilor of Nation-wide, Councilor of Kansai branch), The Society for Biotechnology, Japan (Councilor of Kansai branch)

Inoue, Y.: Yeast Society (Committee Member), The Society for Biotechnology, Japan (Committee Member of Kansai Branch)

### ***Research grants***

Research Grants from Ministry of Education, Culture, Sports, Science, and Technology: Grant-in-Aid for Scientific Research (B) Metabolic signaling: physiological role and mechanism of signal transduction by glycolytic intermediate. (Inoue, Y.) Grant-in-Aid for Young Scientist (B) (2) Function of thioredoxin in alcoholic fermentation and its transport. (Izawa, S.)

## **A-4. International cooperations and overseas activities**

### ***International meetings (roles)***

Kita, K.: The 11th Swiss-Japanese Meeting on Biotechnology and Bioprocess Development, Minusio (invited speaker).

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### a) Courses given

Undergraduate level: Applied Life Sciences (Kita), Applied Microbiology II (Kita), Laboratory Course in Biochemistry (Kita, Inoue, Izawa), Applied Microbiology IV (Inoue), Introduction to Applied Life Sciences III (Inoue)

Graduate level: Cellular Bioenergy Conversion (advanced course) (Kita, Inoue), Cellular Bioenergy Conversion Seminar (Kita, Inoue, Izawa), Experimental Course of Cellular Bioenergy Conversion (Kita, Inoue, Izawa)

### **C. Other Remarks**

Inoue, Y.: Committee on Redox Life Science, Japan Society for the Promotion of Science (Member)

## Chair of Applied Microbiology

### 2.3.7 Laboratory of Fermentation Physiology and Applied Microbiology

*Staff Professor : Shimizu, Sakayu, Dr. Agric. Sci.*  
*Associate Professor: Kataoka, Michihiko, Dr. Agric. Sci.*  
*Assistant Professor: Ogawa, Jun, Dr. Agric. Sci. (-2008.9)*  
*Assistant Professor: Sakuradani, Eiji, Dr. Agric. Sci.*  
*Cooperative staff: Ogawa, Jun, Dr. Agric. Sci. (Professor, Research Division of*  
*Microbial Sciences; 2008.10-)*  
*Ando, Akinori, Dr. Agric. Sci. (Assistant Professor, Research Division of*  
*Microbial Sciences; 2008.11-)*  
*Postdoctoral fellows: Shimada, Yoshimi, Dr. Agric. Sci.*  
*Urano, Nobuyuki, Dr. Agric. Sci.*

### Students and research fellows

<i>Doctor's program</i>	: (1)
<i>Master's program</i>	: (18)
<i>Undergraduate</i>	: (5)
<i>Research student</i>	: (3)
<i>Research fellow</i>	: (2)
<i>Foreign research fellow</i>	: (1)
<i>Educational assistant</i>	: (2)

### A. Research Activities (2008.4-2009.3)

### A-1. Main subjects

a) Microbial production of useful lipids

We have found that mycelia of the fungus *Mortierella alpina*, which was isolated from soil of Kyoto, are rich source of a polyunsaturated fatty acid, arachidonic acid. Furthermore, we succeeded in the selective production of various polyunsaturated fatty acids, for example, dihomo- $\gamma$ -linolenic acid and EPA, by controlling of the culture conditions and breeding of the mutant producers. These strains are now under investigation at practical level with 10,000-liter jar fermenter. We are doing enzymatic and genetic analysis of the filamentous fungus and trying to establish novel transformation system for the fungus. We are making further research in microorganisms for the production of novel functional lipids, and found that lactic acid bacteria produce conjugated fatty acids. Further development of conjugated linoleic acid production by lactic acid bacteria is on going.

b) Microbial production of optically active compounds

Reactions catalyzed by enzymes display for greater specificities than more conventional forms of organic reactions. Among these specificities, stereospecificity is one of the most excellent properties. To overcome the disadvantage of a conventional synthetic process of optically active compounds (amino acids, vitamins and so on), i.e., the troublesome resolution of a racemic

mixture, microbial transformations with enzymes possessing stereospecificities (carbonyl reductases, lactonase, aldolase, etc.) have been applied to the asymmetric synthesis of them. Studies on enzyme and protein chemistry of the enzymes involved in these reactions are also carried out.

c) Functional analysis and application of novel microbial enzymes

Microbial transformations of nucleic acid-related compounds are studied. The enzymes involved in these transformations are applied for followings: 1) dihydropyrimidinase, which functions in nucleic acid-base degradation, is applied for D-amino acids production from DL-5-monosubstituted hydantoins, 2) the enzymes involved in creatinine metabolism are applied to clinical diagnosis of renal dysfunction. A variety of microbial oxidases, such as peroxidases and laccases, are screened and its applicabilities are evaluated. Peroxidases from filamentous fungi are now under development as bleaching agents in clothes washing and as analytical tools for diagnosis. Laccases from basidiomycete are examined as potential tools for bioremediation, novel bio-control reagents and dyeing/bleaching reagents.

d) Microbial nitrile degradation and its application

Nitriles are widely manufactured and extensively used by chemical industries. They are very toxic and are generally bio-undegradable compounds. However, some microorganisms have the ability to utilize nitriles as carbon and/or nitrogen sources. The microbial degradation of nitriles has been found to proceed through two enzymatic pathways. Nitrilase catalyzes the direct cleavage on nitriles to the corresponding acids and ammonia. In the second pathway, nitriles are catabolized in two stages, via conversion to the corresponding amides by nitrile hydratase and then the acids plus ammonia by amidase. These nitrile-converting enzymes are expected to have great potential as catalysts in organic chemical processing, because of the mild conditions, quantitative yields, absence of by-products and in some cases enantio- or regioselectivity. Thus, we established the process for the industrial production of acrylamide, an important chemical commodity, from acrylonitrile using the *Rhodococcus rhodochrous* J1 nitrile hydratase in 1991.

e) Collaboration with the Research Division of Microbial Sciences

The purposes are to discover and develop the latent possibilities of microorganisms and to tune these possibilities into useful applications such as bioprocess design, bio-fuel production, biomass utilization, bioremediation, bio-control, probiotics development, functional food production, pharmaceutical synthesis, etc. For the purposes, the research division encourages broad collections of various kinds of microorganisms and fundamental understandings of microbial metabolisms. The examples of the research topics are: 1) analysis on microbial amino acid metabolism for production of hydroxyl amino acids useful as functional food materials, 2) analysis on microbial reductive fatty acid metabolism for the production of conjugated fatty acids useful for prevention of lifestyle-related diseases. Furthermore, researches on nucleic acid metabolism in lactic acid bacteria for the development of probiotics for hyperuricemia prevention, microbial laccase as a module of bio-battery, and extracellular production of lipids by filamentous fungi are also on going.

## A-2. Publications and presentations

a) Publications

**Books**

Kataoka, M. and S. Shimizu: Chapter 19. Screening of novel microbial enzymes and their

- application to chiral compound production. Biocatalysis and Bioenergy (edited by Hou, C.T. and J.-R. Shaw), pp.355-373, John Wiley & Sons, 2008
- Ogawa, J., N. Horinouchi and S. Shimizu: Multi-step enzyme catalysis. Biotransformations and chemoenzymatic synthesis (edited by Garcia-Junceda, E.), pp.199-211, Wiley-VCH, Weinheim, 2008
- Shimizu, S.: Introduction. Agriculture in 21st Century, Vol. 6, Development of microbial function (edited by Ueda, M.), pp.xi-xxii, Kyoto Univ. Press, Kyoto, 2008 (in Japanese)
- Shimizu, S.: Chapter 5. Microbial factory. Agriculture in 21st Century, Vol. 6, Development of microbial function (edited by Ueda, M.), pp.125-145, Kyoto Univ. Press, Kyoto, 2008 (in Japanese)
- Shimizu, S.: 3.2 Theory and methodology. Encyclopedia of microorganism (edited by Watanabe et al.), pp.138-140, Asakura Press, Tokyo, 2008 (in Japanese)
- Shimizu, S.: 3.3 Application (2) Organic compounds and intermediates (a. acrylamide, b. D-pantolactone). Encyclopedia of microorganism (edited by Watanabe et al.), pp.151-154, Asakura Press, Tokyo, 2008 (in Japanese)
- Shimizu, S.: 3.4 Metabolic engineering (1) Useful lipids. Encyclopedia of microorganism (edited by Watanabe et al.), pp.158-160, Asakura Press, Tokyo, 2008 (in Japanese)
- Shimizu, S.: 4.1.1.29 Sulfinoalanine decarboxylase, etc. Enzyme Handbook, 3rd edition (edited by Yagi et al.), pp.761, 763, 765-766, 769-770, 772-774, 777-779, 802-803, Asakura Press, Tokyo, 2008 (in Japanese)
- Ogawa, J.: Enzyme. Bio for future (edited by Japanese Society of Bioengineering), pp.110-111, 2008 (in Japanese)
- Ogawa, J., S. Kishino, E. Sakuradani and S. Shimizu: Microbial production of PUFA and CLA. White Biotechnology (edited by Ueda, M.), pp.85-91, CMC Press, Tokyo, 2008 (in Japanese)
- Ogawa, J., S. Kishino, E. Sakuradani, K. Yokozeki and S. Shimizu: Creation of food function using microbial function. Frontier of nutritional science (edited by Japanese Society of Nutrition and Food Science), pp.151-165, Kenpakusha, 2008 (in Japanese)

### ***Original papers***

- von Canstein, H., J. Ogawa, S. Shimizu and J.R. Lloyd: Secretion of flavins by *Shewanella* species and their role in extracellular electron transfer. Appl Environ Microbiol 74; 615-623, 2008
- Fernandez, A., J. Ogawa, S. Penaud, S. Boudebouze, D. Ehrlich, M. van de Gucht and E. Maguin: Rerouting of pyruvate metabolism during acid adaptation in *Lactobacillus bulgaricus*. Proteomics 8; 3154-3163, 2008
- Isobe, K., K. Ishikura and S. Shimizu: Identification and characterization of enzyme catalyzing conversion of N(alpha)-benzyloxycarbonyl-L-amino adipic-delta-semialdehyde to N(alpha)-benzyloxycarbonyl L-amino adipic acid in *Aspergillus niger* AKU3302. J Biosci Bioeng 106; 409-411, 2008
- Isobe, K., A. Kato, Y. Sasaki, M. Kataoka, A. Iwasaki, J. Hasegawa and S. Shimizu: Superoxide dismutase exhibit oxidase activity on aldehyde alcohols similar to alcohol oxidase from *Paenibacillus* sp. AIU311. J Biosci Bioeng 105; 666-670, 2008
- Kataoka, M., T. Ishige, N. Urano, Y. Nakamura, E. Sakuradani, S. Fukui, S. Kita, K. Sakamoto and S. Shimizu: Cloning and expression of the L-1-amino-2-propanol dehydrogenase gene from *Rhodococcus erythropolis*, and its application to double chiral compound production.

- Appl Microbiol Biotechnol 80; 597-604, 2008
- Muramatsu, M., C. Ohto, S. Obata, E. Sakauradani and S. Shimizu: Accumulation of prenyl alcohols by terpenoid biosynthesis inhibitors in various microorganisms. Appl Microbiol Biotechnol 80; 589-595, 2008
- Muramatsu, M., C. Ohto, S. Obata, E. Sakuradani and S. Shimizu: Various oils and detergents enhance the microbial production of farnesol and related prenyl alcohols. J Biosci Bioeng 106; 263-267, 2008
- Noge, K., M. Kato, N. Mori, M. Kataoka, C. Tanaka, Y. Yamasue, R. Nishida and Y. Kuwahara: Geraniol dehydrogenase, the key enzyme in biosynthesis of the alarm pheromone, from the astigmatid mite *Carpoglyphus lactis* (Acari: Carpoglyphidae). FEBS J 275; 2807-2817, 2008
- Sakuradani, E., S. Murata, H. Kanamaru and S. Shimizu: Functional analysis of a fatty acid elongase from arachidonic acid-producing *Mortierella alpina* 1S-4. Appl Microbiol Biotechnol 81; 497-503, 2008
- Sasaki, Y., K. Isobe, M. Kataoka, J. Ogawa, A. Iwasaki, J. Hasegawa and S. Shimizu: Purification and characterization of a new aldehyde oxidase from *Pseudomonas* sp. AIU 362. J Biosci Bioeng 106; 297-302, 2008
- Thiwhong, R., M. Kataoka, A. Iwasaki, H. Watanabe, J. Hasegawa, K. Isobe and S. Shimizu: Aldehyde oxidase carrying an unusual subunit structure from *Pseudomonas* sp. MX-058. Microbial Biotechnol 1; 395-402, 2008
- Wada, M., K. Okabe, M. Kataoka, S. Shimizu, A. Yokota and H. Takagi: Distribution of L-azetidine-2-carboxylate *N*-acetyltransferase in yeast. Biosci Biotechnol Biochem 72; 582-586, 2008

### **Reviews**

- Asano, Y. and S. Shimizu: Preface on the special issue of "Directed evolution of biocatalysts and thier uses in industry". Seibutsu Kogaku 85(9); 393, 2007 (in Japanese)
- Kishino, S. and S. Shimizu: Potential of latic acid bacteria. OnkoChishin 45; 24-39, 2008 (in Japanese)
- Kishino, S., J. Ogawa, K. Yokozeki and S. Shimizu: conjugated fatty acid production by lactic acid bacteria. Bioscience & Industry 66; 54-59, 2008 (in Japanese)
- Ogawa, J., Y. Aki and T. Nagao: New target of functional lipid production –Introduction. Seibutsu Kogaku 86; 469, 2008 (in Japanese)
- Shimizu, S.: Introduction -Screening and exploitation of unique microbial function and their industrial applications. Fine Chemical 37; 5-7, 2008 (in Japanese)
- Ogawa, J., S. Kishino and S. Shimizu: Enzymatic Synthesis of conjugated fatty acids. Fine Chemical 37; 18-27, 2008 (in Japanese)
- Shimizu, S.: Bioveture. BIOINDUSTRY 25; 5-6, 2008 (in Japanese)
- Shimizu, S.: Amino acid fermentation –Intoroduction. Bioscience & Industry 66; 426, 2008 (in Japanese)

### **Reports**

- Ogawa, J.: Research of lactic acid bacteria in France. Lactic acid bacteria 19; 46-50, 2008 (in Japanese)
- Shimizu, S.: Microbial factory. Annual Report of Research Institute for Biological Function of Chubu Univ. 8; 13-32, 2008 (in Japanese)

Shimizu, S.: Microbial Bioprocess. Community Information No.224; 5-6, 2008 (in Japanese)

b) Conference and seminar papers presented

Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry 2008: 18 reports

Yabuta Seminar "Use of Environmental Microorganisms": 1 report

36th Annual Conference on Yeasts: 1 report

99th American Oil Chemists' Society Annual Meeting and Expo: 2 reports

9th International Symposium on Cytochrome P450 Biodiversity and Biotechnology: 1 report

60th Annual Meeting of the Vitamin Society of Japan: 1 report

Gordon Research Conference on Biocatalysis: 1 report

Annual Meeting of the Society for Industrial Microbiology 2008: 1 report

2nd Meeting of Target Protein Program: 1 report

Annual Meeting of the Society for Fermentation and Bioengineering, Japan 2008: 5 reports

biocat 2008: 3 reports

8th Academic Meeting of Food Enzyme Chemistry Forum: 1 report

Meeting of Kansai Branch of Japan Society for Bioscience, Biotechnology, and Agrochemistry 2008: 4 reports

The 4th Japan-Netherlands Joint Seminar on Enzyme Science and Biotechnology: 1 report

The 13th International Biotechnology Symposium & Exhibition (IBS2008): 1 report

The 11th Swiss-Japanese Joint Meeting on Biotechnology and Bioprocess Development: 2 reports

BioTrends2008-SusChemEng Conference: 1 report

30th Anniversary Commemorative Symposium on Enzyme Engineering: 4 reports

4th International Symposium on Biocatalysis and Biotechnology: 1 report

34th Meeting of Enzyme Application Association: 1 report

Symposium of Target Protein Program 2008: 1 report

458th Meeting of Kansai Branche of Japan Society for Bioscience, Biotechnology, and Agrochemistry: 2 reports

7th Lipid Reserch Seminar: 3 reports

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Shimizu, S.: Japan Society for Bioscience, Biotechnology, and Agrochemistry (director, vice president); The Society for Fermentation and Bioengineering, Japan (councilor); The Japanese Biochemical Society (councilor); The Vitamin Society of Japan (councilor); The Society of Enzyme Engineering (committieeman); Japan Bioindustry Association (director, vice president, editor), Japan Applied Microbiology Society (director)

Kataoka, M.: The Society of Enzyme Engineering (secretary); The Vitamin Society of Japan (topics editor); The Society for Fermentation and Bioengineering, Japan (secretary of IT-driven microbiology group)

Ogawa, J.: The Society for Fermentation and Bioengineering, Japan (chairman of lipid technology group); Japanese Society for Bioscience, Biotechnology and Agrochemistry (Member of Industry-Government-Academy young people interchange society)

#### ***Research grants***

Monbukagakusho Research Grant: Scientific Research (A) Creation of novel functional lipids by

using multi-use of microbial functions (Shimizu, Kataoka, Ogawa, Sakuradani), Scientific Research (B) Development of production process of useful compounds using bioreduction system (Kataoka, Shimizu, Ogawa), Scientific Research (B) Screening and development of microbial function of reductive fatty acid and organic acid conversion (Ogawa, Shimizu, Sakuradani), Specific Field Research Biocatalytic module development for non-invasive cellular lipid analysis (Ogawa, Sakuradani), Young Scientist Research (A) Production of useful compounds by molecular breeding of oleaginous microbes (Sakuradani)

Research project funded by New Energy and Industrial Technology Development Organization (NEDO): The Project for Development of a Technological Infrastructure for Industrial Bioprocesses (Shimizu, Kataoka, Ogawa, Sakuradani), Next Generation Fuel Battery Development (Ogawa), Microbial production of functional lipids (Sakuradani)

Target Protein Research program: Structural analysis and modification of enzymes useful for chiral compound production (Shimizu, Kataoka, Ogawa, Sakuradani)

#### **A-4. International cooperations and overseas activities**

##### ***International meetings (roles)***

Shimizu, S.: 36th Annual Conference on Yeasts, Slovakia (invited speaker); The 13th International Biotechnology Symposium & Exhibition (IBS2008), China (invited speaker); The 11th Swiss-Japanese Joint Meeting on Biotechnology and Bioprocess Development, Switzerland (organizer, invited speaker)

Kataoka, M.: Gordon Research Conference on Biocatalysis, USA (invited speaker); biocat 2008, Germany (speaker); The 4th Japan-Netherlands Joint Seminar on Enzyme Science and Biotechnology (invited speaker); BioTrends2008-SusChemEng Conference (invited speaker)

Ogawa, J.: 99th American Oil Chemists' Society Annual Meeting and Expo, USA (invited speaker), 9th International Symposium on Cytochrome P450 Biodiversity and Biotechnology, France (speaker), Annual Meeting of the Society for Industrial Microbiology 2008, USA (invited speaker); biocat 2008, Germany (speaker); The 11th Swiss-Japanese Joint Meeting on Biotechnology and Bioprocess Development, Switzerland (invited speaker); 4th International Symposium on Biocatalysis and Biotechnology, Taiwan (invited speaker)

Sakuradani, E.: 99th American Oil Chemists' Society Annual Meeting and Expo, USA (invited speaker)

##### ***Membership in international academic societies***

Shimizu, S.: American Oil Chemists' Society (member of committee on biotechnology section), Journal of American Oil Chemists' Society (editor), Journal of Molecular Catalyst B: Enzymatic (editor)

Kataoka, M.: Journal of Bioscience and Bioengineering (editor), Recent Patents on Biotechnology (editor)

Sakuradani, E.: Applied Microbiology and Biotechnology (editor)

##### ***International joint researchers, overseas research surveys***

Shimizu, S.: Biotechnological researches on cytochrome P450 monooxygenases (Stuttgart University, Germany); Biochemical engineering of old yellow enzyme (Technical



University of Dortmund, Germany)

Kataoka, M.: Biochemical engineering of old yellow enzyme (Technical University of Dortmund, Germany)

Ogawa, J.: Biotechnological researches on cytochrome P450 monooxygenases (Stuttgart University, Germany); Analysis on lipid metabolisms in lactic acid bacteria (L'Institut National de la Recherche Agronomique, France); Functional analysis on microbial laccases (Université Paul Cézanne Aix-Marseille III, France)

### ***Scholars from abroad***

Invited foreign researcher (1) (Philippines)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Outline of Applied Life Sciences II (Shimizu), Applied microbiology III (Shimizu), Applied microbiology IV (Shimizu, Kataoka), Laboratory course in applied microbiology (Kataoka, Ogawa, Sakuradani), Biotechnology (Shimizu)

Graduate level: Fermentation physiology and applied microbiology (Advanced course) (Shimizu, Kataoka, Ogawa, Sakuradani), Fermentation physiology and applied microbiology seminar (Shimizu, Kataoka, Ogawa, Sakuradani), Experimental course of fermentation physiology and applied microbiology (Shimizu, Kataoka, Ogawa, Sakuradani)

#### **b) Seminars**

Mini-lecture on Open-Campus 2008 of Kyoto University (Kataoka), Bioveture (T. Fujita, COO, Neo-Morgan), To students studying natural sciences (T. Fujita, COO, Neo-Morgan), Supramolecular Chemistry of Cyclodextrin in Enzyme Technology (Reynaldo Villalonga Santana, Professor, Matanzas University, Cuba), Research and development of new function of microbial enzymes (Y. Asano, Professor, Toyama Prefectural University), Frontier of biocatalysis research (S. Hashimoto et al, Kyowa Hakko Bio)

### **B-2. Overseas teaching**

#### ***Students and research fellows from abroad***

Research fellows: Research fellow (1) (Korea); Research student (1) (China)

#### ***Lecture in abroad***

Shimizu, S.: Technical University of Slovakia (Slovakia)

Ogawa, J.: l'Institut National de la Recherche Agronomique (France)

## **C. Other remarks**

Shimizu, S.: The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, Prizes for Science and Technology (Development Category); Inoue Harushige Award

Kataoka, M.: The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, Prizes for Science and Technology (Development Category)

## 2.3.8 Laboratory of Microbial Biotechnology

*Staff      Professor                      : Sakai, Yasuyoshi, Dr. Agric. Sci.*

*Associate Professor: Yurimoto, Hiroya, Dr. (Agric. Sci.)*

*Assistant Professor: Masahide Oku, Dr. (Agric. Sci.) (2008.7–, Postdoctoral fellow –2008.6)*

*Postdoctoral fellow: Yamashita, Shun-ichi, Dr. (Agric. Sci.) (–2008.4)*

*Students and research fellows*

*Doctor's program: (5)*

*Master's program: (16)*

*Undergraduate    : (4)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Molecular and cellular biology for efficient production of heterologous proteins

We have developed the field of “C1 fermentation”, in which methanol is used as the raw material for microbial cultivation and chemical synthesis. We have noticed methylotrophs that grow on C1 compounds as a useful biocatalyst and a protein production system. In our studies, a new heterologous gene expression system using the methylotrophic yeast has been established. This is widely noticed as a system for production of various eucaryotic proteins.

##### b) Development of novel metabolic functions of microbes

For the application of the heterologous gene expression system and the metabolic function of the methylotrophic yeast, many genes that participate in methanol metabolism were cloned and we tried to clarify the metabolic pathway at the molecular level. We have found the genes encoding formaldehyde fixation pathway, which has been well characterized in methylotrophic bacteria, in nonmethylotrophic bacteria and archaea. We study on the physiological role and its application of these enzymes. We focus on methane, methanol, and short-chain alkanes as the future natural resources, and clarify the cellular and metabolic function of microorganisms, which utilize these resources, from the aspect of biochemistry, molecular biology and intracellular structure.

##### c) Development of technology to monitor intracellular redox potential

It has been recognized that reactive oxygen species (ROS) attack various biomolecules resulting in aging and many diseases. For the prevention of diseases and control of aging, evaluation and control of oxidative stress *in vivo* may become essential. However, it has been difficult to monitor oxidative stress in a living cell and in real time. We have developed a new molecular probe that can detect intracellular oxidative stress non-invasively using methylotrophic yeasts and mammalian cells as model cells.

#### A-2. Publications and presentations

##### a) Publications

###### ***Books***

Kumagai, H., N. Kato, K. Murata and Y. Sakai: Applied microbiology, Asakura Shoten, Tokyo, 2008  
(in Japanese)

Yurimoto, H. and Y. Sakai: System of microorganisms. Agricultural Science in the 21st century. Vol.

6, Development of microbial function (ed. Ueda, M), pp.3-27, Kyotodaigaku Shuppankai, Kyoto, 2008 (in Japanese)

Yurimoto, H. and Y. Sakai: Recombinant protein production in microorganisms. Encyclopedia of protein (eds. Inokai, A., et al.), pp726-728, Asakura Shoten, Tokyo, 2008 (in Japanese)

### **Original papers**

Limtong, S., N. Srisuk, W. Yongmanitchai, H. Yurimoto and T. Nakase: *Ogataea chonburiensis* sp. nov. and *Ogataea nakhonphanomensis* sp. nov., two thermotolerant, methylotrophic yeast species isolated in Thailand and the transfer of *Pichia siamensis* and *Pichia thermomethanolica* to the genus *Ogataea*. Int J Syst Evol Microbiol 58; 302-307, 2008

Sasano, Y., H. Yurimoto, M. Yanaka and Y. Sakai: Trm1p, a Zn(II)<sub>2</sub>Cys<sub>6</sub>-type transcription factor, is a master regulator of methanol-specific gene activation in the methylotrophic yeast *Candida boidinii*. Eukaryot Cell 7; 527-536, 2008

Egawa, K., H. Shibata, S. Yamashita, H. Yurimoto, Y. Sakai and H. Kato: Overexpression and purification of rat peroxisomal membrane protein 22, PMP22, in *Pichia pastoris*. Protein Expr Purif 64; 47-54, 2009

### **Reviews**

Sakai, Y.: Organeller dynamics and autophagy. Jikken Igaku 26(2); 284-288, 2008 (in Japanese)

Yurimoto, H., I. Orita and Y. Sakai: Physiological role of formaldehyde-fixing enzymes in archaea. Bioscience & Industry 66(8); 447-449, 2008 (in Japanese)

Oku M. and Y. Sakai: Pexphagy in *Pichia pastoris*. Methods Enzymol 451; 217-228, 2008

b) Conference and seminar papers presented

Annual meeting of the Japan Society for Bioscience, Biotechnology, and Agrochemistry 2009: 13 reports

Yeast Genetics and Molecular Biology News Japan No. 41: 5 reports

Biochemistry and Molecular Biology 2008: 4 reports

Annual meeting of the Society for Biotechnology, Japan 2008: 2 reports

The 8th Annula Meeting of the Protein Science Society of Japan: 1 report

Meething of Kansai Branch of the Japan Society for Bioscience, Biotechnology, and Agrochemistry: 2 reports

The 458th meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry Kansai Branch: 2 reports

The 18th Joint Symposium on Yeasts: 1 report

The 9th Symposium on Enzyme Application: 1 report

## **A-3. Off-campus activity**

### **Membership in academic societies (roles)**

Sakai, Y.: Japan Society for Bioscience, Biotechnology, and Agrochemistry (Councilor, Kansai Branch). Yeast Genetics Society of Japan (Administrator). Japan Bioindustry Association; Academic Society for Biotransformations with New Resources (Standing Director). Yeast Research Society of Japan (Administrator).

Yurimoto, H: Japan Bioindustry Association (Topics). Yeast Research Society of Japan (Administrator). Japan Society for Bioscience, Biotechnology, and Agrochemistry (Representative).

### ***Research grants***

Monbukagakusho Scientific research on priority areas: Mechanism of selective intracellular degradation by autophagy (Sakai). Scientific research (B): Cellular function of C1-microorganisms aiming at reduction of green house gas (Sakai). Young Scientists (B): Molecular basis of one-carbon metabolism of microorganisms and regulatory mechanism of gene expression (Yurimoto)

Other Research grant: Japan Science and Technology Agency, CREST, Metabolism-based regulation of organelle homeostasis and cell function (Sakai). The Asahi Glass Foundation Research grant: Molecular and cellular biology of microorganisms aiming at efficient utilization of C1 compounds (Sakai). RITE R&D program on CO<sub>2</sub> fixation and effective utilization, Development of key technology for *in situ* biomass utilization by C1-microorganism consortia (Yurimoto).

## **A-4. International cooperation and overseas activities**

### ***International meetings (roles)***

Sakai, Y.: Gordon Research Conference on Molecular Basis of Microbial One-Carbon Metabolism, USA (invited speaker). The 12th International Congress on Yeasts, Ukraine (invited speaker).

Yurimoto, H.: Gordon Research Conference on Molecular Basis of Microbial One-Carbon Metabolism, USA (invited speaker). JSPS Asian Core Program 1st Joint Seminar on Capacity Building and Development of Microbial Potential and Fermentation Technology towards New Era, Thailand (invited speaker).

### ***Membership in international academic societies***

Sakai, Y.: Biosci Biotechnol Biochem (Editor), Autophagy (Editor)

### ***International joint researches, overseas research surveys***

Sakai, Y.: JSPS Asian Core Program on Capacity Building and Development of Microbial Potential and Fermentation Technology towards New Era

Yurimoto, H.: JSPS Asian Core Program on Capacity Building and Development of Microbial Potential and Fermentation Technology towards New Era

### ***Scholars from abroad***

Invited foreign scholars (1) (University of Washington, USA, Professor)

## **B. Educational Activities (2008.4-2008.4)**

### **B-1. On-campus teaching**

#### **a) Courses given**

***Undergraduate level***: Introduction to Applied Life Sciences I (Sakai), Introduction to Applied Life Sciences II (Sakai), Applied Microbiology I (Sakai), Applied Microbiology IV (Yurimoto), Biochemistry I (Yurimoto), Laboratory Course in Applied Microbiology (Yurimoto, Oku), Seminar in Applied Life Sciences, Part I and II (Sakai, Yurimoto, Oku)

***Graduate level***: Microbial Biotechnology Seminar (Sakai, Yurimoto, Oku), Experimental Course of Microbial Biotechnology (Sakai, Yurimoto, Oku)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Sakai, Y.: Nara Women's University (Life Science), Nara Institute of Science and Technology (Microbial Biotechnology), Fukushima Medical University (School of Medicine).

### **B-3. Overseas teaching**

#### ***Students and research fellows from abroad***

Foreign students: Doctor's program (1) (China), Master's program (1) (Vietnam)

### **C. Other Remarks**

Sakai, Y.: Member of the Advisory Committee of Technological Research for the Verification of Feasibility on CO<sub>2</sub> Fixation and Effective Utilization in Research Institute of Innovative Technology for the Earth. Member of the Advisory Committee of International Center for Environmental Technology Transfer.

Yurimoto, H.: The 9th Symposium on Enzyme Applications (research award)

# Chair of Bioorganic and Biophysical Chemistry

## 2.3.9 Laboratory of Bio-Analytical and Physical Chemistry

<i>Staff</i>	<i>Professor</i>	<i>: Kano, Kenji, Dr. Agric. Sci.</i>
	<i>Associate Professor</i>	<i>: Shirai, Osamu, Dr. Sci.</i>
	<i>Assistant Professor</i>	<i>: Tsujimura, Seiya, Dr. Agric. Sci.</i>
	<i>Postdoctoral fellows</i>	<i>: Freguia, Stefano, Dr. Environ. Eng.</i>

### *Students and research fellows*

<i>Doctor's program :</i>	<i>(1)</i>	<i>Research fellow :</i>	<i>(1)</i>
<i>Master's program:</i>	<i>(10)</i>	<i>Undergraduate:</i>	<i>(5)</i>

## A. Research Activities (2008.4-2009.3)

### A-1. Main subjects

- a) Oxidation-reduction reactions relevant to biological phenomena.

Structure and function of fructose dehydrogenase from acetic acid bacterium (molecular cloning, structural analysis of active site, thermochemical and dynamic properties, electrode reaction, etc.). Single mutation of multicopper oxidase and its function analysis. Interaction between the enzymes and various electrode materials.

- b) Fundamental study of bioenergy conversion system and its application to biofuel cell.

Multi-copper oxidases as very efficient catalysts for electrocatalytic reduction of dioxygen to water based on mediated and direct electron transfer mechanisms. Bioelectrocatalytic oxidation of saccharide using dehydrogenase. Bioelectrocatalytic oxidation of saccharide using saccharide dehydrogenase (mediated and direct electron transfer-type bioelectrocatalysis). Electron transfer at an enzyme-adsorbed and modified carbon and gold electrodes. Development of biofuel cell using enzymes and microbes.

- c) Construction of electrochemical biosensing systems.

Development of a method of complete electrolysis micro-coulometry for multi-purpose use. Development of blood glucose sensor.

- d) Redox chemistry of antioxidants

Autooxidation of catechins concerning ferrous/ferric compounds. Redox chemistry of poly-phenols.

- e) Fundamental study on charge (ion and electron) transfers across biomembranes

Electrochemical analysis on ion transport across planar lipid bilayers in the presence of hydrophobic ions and ionophores. Electron transfer at the surface of tethered BLM. Function of ion channels using planar bilayer lipid membranes (Effect of coexisting ions, Reaction mechanism of accelerator and inhibitor).

- f) Fundamental study of bioenergy conversion system and signal transmission processes.

Coupling mechanism between electron transport system and ion transport system using enzymes, ionophores and hydrophobic ions. Ion transport across liposomal membranes.

## A-2. Publications and presentations

### a) Publications and presentations

#### *Original papers*

- Kurose, S., K. Kataoka, N. Shinohara, Y. Miura, M. Tsutsumi, S. Tsujimura, K. Kano and T. Sakurai: Modification of Spectroscopic Properties and Catalytic Activity of *Escherichia coli* CueO by Mutations of Methionine 510, the Axial Ligand to the Type I Cu. Bull Chem Soc Jpn 82; 504-508, 2009
- Fujieda, N., M. Mori, T. Ikeda and K. Kano: Silent Form of Quinohemoprotein Amine Dehydrogenase from *Paracoccus denitrificans*. Biosci Biotechnol Biochem 73; 524-529, 2009
- Kubota, S., S. Ozaki, J. Onishi, K. Kano and O. Shirai: Selectivity on Ion Transport across Bilayer Lipid Membranes in the Presence of Gramicidin A. Anal Sci 25; 189-193, 2009
- Miura, Y., S. Tsujimura, K. Kurose, Y. Kamitaka, K. Kataoka, T. Sakurai and K. Kano: Direct Electrochemistry of CueO and Its Mutants at Residues to and near Type I Cu for Oxygen-Reducing Biocathode. Fuel Cells 9; 70-78, 2009
- Sakai, H., T. Nakagawa, A. Sato, T. Tomita, Y. Tokita, T. Hatazawa, T. Ikeda, S. Tsujimura and K. Kano: A High-power Glucose/oxygen Biofuel Cell Operating under Quiescent Conditions. Energy Environ Sci 2; 133-138, 2009
- Tsutsumi, M., S. Tsujimura, O. Shirai and K. Kano: Direct electrochemistry of histamine dehydrogenase from *Nocardioides simplex*. J Electroanal Chem 625; 144-148, 2009
- Ozaki, S., S. Aoki, T. Hibi, K. Kano and O. Shirai: Reconstitution of the Voltage-gated K<sup>+</sup> Channel KAT1 in Planar Lipid Bilayers. Electrochem Commun 10; 1509-1512, 2008
- Fukuda, J., S. Tsujimura and K. Kano: Coulometric Bioelectrocatalytic Reactions Based on NAD-dependent Dehydrogenases in Tricarboxylic Acid Cycle. Electrochimica Acta 54; 328-333, 2008
- Hibi, T., S. Aoki, K. Oda, S. Munemasa, S. Ozaki, O. Shirai, Y. Murata and N. Uozumi: Purification of the functional plant membrane channel KAT1. Biochem Biophys Res Commun 374; 465-469, 2008
- Yamada, R., N. Fujieda, M. Tsutsumi, S. Tsujimura, O. Shirai and K. Kano: Bioelectrochemical Determination at Histamine Dehydrogenase-based Electrodes. Electrochemistry 76; 600-602, 2008
- Sasakura, K., S. Kubota, J. Onishi, S. Ozaki, K. Kano and O. Shirai: Ion Transport across a Bilayer Lipid Membrane in the Presence of a Hydrophobic Ion. Electrochemistry 76; 597-599, 2008
- Tsujimura, S., T. Abo, K. Matsushita, Y. Ano and K. Kano: Direct Electron Transfer Reaction of D-Gluconate 2-Dehydrogenase Adsorbed on Bare and Thiol-modified Gold Electrodes. Electrochemistry 76; 549-551, 2008
- Wang, Y.-F., S. Tsujimura and K. Kano: Amperometric Detection of Acetate Based on Mediated Bioelectrocatalysis using *Escherichia coli* Cells Cultivated with Acetate. Electrochemistry 76; 631-633, 2008
- Ishibashi, K., S. Tsujimura and K. Kano: Pentacyanoferrate and Bilirubin Oxidase-bound Polymer for Oxygen Reduction Bio-cathode. Electrochemistry 76; 594-596, 2008
- Ozaki, S., K. Kano and O. Shirai: Electrochemical Elucidation on the Mechanism of Uncoupling Caused by Hydrophobic Weak Acids. Phys Chem Chem Phys 10; 4449-4455, 2008

- Samukawa, T., S. Tsujimura and K. Kano: AC Impedance Analysis of Enzyme-functional Electrodes. *Bunseki Kagaku* 57(8); 625-630, 2008 (in Japanese)
- Wang, Y.-F., M. Masuda, S. Tsujimura and K. Kano: Electrochemical regulation of the end-product profile in *Propionibacterium freudenreichii* ET-3 with an endogenous mediator. *Biotechnol Bioeng* 101; 579-586, 2008
- Tsujimura, S., Y. Miura and K. Kano: CueO-immobilized Porous Carbon Electrode Exhibiting Improved Performance of Electrochemical Reduction of Dioxygen to Water. *Electrochimica Acta* 53; 5716-5720, 2008
- Tsutsumi, M., N. Fujieda, S. Tsujimura, O. Shirai and K. Kano: Thermodynamic Redox Properties Governing Half-reduction Characteristics of Histamine Dehydrogenase from *Nocardioides simplex*. *Biosci Biotechnol Biochem* 72; 786-796, 2008
- Shirai, O., T. Nagai, A. Uehara and H. Yamana: Electrochemical Properties of the Ag<sup>+</sup>|Ag and Other Reference Electrodes in the LiCl-KCl Eutectic Melts. *J. Alloys Comp.*, 456; 498-502, 2008
- Tsujimura, S., A. Ishii, T. Abo, T., and K. Kano: Mediated Bioelectrocatalytic Reaction Using Monolayered Redox Polymer on a Glassy Carbon Electrode Surface and Effect of the Ionic Strength on the Catalytic Current. *J. Electroanal. Chem.*, 614; 67-72, 2008

### **Reviews and others**

- Tsujimura, S. and K. Kano: enzyme functional electrode for biofuel cell. *Electrochemistry* 76; 900-909, 2008 (in Japanese)
- Tsujimura, S. and K. Kano: Biofuel cells, Application technologies and new trends in industrial enzymes. pp.246-256, CMC Publishing CO.,LTD., Tokyo, 2009 (in Japanese)
- Tsujimura, S. and K. Kano: Biofuel cell. Electrochemical measurements. pp.391-400, Joho-Kikou, Tokyo, 2009 (in Japanese)
- Tsujimura, S. and K. Kano: Biofuel cell. Innovative Technologies of Small fuel Cells, (Eds. N. Kamiya and M. Umeda)). pp.209-219, CMC Publishing CO.,LTD., Tokyo, 2008 (in Japanese)
- b) Conference and seminar papers presented.
- The 450th Kansai Branch Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry: 1 report
- Biochemistry and Molecular Biology 2008: 1 report
- The Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry in 2009: 3 reports
- The 76th Electrochemical Society Meeting: 10 reports
- 213th Meeting of Electrochemical Society: 2 reports
- 214th Meeting of Electrochemical Society: 8 reports
- Sixth Asian Conference on Electrochemistry: 1 report
- The 57th Annual Meeting of the Japan Society for Analytical Chemistry: 3 reports
- The 54th Annual Meeting on Polarography and Electroanalytical Chemistry: 5 reports
- 2nd international conference on acetic acid bacteria: 1 report
- Joint symposium on biorelevant chemistry: 2 reports
- The 11th Symposium of JSWE: 2 reports
- The 21st Bioinorganic Chemistry, Summer Seminar: 1 report
- The 95th Analytical Technology Forum: 1 report
- Food Science and Technology Kansai Branch Forum: 1 report



### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Kano K.: The Electrochemical Society of Japan (the chief of Kansai Branch); The Japan Society for Bioscience, Biotechnology, and Agrochemistry (a director); The Japan Society for Analytical Chemistry (a council member); The Polarographic Society of Japan (a director, an editorial board member).

Shirai O.: The Japan Society for Analytical Chemistry (an organizer of Kinki Branch); The Electrochemical Society of Japan (a secretary-general of Kansai Branch); The Polarographic Society of Japan (an accountant secretary).

Tsujimura S.: The Polarographic Society of Japan (a council member)

#### ***Research grants***

Kano K.: Grant-in-Aids for Scientific Research from the Ministry of Education, Science, Sports and Culture of Japan, NEDO

Shirai O.: Grant-in-Aids for Scientific Research from the Ministry of Education, Science, Sports and Culture of Japan

Tsujimura S.: Kurita Water and Environment Foundation Research Grant

### **A-4. International cooperation and overseas activities**

#### ***International meetings (roles)***

Kano, K.: Analytical Biochemistry (an executive editor), Journal of Electroanalytical Chemistry (a council member of editorial board).

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Biophysical Chemistry I (Kano), Biophysical Chemistry II (Kano), Introduction to Applied Life Science I (Kano and others), Analytical Chemistry (Shirai), Laboratory Course in Analytical Chemistry (Shirai, Tsujimura), Laboratory Course in Biophysical Chemistry (Shirai, Tsujimura), New Strategies in Agricultural Sciences (Kano and others), Introduction to Applied Life Science I (Kano and others), Applied Life Science (Kano and others)

Graduate level: Bio-Analytical and Physical Chemistry (Kano, Shirai), Seminar of Bio-Analytical and Physical Chemistry (Advanced course) (Kano, Shirai, Tsujimura), Experimental Course of Bio-Analytical and Physical Chemistry (Kano, Shirai, Tsujimura).

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Kano, K.: Kyushu University (Coordinate Chemistry)

Kano, K.: Osaka Prefectural University (Applied Chemistry)

### **B-4. Other remarks**

Kano K.: Hot Article Award (Anal. Sci.)

Shirai O.: Hot Article Award (Anal. Sci.)

Tsujimura S.: The 9th symposium on enzyme applications (research award)

## 2.3.10 Laboratory of Biofunction Chemistry

*Staff      Professor                      : Hideto Miyoshi, Dr. Agric. Sci.*  
*Assistant Professor : Ishihara, Atsushi, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program: (1) (JSPS research fellow)*

*Master's program: (5)*

*Undergraduate    : (4)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

- a) Bioorganic chemical study for elucidating mitochondrial complex I.

Proto-translocating NADH-ubiquinone oxidoreductase (complex I) is the first complex of the mitochondrial respiratory chain. It couples the transfer of two electrons from NADH to ubiquinone to the translocation of four protons across the inner mitochondrial membrane. The enzyme is composed of at least 46 different subunits with a total molecular mass of approximately 1 MDa. Because of the complexity of the enzyme, our knowledge about the molecular structure and the catalytic mechanism is still highly limited. The aim of our research is to get insights into the structural and functional features of complex I through the syntheses of various molecular probes and the mode of action studies for them.

- b) Design synthesis of the photoaffinity labeling probes and analysis of the target protein in the respiratory system.

Photoaffinity labeling technique is a powerful tool for studying the interreaction between biologically active compounds and target molecules. On the basis of structure-activity relationships on complex I inhibitors and ubiquinone, we have synthesized various radioisotope and biotin-tagged probe molecules which retain higher specificities. Using these photoaffinity labeling probes, we have accumulated the detailed information of the inhibitor/ubiquinone binding site in mitochondrial complex I.

- c) Construction of the synthetic cardiolipin library.

Cardiolipins, a phospholipids localized in the mitochondrial membrane, are believed to play important roles in stabilizing respiratory enzymes and releasing Cyt *c* during the initial phase in apoptosis. We are constructing the synthetic cardiolipin library, which can be used as a biochemical tool, for elucidating the important biological phenomenon in mitochondria.

- d) Bioorganic chemical study on the functions and regulation of plant secondary metabolism.

Plants defend themselves by multiple mechanisms. One of these mechanisms is the utilization of secondary metabolites. Plants respond to pathogenic infection by rapid accumulation of toxic secondary metabolites. We have been analyzing biosynthesis of those metabolites in gramineous species and *Arabidopsis thaliana*.

In addition, we have found that the metabolism of secondary metabolites is important in the plant defense. For example, in response to pathogenic attack, rice leaves accumulate serotonin, which is metabolized and deposits in the cell walls. The serotonin deposition results in the

reinforcement of cell walls. We can elucidate sophisticated defense mechanisms of plants by investigating "where they have been and where they are going".

## **A-2. Publications and presentations**

### **a) Publications**

#### ***Original papers***

- Abe, M., A. Kubo, S. Yamamoto, Y. Hatoh, M. Murai, Y. Hattori, H. Makabe, T. Nishioka and H. Miyoshi: Dynamic Function of the Spacer Region of Acetogenins in the Inhibition of Bovine Mitochondrial NADH-Ubiquinone Oxidoreductase (Complex I). *Biochemistry* 47; 6260-6266, 2008
- Ichimaru, N., M. Murai, N. Kakutani, J. Kako, A. Ishihara, Y. Nakagawa, T. Nishioka, T. Yagi and H. Miyoshi: Synthesis and characterization of new piperazine-type inhibitors for mitochondrial NADH-ubiquinone oxidoreductase (complex I). *Biochemistry* 47; 10816-10826, 2008
- Murai, M., K. Sekiguchi, T. Nishioka and H. Miyoshi: Characterization of the inhibitor binding site of mitochondrial NADH-ubiquinone oxidoreductase by photoaffinity labeling using a quinazoline-type inhibitor. *Biochemistry* 48; 688-698, 2009
- Ly, D., K. Kang, J.-Y. Choi, A. Ishihara, K. Back and S.-G. Lee: HPLC analysis of serotonin, tryptamine, tyramine, and the hydroxycinnamic acid amides of serotonin and tyramine in food vegetables. *J Med. Food* 11; 385-389, 2008
- Ishihara, A., Y. Hashimoto, C. Tanaka, J. G. Dubouzet, T. Nakao, F. Matsuda, T. Nishioka, H. Miyagawa and K. Wakasa: The tryptophan pathway is involved in the defense responses of rice against pathogenic infection via serotonin production. *Plant J* 54; 481-495, 2008
- Ishihara, A., Y. Hashimoto, H. Miyagawa and K. Wakasa: Induction of serotonin accumulation by feeding of rice striped stem borer in rice leaves. *Plant Signal Behav* 3; 714-716, 2008

### **b) Conference and seminar papers presented**

- Annual Meeting of Japanese Society of Bioscience, Biotechnology, and Agrochemistry 2007: 3 report.
- The 43th Annual Meeting of the Japanese Society for Chemical Regulation of Plants : 1 report.
- The 32th Annual Meeting of Pesticide Science Society of Japan: 4 report.
- The 34th Annual Meeting of Japan Bioenergetics Group: 1 report.
- The 15th European Bioenergetics Conference (EBEC 2008, Dublin): 1 report

## **A-3. Off-campus activities**

#### ***Membership in academic societies***

Miyoshi, H.: Pesticide Science Society of Japan (councilor, editorial board member)

#### ***Research grants***

Monbu-Kagakusho Research Grant: Grants-in-Aids for Scientific Research (B), Exploring the function of membrane domain of mitochondrial complex-I using inhibitor probes (Miyoshi head)

## **A-4. International cooperatons and overseas activities**

#### ***International joint researches, overseas research surveys***

Miyoshi, H.: Functional analysis of membrane domain subunits of mitochondrial complex-I

through photoaffinity labeling study. (USA)  
Ishihara A.: Functional analysis of biogenic amines in plants. (Korea)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### a) Courses given

Undergraduate level: Introduction of applied life sciences IV (Miyoshi), Bioorganic chemistry II (Miyoshi), Laboratory course in bioorganic chemistry (Miyoshi, Ishihara)  
Graduate level: Chemistry of biologically active compounds (Miyoshi), Biofunction chemistry seminar (Miyoshi), Experimental course of biofunctional chemistry (Miyoshi).

### **B-2. Off-campus teaching, etc.**

#### Part-time lecturer

Ishihara, A.: Part-time lecturer, Faculty of Human Life and Science, Doshisha Women's College of Liberal Arts.

## 2.3.11 Laboratory of Applied Structural Biology

*Staff Professor : Mikami Bunzo, Dr. Agric. Sci.*

*Associate Professor: Aibara, Shigeo, Dr. Agric. Sci.*

*Assistant Professor : Takahashi, Nobuyuki, Dr. Agric. Sci.*

*Mizutani, Kimihiko, Dr. Agric. Sci.*

*Students and research fellows*

*Master's program: (2)*

*Undergraduate : (3)*

*Research student: (1)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Structure Determination of Proteins and Enzymes

Using X-ray crystallographic analysis, we have determined 3D structures of many proteins (Egg white proteins, plant seed proteins, lectins, and so on) and enzymes (amylase, pullulanase, polysaccharide lyase, and so on). Furthermore, proteins forming good crystals such as ovotransferrin could be applied for sub-atomic resolution X-ray crystallography and neutron crystallography to determine the positions of hydrogen atoms.

##### b) Functional Analysis and Protein Engineering based on Structure Analysis

Industrially utilized enzymes such as  $\beta$ -amylase and pullulanase are trying to be improved on their enzymatic functions by protein engineering based on their structural analyses. The optimal pH and product specificity of  $\beta$ -amylase are modified by site-directed mutagenesis of a few amino acid residues around the catalytic site including a flexible loop of the enzyme based on their crystallographic models. The product specificity of pullulanase is proved to be engineered by site-directed mutagenesis on the loop adjacent to its active site. Furthermore, ovalbumin, a major component of egg white is going to be modified by rational design based on its 3D structure: The protein does not have inhibitory activity, although it belongs to a superfamily of serine proteinase inhibitors, which exert physiologically important roles in vertebrate by a conformational change called loop-insertion. The crystallographic data along with successful productions for mutants with an increased loop-insertion rate strongly suggested that the acquisition of the serpin inhibitory activity is possible for ovalbumin. As another object, the structure of ovotransferrin and its mutant was studied in detail. Transferrin is a iron transporter protein delivering iron from blood to target cells. On the target cells, transferrin-iron complex binds with a specific receptor, internalized into the cell, and then release iron by a domain opening mechanism. To find the anion-dependent iron binding mechanism, the structure of ovotransferrin was studied by X ray crystallographic analysis at sub-atomic resolution. Recently, we have determined the structures of trasglutaminase and protein glutaminase that are useful for food processing. The structure of the mutant of protein glutaminase are in progress for the elucidation of the enzyme mechanism.

##### c) Protein crystal growth using the microgravity environment

The effects of microgravity on protein crystal growth and the mechanism of the crystal growth were studied on the basis of the results of crystallographic analysis of single crystals

prepared in space. Although protein single crystals of good diffraction quality were obtained in space, the crystal growth proceeded by the same mechanism just as on the ground. In space, however, fluctuation of solution was less than on the ground and the migration rate of protein molecules was controlled to the diffusion transport. We explained that it was a factor in growing single crystals of good diffraction quality.

## A-2. Publications and presentations

### a) Publications

#### *Original papers*

- Yoon HJ., SJ. Lee, B. Mikami, HJ. HJ. Park, J. Yoo and SW. Suh: Crystal structure of UDP-N-acetylglucosamine enolpyruvyl transferase from *Haemophilus influenzae* in complex with UDP-N-acetylglucosamine and fosfomycin. *Proteins* 71 (2); 1032-1037, 2008
- Itoh T., B. Mikami, W. Hashimoto and K. Murata: Crystal structure of YihS in complex with D-mannose: structural annotation of *Escherichia coli* and *Salmonella enterica yihS*-encoded proteins to an aldose-ketose isomerase. *J Mol Biol* 377 (5); 1443-1459, 2008
- Fukuda T., N. Maruyama, MR. Salleh, B. Mikami and S. Utsumi: Characterization and crystallography of recombinant 7S globulins of Adzuki bean and structure-function relationships with 7S globulins of various crops. *J Agric Food Chem* 56 (11); 4145-4153, 2008
- Ogura K., M. Yamasaki, B. Mikami, W. Hashimoto and K. Murata: Substrate recognition by family 7 alginate lyase from *Sphingomonas* sp. A1. *J Mol Biol* 380 (2); 373-385, 2008
- Tsuruta H., B. Mikami, C. Yamamoto and H. Yamagata: The role of group bulkiness in the catalytic activity of psychrophile cold-active protein tyrosine phosphatase. *FEBS J* 275 (17); 4317-4328, 2008
- Yoon HJ., MJ. Ku, B. Mikami and SW. Suh: Structure of 3-deoxy-manno-octulosonate cytidyltransferase from *Haemophilus influenzae* complexed with the substrate 3-deoxy-manno-octulosonate in the beta-configuration. *Acta Crystallogr D* 64 (Pt 12); 1292-1294, 2008.
- Murata K., S. Kawai, B. Mikami and W. Hashimoto: Superchannel of bacteria: biological significance and new horizons. *Biosci Biotechnol Biochem* 72 (2); 265-277, 2008
- Sakurama H., T. Takita, B. Mikami, T. Itoh, K. Yasukawa and K. Inouye: Two crystal structures of lysyl-tRNA synthetase from *Bacillus stearothermophilus* in complex with lysyladenylate-like compounds: insights into the irreversible formation of the enzyme-bound adenylate of L-lysine hydroxamate. *J Biochem* 145 (5); 555-563, 2009
- Hashimoto W., A. Ochiai, K. Momma, T. Itoh, B. Mikami, Y. Maruyama and K. Murata: Crystal structure of the glycosidase family 73 peptidoglycan hydrolase FlgJ. *Biochem Biophys Res Commun* 381 (1); 16-21, 2009

#### *Reports*

- Mikami, B., YN. Kang, A. Tanabe and S. Utsumi: X-ray crystallographic analysis of

- beta-amylase/maltose complex -Titration of two loop conformations by maltose-. SPring-8 User Experiment Report 2008A1252, 2008
- Mikami, B., T. Fukuda, C. Fukuda, K. Park. N and S. Utsumi: Crystal structure analysis of pea prolegumin. SPring-8 User Experiment Report 2008A1263, 2008
- Itoh, T., A. Ochiai, K. Ogura, B. Mikami, W. Hashimoto and K. Murata: Structural Insights into the Reaction mechanism of Coenzyme-Independent Mannose Isomerase. SPring-8 User Experiment Report 2008A1119, 2008
- Kita, K., J. Nagao and B. Mikami: X-Ray crystallographic analysis of a type II restriction endonuclease, R.EcoT38I, from *Escherichia coli* TH38. SPring-8 User Experiment Report 2008A1219, 2008
- Takahashi, N., B. Mikami and T. Oe: Molecular mechanism of the structural change of egg white proteins. SPring-8 User Experiment Report 2008A1266, 2008
- Ochiai, A., T. Itoh, K. Ogura, B. Mikami, W. Hashimoto and K. Murata: Structural biology of polysaccharides-degrading enzymes: X-ray crystallographic analysis of bacterial peptidoglycan hydrolase. SPring-8 User Experiment Report 2008A1322, 2008
- Mikami, B., A. Tanabe and S. Utsumi: X-ray crystallographic analysis of mutant beta-amylase/maltose complex-Titration of two loop conformations of D101N and D101E by maltose-. SPring-8 User Experiment Report 2008B1522, 2008
- Mikami, B., K. Park. N, N. Maruyama, A. Shutov and S. Utsumi: X-Ray crystallographic analysis of cleaved phaseolin. SPring-8 User Experiment Report 2008B1574, 2008
- Mizutani, K., M. Toyoda and B. Mikami: Structural Biology of Transport of Metal Ions in Living Body: X-ray Crystallographic Analyses of Transferrin and Transferrin-receptor as a Fundamental Research for Drug-delivery. SPring-8 User Experiment Report 2008B1023, 2008
- Takahashi, N., B. Mikami, K. Mizutani and M. Toyoda: Molecular mechanism of the structural transition of egg white proteins. SPring-8 User Experiment Report 2008B1297, 2008
- Masuda, T., B. Mikami, F. Goto and T. Yoshihara: X-Ray crystallographic analysis of soybean ferritin. SPring-8 User Experiment Report 2008B6828, 2008
- Itoh, T., Ogura, Y. Nakamichi, B. Mikami, W. Hashimoto and K. Murata: Crystal Structure of Alginate-Binding Protein (AlgQ1) in Complex with Unsaturated Mannuronic Acid Trisaccharide. SPring-8 User Experiment Report 2008A1191, 2008
- Hashimoto, W., A. Ochiai, T. Itoh, Y. Ogura, B. Mikami, Y. Maruyama and K. Murata: X-ray Crystal Structure of *Sphingomonas* sp. A1 Peptidoglycan Hydrolase Categorized to Family GH-73. SPring-8 User Experiment Report 2008A1112, 2008

b) Conference and seminar papers presented

The 2009 Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry : 13 papers

The 454th Kansai Branch Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry: 2 reports

The 456th Kansai Branch Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry: 1 report

### A-3. Off-campus activities

#### *Membership in academic societies*



Mikami, B.: The Japanese Society of Applied Glycoscience (an editorial board member)  
Aibara, S.: The 169 committee of Japan society for the promotion of science (General secretary)

***Research grants***

National Project on Target Proteins (Collaborator Mikami, B., Leader Hashimoto W.).  
Program for Promotion of Basic Research Activities for Innovative Biosciences (Collaborator Mikami, B., Leader Murata K.)  
Grants-in-Aid for Scientific Research From the Ministry of Education, Science, Sports and Culture of Japan: General Scientific Research (C) (Takahashi).

**A-4. International cooperations and overseas activities**

***International joint researchers, overseas research surveys***

Mikami B.:The 21st Congress and General Assembly of International Union of Crystallography, Osaka (1 regular paper)  
Takahashi N.:The 5th International symposium on serpin biology, Belgium (2 regular papers)  
Mikami, B.: Tertiary structure of bacterial enzymes (Seoul University, Korea)  
Mizutani, K.:Structure determination of membrane proteins by X-ray crystallography (Imperial College London, England)

**B. Educational Activities (2008.4-2009.3)**

**B-1. On-campus teaching**

a) Courses given

Undergraduate level: Laboratory Course in Biological Chemistry (Mikami, Aibara, Takahashi, Mizutani), Chemistry of Biological Catalysis (Mikami)  
Graduate level: Applied Structural Biology Seminar (Mikami, Aibara, Takahashi, Mizutani), Experimental Course of Applied Structural Biology (Mikami, Aibara, Takahashi, Mizutani)

**B-2. Off-campus teaching, etc.**

***Part-time lecturer***

Mikami, B.: Department of Agricultural Sciences; Kobe University, Faculty of Agriculture, Department of Agricultural Sciences  
Aibara, S.: Mukogawa Women's University; Dep. of Food Sci. and Nutr., School of Human Environ. Sci. (Biochemistry)

## 2.3.12 Laboratory of Chemistry of Molecular Biocatalysts

Staff      Professor                      :

Associate Professor: Hiratake, Jun, Dr. Agric. Sci.

Assistant Professor : Mizutani, Masaharu, Dr. Agric. Sci.

Assistant Professor : Shimizu, Bun-ichi, Dr. Agric. Sci.

Students and research fellows

Master's program : (6)      Research student (1)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

a) Structure-activity relationships of  $\gamma$ -glutamyl transpeptidase by mechanism-based inhibitors

$\gamma$ -Glutamyltranspeptidase (GGT) is a key enzyme in glutathione metabolism. A series of electrophilic  $\gamma$ -phosphonate diester analogues of glutamate were elaborated and evaluated for inhibitory activities of human and *E. coli* GGTs. Structure-activity relationships revealed that the human enzyme possessed high substrate- and stereospecificities for its natural substrate glutathione and was inhibited strongly by the inhibitors with a moiety mimicking glutathione. In contrast, *E. coli* GGT had a strong preference for aromatic amino acids-containing inhibitors, indicating that glutathione is not a natural substrate. A mutational study revealed that K562 of human GGT served as a key residue that recognized the C-terminal carboxy group of glutathione.

b) Design and synthesis of intermediate analogue inhibitors of acyl-activating enzymes

Acyl-activating enzymes constitute a large enzyme family that activate carboxy group of substrates by adenylation, followed by thioesterification (CoA ester) and amide formation. In Arabidopsis, 63 genes are identified. Among them, two families of enzymes are targeted: GH3 enzymes catalyzing the inactivation of auxin, and 4-coumaroyl ligase (4-CL), a key enzyme in the biosynthesis of plant secondary metabolites. N-Acylsulfamide analogues of adenosine were synthesized as a mimic of N-acyladenylate intermediate and were found to serve as strong inhibitors of acyl-activating enzymes according to the substrate specificities of the acyl moieties. In particular, 4-CL exhibited strict substrate specificity for *p*-coumaroyl moiety and was inhibited by the respective N-acylsulfamide analogue with an IC<sub>50</sub> of 0.3  $\mu$ M. In contrast, GH3 were inhibited by a broad range of N-acylsulfamide analogues with varying acyl moieties.

c) Mechanism of the activation/inactivation processes of plant hormones

The physiological functions of plant hormones are regulated by the concerted processes of biosynthesis, catabolism and translocation in the responsive organs. Therefore, identification and characterization of enzymes involved in these process are very important in understanding how they regulate the plant life cycle from germination to flowering. In this study, we have characterized cytochrome P450 monooxygenases (P450) involved in the biosynthesis of brassinosteroids (BRs). We characterized the biochemical properties of a C-22 hydroxylase and a C-23 hydroxylase, and found novel shortcut routes of BR biosynthetic pathway. In addition, we

have identified the *Arabidopsis* CYP710A family as sterol C-22 desaturases involved in the final reaction of plant sterol biosynthesis.

#### d) Coumarin biosynthesis in plants

The coumarin contents in wild-type and a mutant of *Arabidopsis* were determined to find that the roots of *Arabidopsis* accumulate a significant amount of scopolin (a  $\beta$ -glucoside of scopoletin). The mutations of several genes coding the enzymes of the phenylpropanoid pathway caused severe decrease in scopolin contents. Functional analyses of these genes with the recombinant proteins successfully identified the enzymes catalyzing methylation and oxidation steps of scopoletin biosynthesis in *Arabidopsis*. We also identified UGT71C1 (At2g29750) as a glucosyltransferase catalyzing the glucosylation step of scopoletin.

## A-2. Publications and presentations

### a) Publications

#### **Reviews**

Hiratake, J.: The structure of firefly luciferase and its chemiluminescence —the chemical significance of acyl-adenylate intermediate analogues—, *Seibutsukougaku Kaishi* 86; 174-176, 2008 (in Japanese)

Hiratake, J.: Novel inhibitors of  $\gamma$ -glutamyl transpeptidase (GGT) — new chemical tools to probe the physiological function of GGT—, *Wako Junyaku Jiho* 76 (No. 3); 2-6, 2008 (in Japanese)

Shimizu, B., Kai, K. and Mizutani, M.: Identification of cinnamate ortho-hydroxylating enzyme and the biosynthetic pathway of coumarins. *Kagaku to Seibutsu* 46; 518-520, 2008 (in Japanese)

#### **Original papers**

Wada K., Hiratake J., Irie M., Okada T., Yamada C., Kumagai H., Suzuki H. and Fukuyama K.: Crystal Structures of *Escherichia coli* gamma-Glutamyltranspeptidase in Complex with Azaserine and Acivicin: Novel Mechanistic Implication for Inhibition by Glutamine Antagonists. *J Mol Biol* 380; 361-372, 2008

Saino H., Mizutani M., Hiratake J. and Sakata K.: Expression and Biochemical Characterization of beta-Primeverosidase and Application of beta-Primeverosylamidine to Affinity Purification. *Biosci Biotech Biochem* 72; 376-383, 2008

Seki H., Ohyama K., Sawai S., Mizutani M., Ohnishi T., Sudo, H., Akashi T., Aoki T., Saito K. and Muranaka T.: Licorice & beta-amyrin 11-oxidase, a cytochrome P450 with a key role in the biosynthesis of the triterpene sweetener glycyrrhizin. *Proc Natl Acad Sci USA* 105; 14204-14209, 2008

Kai K., Mizutani M., Kawamura N., Yamamoto R., Tamai M., Yamaguchi H., Sakata K. and Shimizu B.: Scopoletin is biosynthesized via ortho-hydroxylation of feruloyl-CoA by an 2-oxoglutarate dependent dioxygenase in *Arabidopsis thaliana*. *Plant J* 55; 989-999, 2008

Shimizu B., Kai K., Tamai M., Yamaguchi H., Mizutani M. and Sakata K.: Biosynthetic origin of the 1-oxygen of umbelliferone in the root tissue of sweet potato. *Zeitschrift fuer Naturforschung* 63c; 687-690, 2008

Daiyasu H., Saino H., Tomoto H., Mizutani M., Sakata K. and Toh H.: Computational and Experimental Analyses of Furcatin Hydrolase for Substrate Specificity Studies of Disaccharide-specific Glycosidases. *J Biochem* 144; 467-475, 2008

- Nakatsubo T., Kitamura Y., Sakakibara N., Mizutani M., Hattori T., Sakurai N., Shibata D., Suzuki S. and Umezawa T.: At5g54160 gene encodes *Arabidopsis thaliana* 5-hydroxyconiferaldehyde O-methyltransferase. J Wood Sci 54; 312-317, 2008
- Nakatsubo T., Mizutani M., Suzuki S., Hattori T. and Umezawa T.: Characterization of *Arabidopsis thaliana* Pinoresinol reductase, a new type of enzyme involved in lignan biosynthesis. J Biol Chem 283; 15550-15557, 2008
- Todoroki Y., Kobayashi K., Yoneyama H., Hiramatsu S., Jin M.-H., Watanabe B., Mizutani M. and Hirai N.: Structure-activity relationship of uniconazole, a potent inhibitor of ABA 8'-hydroxylase, with a focus on hydrophilic functional groups and conformation. Bioorg Med Chem 16; 3141-3152, 2008
- Sekimata K., Ohnishi T., Mizutani M., Todoroki Y., Han S.-Y., Uzawa J., Fujioka S., Yoneyama K., Takeuchi Y., Takatsuto S., Sakata K., Yoshida S. and Asami T.: Brz220 interacts with DWF4, a cytochrome P450 monooxygenase in brassinosteroid biosynthesis, and exerts biological activity. Biosci Biotechnol Biochem 72; 7-12, 2008
- b) Conference and seminar papers presented
- The 2009 Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry: 8 papers
- Japanese Society for Plant Cell and Molecular Biology: 2 papers
- The Japanese Society of Pharmacognosy: 2 papers
- The 2008 Annual Meeting of Kansai Branch of Japan Society for Bioscience, Biotechnology, and Agrochemistry: 1 paper
- The 43<sup>rd</sup> Annual Meeting of the Japanese Society for Chemical Regulation of Plants: 7 papers
- The 50<sup>th</sup> Annual Meeting of the Japanese Society for Plant Physiologists: 3 papers
- The Advanced Research Symposium of Tokyo University of Agriculture: 1 paper
- The 13<sup>th</sup> Agrochemicals Sagami Seminar: 1 paper
- The 3<sup>rd</sup> Joint Symposium of Bio-related Chemistry: 1 paper
- The 57<sup>th</sup> Annual Meeting of The Japanese Society of Applied Glycoscience: 1 paper
- The Joint Meeting of the 31<sup>st</sup> Annual Meeting of the Molecular Biology Society of Japan and the 81<sup>st</sup> Annual Meeting of the Japanese Biochemical Society (BMB2008): 1 paper
- The 458<sup>th</sup> Meeting of Kansai Branch of Japan Society for Bioscience, Biotechnology, and Agrochemistry: 1 paper

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Hiratake, J.: Japan Society for Bioscience, Biotechnology, and Agrochemistry Kansai Branch (councillor)

#### ***Research grants***

Research Grants from Ministry of Education, Culture, Sports, Science and Technology and Japan Society for the Promotion of Science:

Grant-in-Aid for Scientific Research (B), Field studies on mechanism of aroma formation of high-quality Darjeeling tea and development of novel black tea production (Miautani, M); Grant-in-Aid for Scientific Research (B), Development chemicals for controlling glutathione metabolism and oxidative stress for use in chemical biology (Hiratake J)

Grant-in-Aid for Scientific Research (C) (2) Construction of plant oxygenase library and

its functional characterization (Mizutani M).

#### **A-4. International cooperation and overseas activities**

##### ***International joint researches, overseas research surveys***

Hiratake, J.: The 2<sup>nd</sup> International Meeting of Magic Bullets (Ehrlich II), Germany, Nuernberg (invited lecture); True Nano-Bio Symposium 2009 -Trend in the Plant-Secondary Metabolites: Biosynthesis, Physiology, Chemical Biology, Perception, Gene Manipulation, Shizuoka University (invited lecture)

Mizutani, M.: 9th International Symposium on Cytochrome P450 Biodiversity and Biotechnology, Niece, France (invited lecture); 7th Japan-US Seminar, Biosynthesis of Natural Products, "Enzymology, Structural Biology, and Drug Discovery", San Diego, USA (presentation); Annual Meeting of the Phytochemical Society of North America, Washington State University, USA (presentation)

#### **B. Educational Activities (2008.4-2009.3)**

##### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Pocket Seminar (Let's touch the heart of live Organic Chemistry) (Hiratake)

Graduate level: Seminar in Molecular Biocatalysts (Hiratake, Mizutani, Shimizu), Laboratory Course in Molecular Biocatalysts (Hiratake, Mizutani, Shimizu)

##### **B-2. Off-campus teaching, etc.**

###### ***An extension lecture etc.***

Hiratake, J.: Super-Science High School (SSH) sponsored by the Ministry of Education, Culture, Sports, Science and Technology, Laboratory course for students of Rakuhoku high school, Kyoto (2008. 8. 4-8), Science-Partnership Project (SPP) sponsored by the Ministry of Education, Culture, Sports, Science and Technology, Special lecture at Momoyama High School, Kyoto (2008. 11. 1 and 11. 29), Special lecture of Rakuhoku Science Program for junior high school students of Rakuhoku High School, Kyoto (2008. 11. 6)

## 2.3.13 Laboratory of Molecular Microbial Science (Institute for Chemical Research)

Staff      Professor                      : Esaki, Nobuyoshi, Dr. Agric. Sci.

Associate Professor: Kurihara, Tatsuo, Dr. Eng.

Assistant Professor : Mihara, Hisaaki, Dr. Agric. Sci.

Students and research fellows

Doctor's Program : (6)

Master's Program: (8)

Research student: (2)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

a) Physiological function of eicosapentaenoic acid in the cell division of a psychrotrophic bacterium

An Antarctic psychrotrophic bacterium, *Shewanella livingstonensis* Ac10, inducibly produces eicosapentaenoic acid, a long-chain polyunsaturated fatty acid, as a component of membrane phospholipids at low temperatures. The EPA-less mutant generated by disruption of the EPA synthesis gene is cold sensitive and has a defect in cell division at low temperatures. Transmission electron microscopic analysis indicated that the EPA-less mutant developed multi-intracellular membranes in its cell, which are not usually observed in Gram-negative bacteria, suggesting that the deletion of EPA affects the physiological function of proteins involved in membrane organization at low temperatures. FtsEX is supposed to be an ABC transporter composed of ATP-binding domain (FtsE) and membrane-spanning domain (FtsX) and plays the role in the membrane-phospholipid transport at cell division site in Gram-negative bacteria. FtsE is localized to the cell membrane in the wild-type strain. However, it was not observed in the membrane fraction in the EPA-less mutant. The supplementation of EPA-containing phospholipid complemented the growth retardation and the localization of FtsE in the EPA-less mutant. We also found that the EPA-less mutant harboring FtsEX-expression vector grows normally and maintains normal cell morphology at low temperatures. These observations suggest that EPA contributes to the appropriate localization and function of ABC transporter at low temperatures.

b) A novel flavoenzyme that catalyzes the addition of a water molecule to 2-chloroacrylate

Enzymes catalyzing the conversion of organohalogen compounds are useful in chemical industry and environmental technology. We found a new class of dehalogenase that catalyzes the removal of a halogen atom from an unsaturated aliphatic organohalogen compound. A soil bacterium, *Pseudomonas* sp. YL, inducibly produced a protein named CAA67 when the cells were grown on 2-chloroacrylate (2-CAA). The *caa67* gene encoded a protein of 547 amino acid residues (*Mr* 59,301), which shared a weak but significant sequence similarity with various flavoenzymes and contained an FAD-binding motif. We found that 2-CAA is converted into pyruvate when the reaction was carried out with purified CAA67 in the presence of FAD and a reducing agent (NAD(P)H or sodium dithionite) under anaerobic condition. A stoichiometric amount of the reducing agent was not consumed during this reaction, suggesting that FADH<sub>2</sub>

once produced by the reducing agent is regenerated in the catalytic cycle. When the reaction was carried out in the presence of H<sub>2</sub><sup>18</sup>O, [<sup>18</sup>O]-pyruvate was produced. This result implies that CAA67 catalyzes the hydration of 2-CAA to form 2-chloro-2-hydroxypropionic acid, which is chemically unstable and probably spontaneously dechlorinated to form pyruvate. 2-Bromoacrylate, but not other 2-CAA analogs such as acrylate and methacrylate, served as the substrate of CAA67. Thus, we named this new enzyme 2-haloacrylate hydratase. The enzyme is unique in respect that it catalyzes FADH<sub>2</sub>-dependent hydration of the substrate.

## A-2. Publications and presentations

### a) Publications

#### **Books**

Kurihara, T. and N. Esaki: Proteomic studies of psychrophilic microorganisms. *Psychrophiles: From biodiversity to biotechnology* 333-343, 2008

Yasuda, M. H., M. Ueda, K. Okano, H. Mihara and N. Esaki: Enzymatic synthesis of unnatural amino acids. *Asymmetric synthesis and application of α-amino acids* 357-373, 2009

#### **Original Papers**

Kurata, A., M. Fujita, A. M. Mowafy, H. Kamachi, T. Kurihara and N. Esaki: Production of (*S*)-2-chloropropionate by asymmetric reduction of 2-chloroacrylate with 2-haloacrylate reductase coupled with glucose dehydrogenase. *J Biosci Bioeng* 105; 429-431, 2008

Zhang, W., H. Mihara, T. Kurihara and N. Esaki: Investigation of the roles of cysteine desulfurases in the molybdopterin synthesis in *Escherichia coli*. *Trace Nutri Res* 25; 152-157, 2008

Zhang, W., H. Mihara, T. Kurihara and N. Esaki: Role of cysteine desulfurase IscS in the biosynthesis of molybdopterin. *Vitamins (Japan)* 82; 645-650, 2008

Sato, S., T. Kurihara, J. Kawamoto, M. Hosokawa, S. B. Sato and N. Esaki: Cold adaptation of eicosapentaenoic acid-less mutant of *Shewanella livingstonensis* Ac10 involving uptake and remodeling of synthetic phospholipids containing various polyunsaturated fatty acids. *Extremophiles* 12; 753-761, 2008

Mihara, H., R. Hidese, M. Yamane, T. Kurihara and N. Esaki: The *iscS* gene deficiency affects the expression of pyrimidine metabolism genes. *Biochem Biophys Res Commun* 372; 407-411, 2008

Kudou, D., S. Misaki, M. Yamashita, T. Tamura, N. Esaki and K. Inagaki: The role of cysteine 116 in the active site of the antitumor enzyme L-methionine γ-lyase from *Pseudomonas putida*. *Biosci Biotechnol Biochem* 72; 1722-1730, 2008

Abe, K., H. Mihara, Y. Nishijima, S. Kurokawa and N. Esaki: Functional analysis of two homologous mouse selenophosphate synthetases. *Biomed Res Trace Elem* 19; 76-79, 2008

Abe, K., H. Mihara, R. Tobe and N. Esaki: Characterization of human selenocysteine synthase involved in selenoprotein biosynthesis. *Biomed Res Trace Elem* 19; 80-83, 2008

Kurokawa, S., H. Mihara, I. Yokoyama, M. Mochizuki, J. Yodoi, T. Tamura, T. Kurihara and N. Esaki: Thioredoxin reductase 1 is important for selenoprotein biosynthesis in HeLa cells. *Biomed Res Trace Elem* 19; 84-87, 2008

Kawamoto, J., T. Kurihara, K. Yamamoto, M. Nagayasu, Y. Tani, H. Mihara, M. Hosokawa, T. Baba, S. B. Sato and N. Esaki: Eicosapentaenoic acid plays a beneficial role in membrane organization and cell division of a cold-adapted bacterium, *Shewanella livingstonensis*

- Ac10. J Bacteriol 191; 632-640, 2009
- Yamauchi, T., M. Goto, H.-Y. Wu, T. Uo, T. Yoshimura, H. Mihara, T. Kurihara, I. Miyahara, K. Hirotsu and N. Esaki: Serine racemase with catalytically active lysinoalanyl residue. J Biochem 145; 421-424, 2009
- Omori, T., H. Mihara, T. Kurihara and N. Esaki: Occurrence of phosphatidyl-D-serine in the rat cerebrum. Biochem Biophys Res Commun 382; 415-418, 2009
- Nakamura, T., A. Yamaguchi, H. Kondo, H. Watanabe, T. Kurihara, N. Esaki, S. Hirono and S. Tanaka: Roles of K151 and D180 in L-2-haloacid dehalogenase from *pseudomonas sp.* YL: Analysis by molecular dynamics and ab initio fragment molecular orbital calculations. J Comput Chem 2009
- Jitsumori, K., R. Omi, T. Kurihara, H. Mihara, I. Miyahara, K. Hirotsu, and N. Esaki: X-ray crystallographic and mutational studies of fluoroacetate dehalogenase from *Burkholderia sp.* FA1. J Bacteriol 191; 2630-2637, 2009
- Tobe, R., H. Mihara, T. Kurihara, and N. Esaki: Identification of proteins interacting with selenocysteine lyase. Biosci Biotechnol Biochem 73; 1230-1232, 2009

### **Reviews**

- Kurihara, T. and N. Esaki: Bacterial Hydrolytic Dehalogenases and related enzymes: Occurrences, reaction mechanisms, and applications. Chem Rec 8; 67-74, 2008
- Esaki, N. and H. Mihara: Function and biosynthesis of selenoproteins. Biomed Res Trace Elem 19; 308-316, 2008

### **b) Conference and seminar papers presented**

- The 60th Annual Meeting of the Vitamin Society of Japan: 1 papers
- The 19th Annual Meeting of the Japan Society for Biomedical Research on Trace Elements: 3 papers
- The 60th Annual Meeting of the Society for Biotechnology, Japan 2008: 1 paper
- Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry 2008: 5 papers
- Biochemistry and Molecular Biology 2008: 7 papers
- The 9th Annual Meeting of the Japanese Society for Extremophiles: 3 papers
- The 1st Japanese Forum on Metallomics 2008 : 1 paper
- The 2st Meeting on Selenium Research : 4 papers
- iBIO2008 : 1 paper
- The 3rd International Conference on Polar and Alpine Microbiology : 1 paper
- The 4th Finland-Japan Joint Meeting on Biotechnology 2008 : 1 paper
- The 11th Annual Meeting of Japanese Society for Marin Biotechnology : 1 paper

## **A-3. Off-campus activities**

### **Membership in academic societies**

- Esaki, N.: The Japanese Biochemical Society (Councilor and a Member of International Exchange Committee), The Japan Trace Nutrients Research Society (Director), The Japan Society for Bioscience, Biotechnology and Agrochemistry (Councilor), The Society for Biotechnology, Japan (Councilor), The Vitamin Society of Japan (Councilor), Japan Society for Biomedical Research on Trace Element (Councilor)
- Kurihara, T.: The Society for Biotechnology, Japan (Editorial Board), The Japanese Biochemical Society (Kinki Branch Councilor, Secretary, Educational Committee for Biochemistry)



### ***Research grants***

Research Grants from Japan Society for the Promotion of Science: Grant-in-Aid for Scientific Research (B); Structure-function analysis of selenium-specific chemical transformation system and cotranslational selenium insertion into protein (N. Esaki) Grant-in-Aid for Scientific Research (B); Molecular basis of cold adaptation of psychrotrophic bacteria (T. Kurihara), Grant-in-Aid for Scientific Research (B); Exploration of novel cold-adapted microorganisms to develop a system for the production of useful compounds at low temperatures (T. Kurihara)

## **A-4. International cooperations and overseas activities**

### ***International meetings (roles)***

Esaki, N.: The 3rd International Conference on Polar and Alpine Microbiologys (speaker),  
Kurihara, T.: iBIO2008 (speaker)  
The 4th Finland-Japan Joint Meeting on Biotechnology 2008 (speaker)

### ***Membership in international academic societies***

Esaki, N.: The International Society for Extremophiles (editorial board)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Graduate level : Molecular Microbial Science Seminar (Esaki, Kurihara and Mihara),  
Experimental Course of Molecular Microbial Science (Esaki, Kurihara and Mihara)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Esaki, N.: Graduate School of Bioagricultural Sciences and School of Agricultural Sciences,  
Nagoya University  
Kurihara, T. : Faculty of Science, Nara Women's University  
Graduate School of Humanities and Sciences, Nara Women's University  
Rikkyo University  
Graduate School of Agriculture, Hokkaido University  
Nagahama Institute of Bio-Science and Technology

### **B-3. Overseas teaching**

#### ***Students and research fellows from abroad***

Foreign students: Master course student 1 (Korea), Doctor course students 2 (China, Egypt),  
Guest Research Associate 1 (Korea), Research students 2 (China, India)

## 2.3.14 Laboratory of Plant Gene Expression

*Staff*      *Professor*                      : Yazaki, Kazufumi, Dr. Pharm. Sci.  
                 *Associate Professor*: Hayashi, Takahisa, Dr. Agric. Sci.  
                 *Lecturer*                              : Kuroda, Hiroyuki, Dr. Agric. Sci.  
                 *Program-Specific Assistant Professor (METI)* : Shitan, Nobukazu, Dr. Agric. Sci.  
                 *Postdoctoral fellows*: Harada, Emiko  
   Sugiyama, Akifumi  
   Kaida, Rumi  
   Ikegaya, Hisato  
   Kusumaningtyas, Retno

*Students and research fellows*

*Doctor's program*: (3)                      *Research students*: (1)  
                 *Master's program*: (3)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main Subjects

We are studying on the characterization of plant genes including woody plants which are involved in biosyntheses and transport of various valuable metabolites, e.g. secondary products, in plants, and also studying on the regulatory mechanism of the expression of those genes. The molecular breeding using those genes to establish novel woody plants, for instance phytoremediators to be applied for environmental biotechnology, is also our research targets. Individual research activity is as follows.

a) Molecular and cellular biology of secondary metabolism in higher plants and its application.

We are studying on the characterization of plant genes involved in biosyntheses of various secondary metabolites, e.g. isoprenoids and polyphenols, and elucidating the regulatory mechanism of the expression of those genes. In particular, we are interested in prenyltransferases accepting aromatic substrates leading to e.g. shikonin (red naphthoquinone) and coenzyme Q. Recent topic is the first identification of flavonoid-specific prenyltransferase in plants. As applied scientific approaches we are utilizing those genes to alter plant functions, e.g. molecular breeding of thermotolerant plants by isoprene synthase gene and alteration of fragrance of tree species by monoterpene synthases.

b) Molecular biology of transporter proteins in plants.

Plants possess ca. 130 members of (ATP-binding cassette) ABC proteins. Some of them are reported to function as molecular pump for xenobiotics. In particular we are characterizing ABCB- and ABCG-subfamily members, i.e. their roles in the auxin transport in Arabidopsis, and their involvement in the nodule formation in legume plants. Recent topic is the identification of nicotine transporter functioning at the vacuolar membrane in tobacco, which is a MATE-type transporter. As applied sciences using such transporter genes, we attempt to establish

phytoremediation method to clean environment with transgenic plants

c) Cell wall and cellulose biosynthesis.

Cell wall loosening: This study focuses on the structure and function of endo-1,4- $\beta$ -glucanase. Biosynthesis of cellulose in higher plants and in *Acetobacter xylinum*:: Molecular and cell biology of cellulose biosynthesis in higher plants and *Acetobacter xylinum*.

d) Molecular biology of intrinsic cDNA clones from woody plants.

We are focusing on the cDNAs involved in pathogen-resistant traits, some of which are related to secondary metabolism and water stress in woody plants. Their translates and transcripts are respectively studying for the molecular machines and for making a diagnosis of the forest biosphere possible

## A-2. Publications and presentations

a) Publications

### **Books**

Yazaki, K.: Carotenoids, etc., Dictionary for Plant Genome Science (edited by Komamine et al.), Asakura Publishing Co. Ltd. (Tokyo) 2009 (in Japanese)

Hayashi, T.: Reforestation, Kaiseisha Ltd. (Out) 2008 (in Japanese)

### **Original papers**

Sasaki, K., Mito, K., Ohara, K., Yamamoto, H., Yazaki, K.: Cloning and characterization of naringenin 8-prenyltransferase, a flavonoid-specific prenyltransferase of *Sophora flavescens*. *Plant Physiol* 146 (3); 1075-1084, 2008

Satomi Y, Ohara K, Yazaki K, Ito M, Honda G, Nishino H.: Production of the monoterpene limonene and modulation of apoptosis-related proteins in NIH3T3 cells by introduction of the limonene synthase gene isolated from the plant *Schizonepeta tenuifolia*. *Biotechnol Appl Biochem* 52 (Pt3); 185-190, 2009

Tsubasa Shoji, T., Inai, K., Yazaki, Y., Sato, Y., Takase, H., Shitan, N., Yazaki, K., Goto, Y., Toyooka, K., Matsuoka, K., Hashimoto, T.: MATE-type transporters Implicated in vacuolar sequestration of nicotine in tobacco roots. *Plant Physiol* 149 (2); 708-718, 2009

Akashi, T., Sasaki, K., Aoki, T., Ayabe, S., and Yazaki, K.: Molecular cloning and characterization of a cDNA for pterocarpan 4-dimethylallyltransferase catalyzing the key prenylation step in the biosynthesis of glyceollin, a soybean phytoalexin. *Plant Physiol* 149 (2); 683-693, 2009

Kamimoto, Y., Hamamoto, M., Shitan, N., Yazaki, K.: Unusual expression of an Arabidopsis ATP-binding cassette transporter ABCC11. *Plant Biotechnol* 26 (2); 261-265, 2009

Morita, M., Shitan, N., Sawada, K., Van Montagu, M., Inzé, D., Rischer, H., Goossens, A., Oksman-Caldentey, K-M., Moriyama, Y., Yazaki, K.: Vacuolar transport of nicotine is mediated by a novel multidrug and toxic compound extrusion (MATE) transporter in *Nicotiana tabacum*. *Proc Natl Acad Sci USA* 106 (7); 2447-2452, 2009

Sasaki, K., Tsurumaru, Y., Yazaki, K.: Prenylation of flavonoids by the biotransformation of yeast expressing plant membrane-bound prenyltransferase SfN8DT-1. *Biosci Biotech Biochem* 73 (3); 759-761, 2009

T Hayashi, YW Park, A Isogai and T Nomura: Cross-linking of plant cell walls with dehydrated fructose by smoke-heat treatment. *J Wood Sci* 54: 90-93, 2008

T Taniguchi, Y Ohmiya, M, Kurita, M Tsubomura, T Kondo, YW Park, K Baba, T Hayashi:

- Biosafety assessment of transgenic poplars overexpressing xyloglucanase (AaXEG2) prior to field trials. *J Wood Sci* 54; 408-413, 2008
- R Kaida, T Hayashi, TS Kaneko: Purple acid phosphatase in the walls of tobacco cells. *Phytochem* 69; 2546-2551, 2008
- T Takabe T, A Uchida A, F Shinagawa, Y Terada, H Kajita, Y Tanaka, T Takabe, T Hayashi, T Kawai, T Takabe: Overexpression of DnaK from a halotolerant cyanobacterium *Aphanothece halophytica* enhances growth rate as well as abiotic stress tolerance of poplar plants. *Plant Growth Reg* 56; 265-273, 2008
- S Hartati, E Sudarmonowati E, YW Park YW, T Kaku, R Kaida, K Baba, T Hayashi: Overexpression of poplar cellulase accelerates growth and disturbs the closing movements of leaves in sengon. *Plant Physiol* 147; 552-561, 2008
- H Ikegaya, T Hayashi, T Kaku, K Twata, S Sonobe, T Shimmen: Presence of xyloglucan-like polysaccharide in *Spirogyra* and possible involvement in cell-cell attachment. *Phycological Res* 56; 216-222 (2008)
- T Hayashi, R Kaida, T Kaku, K Baba: Enhancement of saccharification by overexpression of various endoglycanase in poplar. *J Brasil Sci* 55; 145-149, 2008
- K Ozaki, A Uchida, T Takabe, F Shinagawa, Y Tanaka, T Takabe, T Hayashi, T Hattori, AK. Raid, T Takabe: Enrichment of sugar content in melon fruits by hydrogen peroxide treatment, *J Plant Physiol* 166; 569-578, 2009
- EJ Mellerowicz, P Immerzeel, T Hayashi, Xyloglucan: The molecular muscle of trees. *Annals Bot* 102; 659-665, 2008

### **Reviews**

- Verrier, P. J., Bird, D., Burla, B., Dassa, E., Forestier, C., Geisler, M., Klein, M., Kolukisaoglu, Ü., Lee, Y-S/, Martinoia, E., Murphy, A., Rea, P. A., Samuels, L., Schulz, B., Spalding, E. J., Yazaki, K., and Theodoulou, F. L.: Plant ABC proteins- unified nomenclature and updated inventory. *Trends in Plant Sci.* 13 (4); 151-159, 2008
- Yazaki, K., Sugiyama, A., Morita, M., Shitan, N.: Secondary transport as an efficient membrane transport mechanism for plant secondary metabolites. *Phytochem. Rev.* 7; 513-524, 2008
- Sugiyama, A., Shitan, N., Tomohisa Kuzuyama, Yazaki, K.: Development of transgenic plants producing prenylated poyphenols. *Bio Industry*, 26 (1); 41-48, 2008 (in Japanese)
- Sasaki, K., Yazaki, K.: Discovery of plant prenyltransferase gene modulating functions of flavonoids. *Bio Industry* 25 (10); 58-65, 2008 (in Japanese)
- Sasaki, K., Tsurumaru, Y., Yazaki, K.: Prenyltransferase responsible for the increase in biological activities of polyphenols. *Biosci & Ind.* 66 (9); 509-513, 2008 (in Japanese)
- Hayashi, T., Kaku, T., Kaida, R., Baba, K.: Overexpression of cellulase in plants, *Cellulose Communication*, 15, 148-152, 2008 (in Japanese)

### **Patents**

- Yazaki, K.: No. 2008-190159 'Prenyltransfease', inventor: Yazaki, K., patentee: Kyoto University & Api Co. Ltd., registration date: Jul. 23, 2008
- b) Conference and seminar papers presented
- Annual Meeting of Japanese Society for Bioscience, Biotechnology and Agrochemistry 2009 : 3 reports
- 50th Annual Meeting of Japanese Society for Plant Physiologists : 2 reports
- The 25th Annual Meeting of Japanese Society for Plant Cell and Molecular Biology : 6 reports

55th Annual Meeting of Pharmacognosy: 3 reports  
 Symposium on Lotus japonicus and soybean: 1 report  
 3rd Meeting on Transporters: 1 report  
 5th Meeting on Food Supplements: 1 report  
 7th Meeting on Bio-quinones: 1 report  
 Biogenic Trace Gas Workshop in Japan: 1 report  
 Symposium of Biotechnology Research Center: 1 report  
 59 th Annual Meeting of Japanese Wood Research Society: 1 report  
 120 th Annual Meeting of Japanese Forest Society: 1 report

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Yazaki, K. : The Japanese Society for Plant Cell and Molecular Biology (Secretary, Editor), The Japanese Society for Plant Physiologist (Secretary, Editor), Japan Society for Bioscience, Biotechnology, and Agrochemistry (Board member), METI Plant Project Committee (Board member), The Japanese Bioindustry Association (Editorial Board), Association of Bio Quinone (Executive Board).  
 Hayashi, T.: Japan Society for Wood Science (Associate Editor), Japan Society for Carbohydrate Science (Board) Kuroda, H.: The Japan Wood Research Society (sub-coordinator)

#### ***Research grants***

Monbusho Research Grant: Priority Areas, Alkaloid transport by MATE-type transporter localized to vacuolar membrane and the sink function (Yazaki, Head); Priority Areas, Transport of signal molecules by ABC proteins involved in the generation of lateral organs and the meristem regulation (Yazaki, Head); Priority Areas, LjPDR1, an ABC transporter involved in symbiotic nitrogen fixation and the regulation of nodulation (Yazaki, Head); Exploratory Research, Creation of cadmium non-absorbing crop plants by proteinase inhibitor BBI (Yazaki, Head).  
 Others: METI Project, Plant metabolic engineering with prenyltransferase genes (Yazaki, Head), Kirin Holdings, Molecular genetic studies on secondary metabolites in hop flowers (Yazaki); Molecular genetic analysis of a medicinal plant *Lithospermum erythrorhizon* (Yazaki); Research grant for Sustainable Humanosphere for Mission 1 (H20), Thermotolerance of isoprene-emitting plant and application to molecular breeding (Yazaki); Grant from Institute of Sustainability Science Exploratory research (H20), Morphological analysis of secretory tissue for prenylated flavonoids in a tropical tree and utilization of honey bees (Yazaki, Head), Research grant for Sustainable Humanosphere for Exploratory Mission (H20), Analysis of signal network mediated by volatile terpenoids (Arimura Head, Yazaki Partaker), Research grant for Sustainable Humanosphere for Exploratory Mission (H20), Role of genetic diversity of trees in the arthropod population and ecological function (Ohgushi Head, Yazaki Partaker), ISS grant for Siga site research, Molecular markers in Pine Forest Health (Kuroda, Head).

### **A-4. International cooperations and overseas activities**

#### ***International meetings (roles)***

Yazaki, K.: 7th-Japan-US Seminar, Biosynthesis of Natural Products, San Diego (Invited speaker),

Plant Metabolism 2008, Banff (Invited speaker), 2nd World Conference on Magic Bullets, (EHRlich II), Nürnberg (Invited speaker), 99th RISH Symposium “1st VTT-RISH Joint Symposium –Sustainable Utility of Wood Biomass–” Uji (Chair), EHRlich II – 2nd World Conference on Magic Bullets, Nürnberg (Chair)

***International Joint Researches, overseas research surveys***

Yazaki, K.: Biochemical analyses of plant ABC protein functions (Cadarahe Institute, France), Characterization and application of alkaloid transporter genes of plant cells (Leiden University, Netherland), Water stress tolerance mediated by PGP in Arabidopsis (Purdue University, USA), Transport mechanism of auxin in arabidopsis (Zurich University, Switzerland), Alkaloid transport by MATE-type transporter in tobacco (Ghent University, Belgium), Statistical analysis of cell size and numbers in isoprene-emitting transgenic plants (VTT Technical Research Center, Finland)

**B. Educational Activities (2008.4-2009.3)**

**B-1. On-campus teaching**

a) Courses given

Undergraduate level: Science of Sustainable Humanosphere (Shiotani, Tsuda, Yazaki), KSI lecture Science for Diagnostics and Control of Humanosphere (Shiotani, Hashiguchi, Horinouchi, Yazaki, Honda, Umezawa, Sugiyama)

Graduate level: Laboratory Course in Plant Gene Expression (Yazaki, Hayashi, Kuroda), Seminar in Plant Gene Expression (Yazaki, Hayashi, Kuroda)

**B-2. Off-campus teaching, etc.**

***Part-time Lecturer***

Yazaki, K.: Department of Food and Nutritional Sciences, University of Shizuoka (Special Seminar on Food and Nutrition), International College of Arts and Sciences, Yokohama City University (General Lecture B, Frontier in life science)

**B-3. Overseas teaching**

***Lectures and seminars***

Yazaki, K.: Molecular Botanic, University of Ulm (Special lecture)

**C. Other remarks.**

Kuroda, K.: A prize for excellent poster presentations at 59 th Annual Meeting of Japanese Wood Research Society

## 2.3.15 Laboratory of Metabolic Science of Forest Plants and Microorganisms

*Staff      Professor                      : Umezawa, Toshiaki, Dr. Agric. Sci.*

*Assistant Professor : Hattori, Takefumi, Dr. Agric. Sci.*

*Postdoctoral fellow : Yamamoto, Naoki, Dr. Life Sci., Murakami, Shinya, Dr. Agric. Sci., Mahabubur,  
Rahman Md, Dr. Agric. Sci., Azad, Mustafa Abul Kalam, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's Program: (2)*

*Master's Program: (1)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Integrated mechanisms for wood formation

It is obvious that we need to move from the fossil resource based society to the renewable resource dependant society. Among renewable biomass resources, it is wood biomass that the most abundantly accumulated is. Therefore, mechanisms for wood formation provide us the basic knowledge for tree biotechnology and cell-wall metabolic engineering. Lignin is one of the major components of plant cell wall, and much attention has been focused on the regulation of its biosynthesis from the standpoints of postharvest, cellulose-based wood processing for fiber, chemical, and bioethanol production. We are working on elucidating the integrated control mechanisms, including isolation of transcription factors, for the biosynthesis of lignin and other cell wall components by gene-coexpression network analysis and by comprehensive metabolite analysis.

##### b) Biosynthetic mechanisms for lignans produced by woody plants

Many lignans are isolated from various parts of plants, *e.g.* heartwoods, and known to have various biological activities. Lignans are optically active and their biosyntheses involve enantioselective processes. However, little has been known about biosynthetic mechanisms of lignans. We have been working on elucidating the stereochemical mechanisms for dibenzylbutyrolactone lignan biosyntheses and the biosynthetic mechanisms for antitumor lignans.

##### c) Biosynthetic mechanisms for norlignans produced by woody plants

Norlignans are compounds which cause heartwood coloration in important woods such as *Cryptomeria japonica* and *Chamaecyparis obtusa*. However, little has been known about biosynthetic mechanisms of norlignans. We have isolated cDNAs encoding a norlignan synthase (hinokiresinol synthase, HRS) for the first time. We are working on elucidating the reaction mechanisms for HRS catalyzed reactions and its gene expression mechanisms.

##### d) Molecular breeding of trees suitable for sustainable societies

It is extremely important to establish systems for the sustainable production of renewable biomass resources, mostly wood biomass. In our laboratory, we are working on molecular breeding of trees which are suitable for sustainable societies with respect to commercial benefits such as improved resistance to wood-rotting fungi and high production of industrial raw materials and bioethanol based on knowledges of biosynthetic mechanisms for wood components.

##### e) Mechanisms for organic acid metabolism of wood-rotting fungi and ectomycorrhizal fungi

Biodegradation of wood components by wood-rotting (WR) fungi including white- and brown-rot basidiomycetes is important as a first process leading to humus production, which in turn contributes greatly to sustainable forest ecosystems. On the other hand, ectomycorrhizal (ECM) fungi, symbiont of some woody plants, serve as phosphate supplying biofertilizers for host plants, which help trees in growing well in forest. Oxalate excreted from WR and ECM fungi play a wide variety of roles in these process. The purpose of this study is to elucidate regulatory mechanisms for metabolism of organic acid including oxalate in WR and ECM fungi for comprehensive understanding of possible role of the two fungi in forest at molecular level.

## A-2. Publications and presentations

### a) Publications

#### *Original papers*

- Watanabe, T., T. Fujiwara, T. Umezawa, M. Shimada and T. Hattori: Cloning of a cDNA encoding a NAD-dependent formate dehydrogenase involved in oxalic acid metabolism from the white-rot fungus *Ceriporiopsis subvermispora* and its gene expression analysis. FEMS Microbiol Lett 279; 64-70, 2008
- Nakatsubo, T., Y. Kitamura, N. Sakakibara, M. Mizutani, T. Hattori, N. Sakurai, D. Shibata, S. Suzuki and T. Umezawa: At5g54160 gene encodes *Arabidopsis thaliana* 5-hydroxyconiferaldehyde O-methyltransferase. J Wood Science 54; 312-317, 2008
- Nakatsubo, T., L. Li, T. Hattori, S. Lu, N. Sakakibara, V.L. Chiang, M. Shimada, S. Suzuki and T. Umezawa: Roles of 5-hydroxyconiferaldehyde and caffeoyl-CoA O-methyltransferases in monolignol biosynthesis in *Carthamus tinctorius*. Cellulose Chemistry and Technology 51; 511-520, 2007 (printed in 2008)
- Nakatsubo, T., M. Mizutani, S. Suzuki, T. Hattori and T. Umezawa: Characterization of *Arabidopsis thaliana* Pinoresinol Reductase that is a new type enzyme related in lignan biosynthesis. J Biol Chem 283; 15550-15557, 2008
- Hattori, T., K. Okawa, M. Fujimura, M. Mizoguchi, T. Watanabe, T. Tokimatsu, H. Inui, K. Baba, S. Suzuki, T. Umezawa and M. Shimada: Subcellular localization of the oxalic acid-producing enzyme, cytochrome *c* dependent glyoxylate dehydrogenase, in brown-rot fungus *Fomitopsis palustris*. Cellulose Chemistry and Technology 51; 545-553, 2007 (printed in 2008)
- Noguchi, A., Y. Fukui, A. Iuchi-Okada, S. Kakutani, H. Satake, T. Iwashita, M. Nakao, T. Umezawa and E. Ono: Sequential glucosylation of a furofuran lignan, (+)-sesaminol, by *Sesamum indicum* UGT71A9 and UGT94D1 glucosyltransferases. Plant J 54, 415-427, 2008

#### *Reviews*

- Hattori, T.: Mechanisms for carbon metabolism of copper-tolerant mushrooms. Seizonken Kenkyu 4; 1-9, 2008
- Umezawa, T., S. Suzuki and D. Shibata: Tree biotechnology of tropical *Acacia*. Plant Biotechnology 25; 309-313, 2008
- Umezawa, T. and S. Suzuki: Metabolic engineering of lignin biosynthesis. Bioindustry 25, 50-60, 2008
- Suzuki, S., M. Yamamura and T. Umezawa: Hinokiresinol synthase. Kagaku to Seibutsu 46, 592-594, 2008



b) Conference and seminar papers presented

59th Annual Meeting of Japan Wood Res. Soc. (Matsumoto): 2 papers

The 26th Annual Meeting of the Japanese Society of Plant Cell and Molecular Biology (Osaka): 2 papers

53rd Lignin Symposium, (Tokyo): 1 paper

50th Annual meeting of the Japanese Society of Plant Physiology, (Nagoya): 1 paper

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Umezawa, T.: International Academy of Wood Science (Fellow), The Japan Wood Research Society (Committee Member of Future Planning, Committee Member of International Academic Exchange, Program Committee Member, Coordinator of Program Committee)

Hattori, T.: The Japan Wood Research Society (Editorial Board)

#### ***Research grants***

Monbukagakusho Research Grants: Grant-in-Aid for Scientific Research (B) (2): Molecular breeding of lignocellulosics based on metabolic network control (Head Investigator: Umezawa, T.). *Grant-in-Aid for Exploratory Research*: Identification of genes controlling wood formation. (Principal Investigator: Umezawa, T.). Institute of Sustainability Science, Kyoto University, *Grant-in-Aid for Exploratory Research* (Principal Investigator: Umezawa, T.). New Energy and Industrial Technology Development Organization, High Efficiency Bioenergy Conversion Project / Development of Preparatory Basic Bioenergy Technologies (Genetic Modification of Rice Cell Walls for Efficient Saccharification) (Principal Investigator: Umezawa, T.). A grant from the Ministry of Agriculture, Forestry and Fisheries of Japan (Genomics for Agricultural Innovation GMA-0006) (Principal Investigator: Umezawa, T.) R&D Project of Industrial Science and Technology Frontier Program supported by New Energy and Industrial Technology Development Organization (Umezawa, T.), Grant-in-Aid for Scientific Research (C): Elucidation of the mechanisms for solubilization of insoluble phosphate salt by mycorrhizal fungi. (Head Investigator: Hattori, T.).

### **A-4. International cooperations and overseas activities**

#### ***International meetings (roles)***

Umezawa, T.: 1<sup>st</sup> International Conference on Plant Secondary Metabolism, Kunming, China (Invited lecture), Shanghai Institute of Plant Physiology and Ecology Seminar, Shanghai, China (Invited lecture), North Carolina State University Seminar, Raleigh, USA (Invited lecture), The 11th International Congress of Biotechnology in the Pulp and Paper Industry (program committee).

#### ***Oral presentation***

Umezawa, T.: Ferulate 08, Minneapolis/St.Paul, USA (Oral presentation), 2008 Phytochemical Society of North America Annual Meeting, Pullman, USA (Oral presentation),

#### ***International Joint Researches, overseas research surveys***

Umezawa, T.: International collaboration of phenylpropanoid biosynthesis (North Carolina State University), Field study of *Acacia mangium* breeding (Perusahaan Kosinar, Malaysia), International collaboration of *Acacia mangium* biotechnology (Indonesian

Institute of Sciences, Indonesia), International collaboration of antitumor lignan biosynthesis (Duesseldorf University, Germany), Sustainable Production of Tropical Forest Resources for Establishment of Recycling-based Society (Indonesian Institute of Sciences, Indonesia)

***Scholars from abroad***

Mahabubur, Rahman Md: Collaborative research work on transgenic *Acacia mangium*

Azad, Mustafa Abul Kalam: Collaborative research work on transgenic *Acacia mangium*

**B. Educational Activities (2008.4-2009.3)**

**B-1. On-campus teaching**

Undergraduate level: Cyclic Utilization of Bio-based Resources of the Humanosphere (Umezawa), Introduction to mushroom science (Hattori), Mushroom science (Hattori)

Graduate level: Metabolic Science of Forest Plants and Microorganisms (Advanced Course) (Umezawa), Experimental Course of Metabolic Science of Forest Plants and Microorganisms (Umezawa and Hattori), Seminar on Metabolic Science of Forest Plants and Microorganisms (Umezawa and Hattori), Science for Diagnostics and Control of Humanosphere (Umezawa)

**B-2. Off-campus teaching**

***Open seminar, etc.***

Umezawa, T.: Yabuta Seminar (Kobe, May 09, 2008) (Invited speaker), Oji Paper Seminar (Kameyama, May 16, 2008) (Invited speaker), The 26<sup>th</sup> Annual Meeting of the Japanese Society of Plant Cell and Molecular Biology (Osaka, September 02, 2008) (Invited speaker), Future Prospects in Biomass Energy (Fukuoka, October 24, 2008) (Invited speaker), The 112<sup>th</sup> RISH Symposium (Importance of metabolomics in future studies of sustainability) (Kyoto, March 18, 2009) (Organizer, Chairperson, Invited speaker)

Hattori, T.: The 112<sup>th</sup> RISH Symposium (Importance of metabolomics in future studies of sustainability) (Kyoto, March 18, 2009) (Chairperson)

## 2.3.16 Laboratory of Biomass Conversion

*Stuff Professor : Watanabe, Takashi, Dr. Agric. Sci.*  
*Associate Professor: Honda, Yoichi, Dr. Agric. Sci.*  
*Assistant Professor : Watanabe, Takahito, Dr. Agric. Sci.*  
*Postdoctoral fellows: Ohashi, Yasunori, Dr. Sci.*  
*Oyadomari, Masafumi, Dr. Agr. Sci.*  
*Yoshioka, Koichi, Dr. Agr. Aci.*  
*Iguchi, Kazunari, Dr. Sci.*  
*Takada, Rie, Dr. Agr. Sci.*  
*Tsukihar,a Takahisa, Dr. Agr. Sci.*  
*Liu, Jian, Dr. Eng.*  
*Pradeep, Verma, Dr. Microbiol.*

*Students and research fellows*

*Doctor's program : (3)*

*Research fellow: (3)*

*Master's program : (9)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

- a) Conversion of wood biomass to energy and functional materials by microorganisms and enzymatic reactions

Wood biomass and its components are converted to energy and useful materials including ethanol, chemicals, feedstuff and others by using microorganisms and their enzymes. The research subjects include pretreatments of wood by selective white rot fungi, solvolysis and milling. The research includes enzymatic decomposition of inhibitors for ethanol fermentation, and analysis of physiological response of alcohol-producing microorganisms to the inhibitors of ethanol fermentation.

- b) Molecular biological characterization of white rot fungi

Extracellular enzymes are isolated from the culture of white rot basidiomycetes and genes encoding these enzymes are cloned and characterized. Regulation of gene expression, overexpression with gene engineering techniques, a reaction mechanism of the enzymes, and their application in degradation of polymers are studied. New strategies for transformation and gene-targeting system are under development.

- c) Development of efficient biocatalysts for wood biomass conversion

Isolation of biocatalysts for efficient conversion of wood biomass is aimed by modifying microorganisms including bacteria, yeasts, and lignin-degrading basidiomycetes with gene engineering techniques. These include construction of basidiomycetes with higher and more selective ligninolytic activities, and alcohol-producing microorganisms with higher tolerance to the fermentation inhibitors.

- d) Analysis and application of free radical-regulating systems of selective white rot fungi

Ligninolytic systems of selective white rot fungi including functions of key metabolites in the selective lignolysis are studied. Molecular cloning and expression of the genes encoding enzymes responsible for the biosynthesis of key metabolites are also studied. Gene-engineered white rot

fungi and biomimetic lignin-degrading reactions are applied to the degradation of organopollutants and pretreatments for enzymatic saccharification and fermentation of wood biomass.

## A-2. Publications and presentations

### a) Publications

#### ***Books***

Tsubota, J. and T. Watanabe: Methane fermentation of recalcitrant wood biomass, Development and Application of The second Generation Biofuels, CMC Publishing, Tokyo, 209-219, 2009

Watanabe, T.: Pretreatments using biological functions of microbes. In Industrial Technologies of Bio-Refinery for Automobile Biofuel, CMC Publishing, Tokyo, pp.207-222, 2008

Watanabe, T.: Pretreatments using biological functions of microbes. In Frontiers of Cellulose Utilization Technologies, CMC Publishing, Tokyo, pp.334-349, 2008

#### ***Reviews***

Watanabe, T.: Biomass conversion by white rot fungi, Transactions of The Mycological Society of Japan Nishi-Nippon Branch 17; 3-18, 2008

#### ***Original papers***

Nishimura, H., S. Tsuda, H. Shimizu, Y. Ohashi, T. Watanabe, Y. Honda and T. Watanabe: *De novo* synthesis of (*Z*)- and (*E*)-7-hexadecenylitaconic acids by a selective lignin-degrading fungus, *Ceriporiopsis subvermispota*, Phytochemistry, 69, 2593-2602, 2008

Tsukihara, T., Y. Honda, R. Sakai, T. Watanabe and T. Watanabe: Mechanism for oxidation of high-molecular-weight substrates by a fungal versatile peroxidase, MnP2. Appl Environ Microbiol 74; 2873-2881, 2008

### b) Conference and seminar papers presented

Annual meeting of Japan Society of Bioscience, Biochemistry and Agrochemistry 2009: 8 presentations

The 14th Annual meeting of The Japan Institute of Energy: 1 presentation

Annual meeting of the Society for Bioscience and Bioengineering: 1 presentation

The 59th Annual Meeting of Japan Wood Research Society: 8 presentations

The 53th Lignin Symposium: 1 presentation

The 12th Annual meeting of Japanese Society of Mushroom Science and Biotechnology: 2 presentations

The 5th meeting of East Asia for Collaboration on Edible Fungi: 1 presentation

Genetics and Cell Biology of Basidiomycetes Conference VII: 1 presentation

Mie Bioforum 2008 Biotechnology of Lignocellulose Degradation, Biomass Utilization and Biorefinery : 2 presentations

## A-3. Off-campus activities

### ***Membership in academic societies***

Watanabe, Takashi: Japan Society of Bioscience, Biochemistry and Agrochemistry (council of Kansai branch), Japan Tappi (Committee member of Wood Sci.), Japanese Society of Mushroom Science and Biotechnology (Council member), Japan Wood Research Society (Committee member )

Honda, Y.: Japan Wood Research Society (Secretary of the Institute.), Japanese Society of

Mushroom Science and Biotechnology (Council member and board)

### ***Research grants***

Monbukagakusho Research Grants: Grant-in-Aid for Scientific Research (B), Elucidation of structure, functions and biosynthetic pathway of hydrophobic metabolites produced by white rot fungi (Takashi Watanabe), Grant-in-Aid for Exploratory Research, Production of biofuels by biomechanicochemical reactions from wood by iron chelators which suppress active oxygen species, hydroxyl radical (Takashi Watanabe),

Others: Grant: NEDO Grant for Frontier Research and Technology of biomass energy, Highly efficient conversion system of wood biomass into bioethanol (Takashi Watanabe), NEDO Grant for Frontier Research and Technology of biomass energy, Basic studies for efficient enzymatic saccharification and fermentation (Takashi Watanabe), RITE Research grant for advanced research, Analysis and molecular breeding of selective white rot fungi for the production of ethanol (Takashi Watanabe), Ministry of Industry and Economy, R & D for Regional innovation, New environmentally-benign technology on pretreatment of woody biomass for ethanol production

## **A-4. International cooperations and overseas activities**

### ***International meetings (roles)***

Watanabe, Takashi: Mie Bioforum 2008 Biotechnology of Lignocellulose Degradation, Biomass Utilization and Biorefinery (presentation), 99th RISH Symposium VTT-RISH Joint Symposium -Sustainable Utility of Wood Biomass (presentation), ASEAN COST+3: New Energy Forum for Sustainable Environment, Pre-Symposium, 6th Eco-Energy and Materials Science and Engineering Symposium (EMSES) (committee member, presentation), The Second G-COE International Conference, In Search of Sustainable Humanosphere in Asia and Africa: Biosphere as a Global Force of Change (moderator), The 2nd International Symposium on BioEnergy and Bioprocess Technology, Chinese Academy of Sciences (presentation)

Honda, Y.: The 5th meeting of East Asia for Collaboration on Edible Fungi Fukuoka (chairman and presentation), Genetics and Cell Biology of Basidiomycetes Conference VII USA (presentation)

### ***International joint researches, overseas research surveys***

Watanabe, Takashi: G-COE program, Survey of Biomass utilization in Indonesia

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) courses given

Undergraduate level: Science of Humanosphere –Conversion of Solar Energy- (Takashi Watanabe, Honda), Mushroom Biology Seminar (Honda), Mushroom Science (Honda)

Graduate level: Chemistry of Wood Biomass Conversion (Takashi Watanabe, Honda), Seminar on Chemistry of Wood Biomass Conversion (Takashi Watanabe, Honda, Takahito Watanabe), Experimental Course in Chemistry of Wood Biomass Conversion (Takashi Watanabe, Honda, Takahito Watanabe), Science for diagnostics and control of the Humanosphere (Honda)

## **B-2. Off-campus teaching etc.**

### ***Open seminar, etc***

Watanabe, Takashi: 74th Annual meeting of the The Society of Chemical Engineers, Japan, The Japan Society of Applied Glycoscience West Japan Branch Meeting, The 60th Annual Meeting of The Society for Biotechnology, Japan., the 3rd Wood Science Symposium

Honda, Y.; The 4th Energy Recycling Symposium - Biomass conversion and solar power satellite

### ***Students and research fellows from abroad***

Doctor course: 2

Cooperative research fellows: 1

## **B-3. Overseas teaching**

### ***Students and research fellows from abroad***

JSPD PD fellow: Liu Jian (China)

JSPS PD fellow: Pradeep Verma (India)

## 2.4 DIVISION OF APPLIED BIOSCIENCES

The Division of Applied Biosciences was created in 1996 to consolidate the three divisions of Agricultural Biology (founded in 1953), Fisheries Science (1953), Animal Science (1976) and two research laboratories from Division of Tropical Agriculture (1981).

The division is conducting the research and education on the subjects aiming at the efficient utilization, conservation and creation of species for a variety of living organisms including microorganisms, plants, animals and fishes living in land and sea from the molecular to population levels. The division consists of 16 laboratories in which 118 master students including 7 students from abroad and 53 Ph D. students including 6 students from abroad are enrolled.

# Chair of Science of Plant Resources

## 2.4.1 Laboratory of Plant Genetics

Staff      Professor                      : Endo, Takashi, D. Agric. Sci  
Associate Professor : Miyashita, Naohiko, Ph. D.  
Assistant Professor : Nasuda, Shuhei, Ph. D.

Students and research fellows

Doctor's program      : (2)  
Master's program      : (5)                      Undergraduate : (2)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main Subjects

a) Cytogenetic analysis of a genetic genome rearrangement system in wheat

Chromosomal structural changes frequently occur in specific lines of common wheat carrying certain alien chromosomes from wild species related to wheat. These chromosomal aberrations can be identified by the chromosome banding and in situ hybridization techniques. Using this genome rearrangement system, we have established deletion and translocation lines of wheat and are conducting studies on chromosome mapping and the introduction of useful genes from alien species, such as barley and rye, into bread wheat. Also, we have initiated a basic study aimed at cloning the gene responsible for the unique genome rearrangement system.

b) Molecular cytogenetic analysis of wheat and its relative species

We are aiming at elucidating the molecular structure of the chromosomes of wheat, barley and rye by the analyses of molecular genetics and cytogenetics. Major interests are (1) chromosome mapping of DNA markers by using aneuploid lines, (2) functional and structural analysis of the centromere of chromosomes, and (3) molecular analysis of the chromosome behavior during the gametogenesis of synthetic triploid wheat.

c) Molecular population genetics study on DNA variation in the genera *Arabidopsis* and *Arabis*, and *Oryza*.

To establish a model system for plant population genetics, we have chosen two genera *Arabidopsis* and *Arabis*. So far, several genic regions have been analyzed to quantify DNA variation at a specific genic region. In addition, microsatellite and AFLP analyses were conducted to investigate the pattern of DNA polymorphism over the entire genome. Currently, we are analyzing genes involved in herbicide resistance in *A. thaliana*. To examine a more general picture of molecular variation in plant species, we are planning to compare these two genera and *Oryza* species, which are monocots. We have already analyzed DNA variation in two *Adh* locus regions in *Oryza* species, and are analyzing Blast-related and flowering genes.

#### A-2. Publications and presentations

a) Publications



### ***Books***

Masoudi-Nejad, A. and T. R. Endo: Gametocidal mapping: A method for high-throughput gene mapping in post-genomics era, Chromosome Mapping Research Developments (edited by J.F. Verrity and L.E. Abbington), pp.1-33, Nova Science Publishers, Inc., New York, 2008

### ***Original papers***

Endo, T. R., S. Nasuda, N. Jones, Q. Dou, A. Akahori, M. Wakimoto, H. Tanaka, K. Niwa and H. Tsujimoto: Dissection of rye B chromosomes, and nondisjunction properties of the dissected segments in a common wheat background. *Genes & Genetic Systems* 83; 23-30, 2008

Tsuchida, M., T. Fukushima, S. Nasuda, A. Masoudi-Nejad, G. Ishikawa, T. Nakamura and T.R. Endo: Dissection of rye chromosome 1R in common wheat. *Genes & Genetic Systems* 83; 43-53, 2008

Nomura, T., S. Nasuda, K. Kawaura, Y. Ogihara, N. Kato, F. Sato, T. Kojima, A. Toyoda, H. Iwamura and T.R. Endo: Structures of the three homoeologous loci of wheat benzoxazinone biosynthetic genes *TaBx3* and *TaBx4* and characterization of their promoter sequences. *Theor. Appl. Genet.* 116; 373-381, 2008

Teranishi, C., K. Yoshida and N.T. Miyashita: DNA polymorphism in the *SUPERWOMEN1* (*SPW1*) locus of the wild rice *Oryza rufipogon* and its related species, *Genes & Genetic Systems* 83; 403-415, 2008

b) Conference and seminar papers presented

The 80<sup>th</sup> Annual Meeting of the Genetic Society of Japan: 1 presentation

Congress of Japanese Society of Breeding: 1 presentation

The 30<sup>th</sup> Annual Meeting of BMB 2008: 1 presentation

## **A-3. Off-campus activities**

### ***Membership in academic societies***

Endo, T.: Genetic Society of Japan (Editor-in-Chief), Genetic Resources Committee and Resource Center, National Institute of Genetics (Member)

### ***Research grants***

Grant-in-Aid for Scientific Research from the Ministry of Education, Science, Sports and Culture: Exploratory Research (Endo)

Grant-in-Aid for Scientific Research in Priority Areas (Endo), Grant-in-Aid for Scientific Research in (B) (Endo)

National Bioresource Project (the Ministry of Education, Science, Sports and Culture) (Endo and Nasuda)

## **A-4. International cooperations and overseas activities**

Endo, T.: 3<sup>rd</sup> Asian Chromosome Colloquium (Osaka, oral presentation)

Nasuda, S.: 11<sup>th</sup> International Wheat Genetics Symposium (Australia, oral presentation)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Basic Bioresource Science I (Endo), Outline of Bio-production Science I

(Endo), Genetics I (Endo), Genetics II (Miyashita), laboratory of Bioresource Science I, II (Endo and Miyashita), Seminar in Plant Resource Science (Endo and Miyashita)  
Graduate level: Genetics (Advance Course) I (Endo), Genetics (Advance Course) II (Miyashita), Seminar in Plant Genetics (Endo and Miyashita), Research in Plant Genetics (Endo and Miyashita)

## **B-2. Off-campus teaching, etc**

### ***Part-time lecturer)***

Nasuda, S.: Faculty of Education, Kyoto University of Education (Genetics), Doshisha Women's College of Liberal Arts (Life Sciences)

## **B-3. Oversea teaching**

### ***Students and research fellows from abroad***

Doctor's program: 2 (Nepal)

## 2.4.2 Laboratory of Crop Evolution

*Staff Associate professor: Kawahara, Taihachi, Dr. Agr. Sci.*

*Assistant professor : Yasui, Yasuo, Dr. Agr. Sci.*

*Students and research fellows:*

*Doctor's program : (2)*

*Master's program : (2)*

### A. Research Activities (2008.4 - 2009.3)

#### A-1. Main subjects

##### a) Studies on the genetic variation of wheat

Ethiopia is very famous as one of the centers of crop plant diversity. We started investigations to clarify the genetic diversity of cultivated tetraploid wheat collected in Ethiopia by utilizing nuclear SSR markers. We selected about 70 SSR markers distributing the entire 14 chromosomes from previous studies on hexaploid wheat. We are now checking the PCR conditions.

##### b) Studies on the genetic variation of wild relatives of wheat

The genealogical and geographic structure of variation in spikelet morphology was analyzed for central Eurasian wild wheat *Aegilops tauschii* Coss. using a diverse array of 203 sample accessions that represented the entire species range. In this sample set, two subspecies were identified on the basis of *sensu-stricto* criteria: only the accessions having markedly moniliform spikes were assigned to subspecies *strangulata* (Eig) Tzvel., whereas those having mildly moniliform and cylindrical spikes to subspecies *tauschii*. In a principal component analysis based on nine spikelet traits, the two subspecies formed separate clusters, indicating that subspecies *strangulata sens. str.* is a practically usable taxon. Chloroplast-DNA-based genealogical analyses suggested that subspecies *strangulata* diverged from an ancestor that carried a specific chloroplast DNA type, whereas, after divergence, this subspecies became polyphyletic, likely through hybridization. Geographically, significant longitudinal and latitudinal clines were detected for spikelet size, with spikelets tending to be small in the eastern and southern regions. These results shed some light on the patterns of subspecies divergence and spikelet-shape diversification in the course of *Ae. tauschii*'s long-distance dispersal from the Transcaucasus to China.

##### c) Studies on the self-incompatibility gene of common buckwheat

In common buckwheat, the self-incompatibility gene is closely linked with the genes controlling several morphologies related with heterostyly and they form the S supergene. So far, the linkage map and genomic library have been constructed as a first step for the cloning of the S gene by the positional cloning method. We also screened a large mapping population (7000 individuals) and detected three AFLP markers, which completely linked to the S locus. From an association study using 92 individual collected in Asian and European countries, we clarified that one of three AFLP markers locates nearby S locus. We carried out chromosome walking from the AFLP marker and obtained the contig consisting of 27 BAC clones. Partial sequences of these BAC clones were determined by a next generation sequencing machine (Solexa). Three candidate genes were obtained from the subsequent BLASTX search.

##### d) Screening of *Au SINE* element in vascular plants

SINE sequence is widely found in animal genomes and many researches are already reported. However, studies on plant SINE sequence is few because of limited distribution in plants. *p-SINE1* is only found in the genus *Oryza*, *TS* in tobacco and *S1* in *Brassica*. Recently, we found novel retro element, *Au SINE*, in relatives of wheat. This *Au SINE* is found in several species belonging to Poaceae, Fabaceae and Annonaceae, and is the first plant SINE with quite wide distribution. We are now continuing to screen in other plant species and could be able to find out in genus *Gnetum* belonging to gymnosperm. Distribution both in angiosperm and gymnosperm was confirmed.

## **A-2. Publication and presentation**

### **a) Publication**

#### ***Original papers***

Matsuoka, Y., S. Takumi and T. Kawahara: Flowering time diversification and dispersal in Central Eurasian wild wheat *Aegilops tauschii* Coss.: Genealogical and Ecological Framework. PLoS ONE 3(9): e3138. doi:10.1371/journal.pone.0003138. 2008

Yasui, Y., M. Mori, D. Matsumoto, O. Ohnishi, C.G. Campbell and T. Ota: Construction of a BAC library for buckwheat genome research: an application to positional cloning of agriculturally valuable traits. Genes & Genet. Syst. 83: 393-401. 2008

### **b) Conference and seminar papers presented**

114th annual meeting of the Japanese Society of Breeding: 1 paper

115th annual meeting of the Japanese Society of Breeding: 1 paper

## **A-3 Offcampus activities**

#### ***Research Grant***

National Bioresource Project KOMUGI (the Ministry of Education, Science, Sports and Culture)  
(Collaborator: Kawahara)

Grant-in-Aid for Scientific Research from the Japanese Society for Promotion of Science (A):  
Analysis of genetic diversity in plants with wide distribution in Eurasia by using wild relatives of wheat (Head: Kawahara, Collaborator: Yasui)

Grant-in-Aid for Scientific Research from the Japanese Society for Promotion of Science (B):  
Molecular cloning and evolutionary analysis of the heterostylous self-incompatibility gene of buckwheat (Head: Yasui)

## **A-4. International cooperation and oversea activities**

#### ***International joint Researches, oversea research surveys***

Kawahara, T.: Conservation of synthetic wheat lines and their utilization for breeding (Russia)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-Campus teaching**

#### **a) Courses given**

Undergraduate level: Outline of Bio-production Science I, Plant Genetic Resources, Seminar in Plant Resource Science (Kawahara)

Graduate level: Ethnobotany (Kawahara), Seminar in Origin of Cultivated Plants (Kawahara),

**B-2. Off-campus teaching, etc.**

***Part-time lecturer***

Kawahara, T.: Fac. Agr. Kyoto Prefectural Univ. (Genetics), Fac. Agr. Okayama Univ. (Origins of cultivated plants)

# Chair of Science of Plant Protection

## 2.4.3 Laboratory of Plant Pathology

Staff	Professor	: Okuno, Tetsuro, Dr. Agric. Sci.
	Associate Professor	: Mise, Kazuyuki, Dr. Agric. Sci.
	Lecturer	: Takano, Yoshitaka, Dr. Agric. Sci.
	Assistant Professor	: Kaido, Masanori, Dr. Agric. Sci.
	Post-doctoral fellows	: Nagano, Hideaki, Dr. Agric. Sci.
		: Asakura, Makoto, Dr. Agric. Sci.
		: Iwahashi, Fukumatsu, Dr. Agric. Sci.

### Students and research fellows

Doctor's program : (4)	Undergraduate: (5)
Master's program : (11)	Research assistant: (2)

## A. Research Activities (2008.4-2009.3)

### A-1. Main subjects

#### a) Studies on plant RNA virus infection

Plant viruses cause serious diseases in many important plant species, but few effective antiviral strategies have been developed. This is likely due to our inadequate understanding of the basic biology of plant viruses. We are studying the mechanisms of infection and replication of plant viruses and their interaction with host plants. Viruses used for the studies are dianthoviruses and bromoviruses. Plants used for the studies are *Arabidopsis*, barley, cowpea, tobacco and others. We have been analyzing the molecular structures and the functions of viral RNAs and proteins in the infection process of viruses in both plant and protoplast systems. Researches include investigations on the early events of infection to the late maturation stage such as protein synthesis, RNA replication, the cell-to-cell movement of virus, and packaging of viral RNAs into virions and analyses of molecular mechanisms of symptom expression caused by plant virus infection.

#### b) Identification of host factors involved in plant virus infection

Viruses utilize host proteins to establish infection in plants. Plant virus genomes and their encoded proteins are proposed to have physical interactions with putative host-derived factors. Surveys for plant genes involved in RNA virus infections have been progressing by using proteomics approach including affinity chromatography purification and mass spectrometry and genetic approach using *Arabidopsis* mutants.

#### c) Studies on infection mechanism of phytopathogenic fungi

Plant pathogenic fungi cause serious diseases on a wide range of crops and ornamental plants. For development of novel strategies for protecting plants from fungal infection, it is necessary to understand both of fungal infection and plant resistant mechanisms at molecular level. Researchers are studying infection mechanism of a plant pathogenic fungus *Colletotrichum orbiculare*, the causal agent of cucumber anthracnose. Molecular genetic analysis has identified

many genes involved in pathogenicity of *C. orbiculare*. Based on information about identified pathogenicity-related genes, we are especially focusing on relations of peroxisomal metabolic function, autophagy, and RNA regulation with fungal infection mechanism. Using *Arabidopsis thaliana* and several *Colletotrichum* species that have different host ranges, we are studying nonhost plant resistance and suppression of plant defense responses by adapted pathogens.

## A-2. Publications and presentations

### a) Publications

#### **Books**

Asakura, M., and Y. Takano: Peroxisomes and phytopathogenicity. In Emergent Functions of the Peroxisome. Ed., Terlecky, S.R., and Titorenko, V.I. p. 33-42. Research Signpost, Kerala, India, 2009

#### **Original papers**

Asakura, M., S. Ninomiya, M. Sugimoto, M. Oku, S. Yamashita, T. Okuno, Y. Sakai and Y. Takano: Atg26-mediated pexophagy is required for host invasion by the plant pathogenic fungus *Colletotrichum orbiculare*. Plant Cell 21; 1291-1304, 2009

Fujisaki, K., F. Iwahashi, M. Kaido, T. Okuno, and K. Mise: Genetic analysis of a host determination mechanism of bromoviruses in *Arabidopsis thaliana*. Virus Res. 140; 103-111, 2009

Damayanti, T. A., D. Susilo, S. Nurlaelah, D. Sartiami, T. Okuno and K. Mise: First report of *Bean common mosaic virus* in yam bean (*Pachyrhizus erosus* (L.) Urban) in Indonesia. J. Gen. Plant Pathol. 74; 438-442, 2008

Iwakawa, H.-O., H. Mizumoto, H. Nagano, Y. Imoto, K. Takigawa, S. Sarawaneeyaruk, M. Kaido, K. Mise and T. Okuno: A viral non-coding RNA generated by *cis*-element-mediated protection against 5'→3' RNA decay represses both cap-independent and cap-dependent translation. J. Virol. 82; 10162-10174, 2008

Matsumoto, K., H. Sawada, K. Matsumoto, H. Hamada, E. Yoshimoto, T. Ido, S. Takeuchi, S. Tsuda, K. Suzuki, K. Kobayashi, A. Kiba, T. Okuno and Y. Hikichi: The coat protein gene of tobamovirus P0 pathotype is a determinant for activation of temperature-insensitive L1a-gene-mediated resistance in Capsicum plants. Arch. Virol. 153; 645-650, 2008

Matsumoto, K., C. Tomikawa, T. Toyooka, A. Ochi, Y. Takano, N. Takayanagi, M. Abe, Y. Endo and H. Hori: Production of yeast tRNA (m<sup>7</sup>G46) methyltransferase (Trm8-Trm82 complex) in a wheat germ cell-free translation system. J. Biotechnol. 133; 453-460, 2008

Okamoto, K., H. Nagano, H.-O. Iwakawa, H. Mizumoto, A. Takeda, M. Kaido, K. Mise and T. Okuno: *cis*-Preferential requirement of a -1 frameshift product p88 for the replication of *Red clover necrotic mosaic virus* RNA1. Virology 375; 205-212, 2008

#### **Reviews**

Okuno, T.: RNA replication and mechanisms of *Red clover necrotic mosaic dianthovirus* to circumvent host defenses. J. Gen. Plant Pathol. 74; 446-449, 2008

Okuno, T.: Mechanisms of gene expression of dianthovirus and circumvent of host defense. Jpn. J. Phytopathol. 74; 128-130, 2008 (in Japanese)

Mine, A. and T. Okuno: Virus and RNA silencing. Uirusu 58; 61-68, 2008 (in Japanese)

Mise, K., F. Iwahashi, Y. Saruwatari, M. Hayashi, T. Narabayashi, H. Inui, K. Fujisaki, T. Okuno

and K. Mise: Mechanism of systemic necrosis development in *Arabidopsis thaliana* upon bromovirus infection. PSJ Plant Virus Disease Workshop Report. 9: 47-56, The Phytopathological Society of Japan, Tokyo, 2008 (in Japanese with English summary)

b) Conference and seminar papers presented

Annual Meeting of the Phytopathological Society of Japan: 11 papers

Kansai Meeting of the Phytopathological Society of Japan: 1 paper

Annual Meeting of the Japanese Society for Virology: 2 papers

Annual Meeting of the Molecular Biology Society of Japan: 1 paper

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

Okuno, T.: The Phytopathological Society of Japan (Editor-in-Chief of PSJ Journal, Councilor), The Japanese Society for Virology (Councilor), The Molecular Biology Society of Japan, The RNA Society of Japan

Mise, K.: The Phytopathological Society of Japan (Managing Editor of PSJ Journal), The Japanese Society for Virology, The Molecular Biology Society of Japan

Takano, Y.: The Phytopathological Society of Japan (Editorial Manager of PSJ Journal), The Molecular Biology Society of Japan, The Japanese Society of Plant Physiologists

Kaido, M.: The Phytopathological Society of Japan (Editorial Manager of PSJ Journal)

#### ***Membership in Science Council of Japan, etc.***

Okuno, T.: Japan Science and Technology Agency (Basic Research Program Adviser), National Agriculture and Food Research Organization, Bio-oriented Technology Research Advancement Institution (Selection and evaluation committee member)

#### ***Research grants***

Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science: Grant-in-Aid for Scientific Research (A) (Okuno, head), Grant-in-Aid for Scientific Research (B) (Mise, head), Grant-in-Aid for Scientific Research (B) (Takano, head), Grant-in-Aid for Scientific Research (C) (Kaido, head), and Grant-in-Aid for Scientific Research (B) (Kaido, member)

Grant-in Aid for Industrial Research from New Energy and Industrial Technology Development Organization (NEDO) (Takano, head)

Others: Core Research for Evolutionary Science and Technology (CREST) from Japan Science and Technology Agency (Takano, member)

### **A-4. International cooperations and overseas activities**

#### ***International meetings (roles)***

2008 International Congress of Virology, 8.10 ~ 15 (2008) Istanbul, Turkey, 4 poster presentations (Okuno, Mise, Kaido)

#### ***Membership in academic societies***

Okuno, T.: The RNA Society, The American Society for Virology

Mise, K.: The American Phytopathological Society, The American Society for Virology, The American Association for the Advancement of Science, The Society for General Microbiology

Takano, Y.: The International Society of Molecular Plant-Microbe Interactions



## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Plant Pathology I (Okuno), Plant Pathology II (Mise, Takano), Seminar in Plant Protection (Okuno), Biotechnology-Novel Strategies for Agriculture (Okuno), Microbiology (Okuno), Cell Biology III (Mise), Outline of Bioresource Science IV (Mise, Takano), Laboratory Course in Bioresource Science I, II (Okuno, Mise, Takano, Kaido)

Graduate level: Plant Pathology (Advanced Course) II (Mise, Takano), Seminar in Plant Pathology (Okuno, Mise, Takano, Kaido), Research in Plant Pathology (Okuno, Mise, Takano, Kaido)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Mise, K.: Kyoto Institute of Technology (Plant Pathology), The University of Tokyo (Plant Pathology)

#### ***Symposia etc.***

Okuno, T.: Plant Stress Science Symposium at Research Institute for Bioresources, Okayama University (Lecturer), Sumitomo Chemical Co. Research Institute (Lecturer)

Mise, K.: 10th Plant Biotechnology Symposium at Kyoto Prefectural University (Lecturer)

### **B-3. Overseas teaching**

#### ***Students and research fellows from abroad***

Doctor's program: 1 (Thailand), Master's program: 2 (China), 1 (Indonesia)

## **C. Other remarks**

Okuno, T.: A winner of the Society Fellowship at the 2008 Annual Meeting of the Phytopathological Society of Japan, Chairman of the department of Bioresource Science, Vice chairman of the division of Applied Biosciences, The Steering Committee of Kyoto University Museum, The Committee of Kyoto University for National Center Test for University Admissions, The Committee of Graduate School of Agriculture for Educational Affairs, The Committee of Graduate School of Agriculture for Information System Management, The Committee of Graduate School of Agriculture for Information Security

Mise, K.: The Committee of Graduate School of Agriculture for the Prevention of Radiation Injury

Takano, Y.: A winner of Japan Prize in Agricultural Science, Achievement Award for Young Scientist (2008)

Kaido, M.: The Committee of Graduate School of Agriculture for the Safety and Sanitation, The Committee of Kyoto University for Disposal of Inorganic Liquid Wastes

## 2.4.4 Laboratory of Insect Ecology

*Staff*      *Professor*                      : Fujisaki, Kenji, D. Agric. Sci.  
                 *Associate Professor* : Ohsaki, Naota, D. Agric. Sci.  
                 *Instructor*                        : Nishida, Takayoshi, D. Agric. Sci.

*Students and research fellows*

*Post doctoral fellow* : (9)              *Master's Program* : (11)  
*Doctor's program* : (10)              *Undergraduate* : (2)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

The studies in this laboratory are concentrated on the ecology, dynamics, evolution and management of insect populations or communities with reference to agriculture and forestry. On-going main topics of research by the staff members are as follows.

- a) Analysis on life history strategy in insects - Insects have evolved various life history strategies in response to spatio-temporal heterogeneity of habitats. Among them, life history traits such as migration and diapause are especially important. These life history traits correlate with each other and constitute a syndrome. The evolutionary pathway of wing polymorphism as an example of such a syndrome is going to be clarified through the physiological, ecological and genetic analysis.
- b) Role of parasitic natural enemies in host plant choice by *Pieris* butterflies - Herbivorous insects do not always use nutritionally superior plants as food but use sometimes only inferior ones. This suggests the existence of other ecological factors influencing the food plant choice by herbivores. By studies of the host plant - herbivore - parasitoid interactions using *Pieris* butterflies, field and laboratory evidence is now being accumulated to infer that the difference in defense mechanisms of the insects against their specific parasitoids determines their host plant preference.
- c) Sex specific expression of Batesian mimicry - In Batesian mimicry, mimetic forms are either female limited or not sex limited, but male limited mimicry is very rare or absent. To explain these curious phenomena, ecological interplays among cost of mimicry, sex-related biased predation by visually hunting predators and sexual selection are analyzed.
- d) Evolutionary ecology of predation avoidance - Field observations and laboratory experiments have gradually revealed that prey often suffers more from non-lethal effects of predation (non-lethal injury, starvation, postponed reproduction and so on) than from direct predation events. This may explain why traditional analyses of population dynamics have long underestimated the effect of predation as the regulatory factor for prey-predator systems.
- e) Reproductive interference as a major underpinning mechanism of biological communities - Both theoretical- and empirical studies have revealed that reproductive interference between closely related species can explain a wide spectrum of ecological phenomena, such as host range, niche or habitat partitioning, geographic distribution, and biological invasion in both animals and plants.
- f) Prediction of the expansion of distribution range and the population dynamics in insects as a biosensor of global warming - Climatic adaptation of some southern insect pests such as the

cotton bollworm and the southern green stink bug to temperate climate zone has been analyzed. Based on the obtained data, the model of forecasting the seasonal occurrence under the future warming conditions is now constructing.

g) Analysis of the host-egg parasite relationship in sting bugs-Research on host-egg parasite relationship is not only important for the development of biological control but also interesting from the ecological aspect. The host-egg parasite relationship is now ongoing using eggs of some stink bugs and their parasitic wasps.

## A-2. Publications and presentations

### a) Publications

#### ***Books***

Fujisaki, K.: Introduction, a lesson from entomological science, Entomological Science and its Perspective (edited by Fujisaki et al.), pp. i-ix. Kyoto University Press, Kyoto, 2009 (in Japanese).

Fujisaki, K.: For the restoration of the traditional cultural love for insects, Entomological Science and its Perspective (edited by Fujisaki et al.), pp. 541-562. Kyoto University Press, Kyoto, 2009 (in Japanese).

Fujisaki, K., K. Shimizu, D. Togo, and D. L. Musolin: Impacts of the global warming on insects -case studies of the cotton bollworm and the southern green stink bug-, Entomological Science and its Perspective (edited by Fujisaki et al.), pp. 13-40. Kyoto University Press, Kyoto, 2009 (in Japanese).

Himuro, C. and K. Fujisaki: Inhibition of the female re-mating by accessory gland substances in males of the seed bug *Togo hemipterus*, Entomological Science and its Perspective (edited by Fujisaki et al.), pp. 299-303. Kyoto University Press, Kyoto, 2009 (in Japanese).

Kakutani, T., J. Yoshida and K. Fujisaki: Marked changes in flower visiting insect fauna reveal environmental changes, Entomological Science and its Perspective (edited by Fujisaki et al.), pp. 88-90. Kyoto University Press, Kyoto, 2009 (in Japanese).

Kishi, M. and K. Fujisaki: Life history strategy of the water strider in brackish water environments, Entomological Science and its Perspective (edited by Fujisaki et al.), pp. 51-53. Kyoto University Press, Kyoto, 2009 (in Japanese).

Nishida, T.: Evolutionary Ecology of Predation Avoidance. 206pp. Yasaka Shobo, Tokyo, 2008 (in Japanese)

Ohsaki, N. The Evolution of Mimicry. 286pp. Kaiyusha, Tokyo, 2009 (in Japanese).

Perez Goodwyn, P. and K. Fujisaki: The biomechanics of water striders, Entomological Science and its Perspective (edited by Fujisaki et al.), pp. 423-438. Kyoto University Press, Kyoto, 2009 (in Japanese).

Perez Goodwyn, P. and Y. Maezono and K. Fujisaki: Super-performance waterproof wings of a danaid butterfly *Parantica sita*, Entomological Science and its Perspective (edited by Fujisaki et al.), pp. 439-443. Kyoto University Press, Kyoto, 2009 (in Japanese).

Yokoi, T. and K. Fujisaki: Utilization of scent marking and its effects in bees, Entomological Science and its Perspective (edited by Fujisaki et al.), pp. 221-223. Kyoto University Press, Kyoto, 2009 (in Japanese).

### ***Original papers***

- Egusa, S., T. Nishida, H. Sawada and K. Fujisaki: Is selection of host plants by *Plagioder a versicolora* based on plant-related performance? *Entomologia Experimentalis et Applicata*, 128:258-264, 2008
- Himuro, C. and K. Fujisaki: Males of the seed bug *Togo hemipterus* (Heteroptera: Lygaeidae) use accessory gland substances to inhibit remating by females. *Journal of insect physiology* 2008;54(12):1538-42.
- Honma, A., K. Takakura, and T. Nishida: Optimal-foraging predator favors commensalistic Batesian mimicry. *PLoS ONE* 3 (10): e3411, 2008.
- Kishi, M., T. Harada and K. Fujisaki (2009) Responses of life-history traits of brackish- and freshwater populations of the water strider to NaCl *Aquarius paludum* (Hemiptera: Gerridae). *Eur. J. Entomol.* 106:43-48.
- Kishi, S., T. Nishida and Y. Tsubaki: Reproductive interference determines the competition winner in *Callosobruchus* bean weevils. *Journal of Animal Ecology*, doi: 10.1111/j.1365-2656.2009.01560.x, 2009.
- Miura, K., H. Iida, K. Imai, S. Lyon, R. Readon and K. Fujisaki (2008) Herbivorous insect fauna of mile-a-minute weed, *Persicaria perfoliata* (Polygonaceae), in Japan. *Florida Entomologist* 91(2) 319-323.
- Perez Goodwyn, P.J., D. Voigt, K. Fujisaki: Skating and diving: Changes in functional morphology of the setal and microtrichial cover during ontogenesis in *Aquarius paludum* Fabricius (Heteroptera, Gerridae). *Journal of Morphology* 269: 734-744. 2008.
- Perez Goodwyn, P. J., E. De Souza, K. Fujisaki and S. Gorb: Moulding technique demonstrates the contribution of surface geometry to the super-hydrophobic properties of the surface of a water strider. *Acta Biomaterialia* 4: 766-770, 2008
- Perez Goodwyn, P.J., Wang, J. Wang, Z. Ji, A., Dai, Z. and K. Fujisaki: Water striders: the biomechanics of water locomotion and functional morphology of the hydrophobic surface (Insecta: Hemiptera-Heteroptera). *Journal of Bionic Engineering* 5: 121-126, 2008
- Sawada, H., Y. Masumoto, T. Matsumoto and T. Nishida: Comparisons of cocoon density and survival processes of an invasive moth *Parasa lepida* (Cramer) between the deciduous and evergreen trees. *Japanese Journal of Environmental Entomology and Zoology* 19:59-67, 2008.
- Sawada, H., S. Shimomura, T. Nishida and T. Matsumoto: Causes of larval mortality in relation to host plant quality in the invasive grub moth, *Parasa lepida* (Cramer). *Japanese Journal of Environmental Entomology and Zoology* 19:69-78, 2008.
- Sawada, H., Y. Hori, S. Nishida, T. Matsumoto and T. Nishida: Population dynamics of an invasive grub moth, *Parasa lepida* (Cramer) that damages ornamental trees: the seasonal and annual fluctuations of the cocoon density. *Japanese Journal of Environmental Entomology and Zoology* 19:115-124, 2008.
- Takakura, K., T. Nishida, T. Matsumoto, and S. Nishida: Alien dandelion reduces the seed-set of a native congener through frequency-dependent and one-sided effects. *Biological Invasions* 11:973-981, 2009.
- Tougou D., D. L. Musolin and K. Fujisaki: Some like it hot: Rapid climate change promotes shifts in distribution ranges of *Nezara viridula* and *Nezara antennata* (Heteroptera: Pentatomidae) in Japan. *Entomologia Experimentalis et Applicata* 130: 249-258, 2009

Yamasaki, A., K. Shimizu and K. Fujisaki (2009) Effect of host plant part on larval body-color polymorphism in the cotton bollworm, *Helicoverpa armigera* (Hubner)(Lepidoptera: Noctuidae). Annals of the Entomological Society of America 102(1): 76-84.

Yokoi, T. and K. Fujisaki: Hesitation behaviour of hoverflies *Sphaerophoria* spp. To avoid ambush by crab spiders. Naturwissenschaften 96: 195-200, 2009

Yoshimoto, J. and T. Nishida: Factors affecting behavioral interactions among sap-attracted insects. Annals of Entomological Society of America 102(2):201-209, 2009.

b) Conference and seminar papers presented

The 50th Annual Meeting of Japanese Society of Applied Entomology and Zoology: 15 presentations

The 53rd Annual Meeting of Ecological Society of Japan: 16 presentations

The 24<sup>th</sup> Annual meeting of Society of Population Ecology: 4 presentation

The 27<sup>th</sup> Annual meeting of Society of Animal Behavior: 6 presentations

The 68<sup>th</sup> Annual meeting of Japanese Society of Entomology: 3 presentations

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Fujisaki, K.: The Japanese Society of Applied Entomology and Zoology (President), Ohsaki, N.: The Japanese Society of Ethology (Editor)

Nishida, T.: The Entomological Society of Japan (Editor), British Ecological Society (Associate Editor)

#### ***Research Grant***

21st century COE program: Innovative food and environmental studies pioneered by entomomimetic sciences (Fujisaki, K. project leader)

Monbu-kagakusyo Research Grant: Scientific Research (C) (2) Effects of parasitoids on the evolution of host range of Pieris butterflies (Ohsaki, N.), Scientific Research: An integrated understanding of the risk of invasive species by reproductive interference (Nishida, T.), Scientific Research (C) Diversity and adaptive significance of domatia in Viburnum plants (Nishida, T.)

### **A-4. International cooperations and overseas activities**

#### ***Scholars from abroad***

COE foreign researcher (Russia, Argentina)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Insect ecology I (Fujisaki), Introduction to general bio-resource science IV (Fujisaki), Biology of biosphere (Fujisaki), Insect ecology II (Ohsaki), Readings in bio-resource science (Fujisaki), Laboratory course in bio-resource science I and II (Ohsaki, Nishida), Seminar in plant protection (Fujisaki, Ohsaki)

Graduate level: Population dynamics in insects (Fujisaki), Insect evolutionary ecology (Ohsaki),

Seminar in insect ecology (Fujisaki, Ohsaki), Research in insect ecology (Fujisaki, Ohsaki)

b) Open seminar

Multidisciplinary understanding of forests, rural areas, and sea from a view point of entomology.

Fourth open seminar at the Watch Tower, Kyoto University.

### **B-3. Overseas teaching**

*Students and research fellows from abroad*

Master course student: 1 (Honduras)

### **C. Other remarks**

Fujisaki, K.: The Steering Committee of Center for Ecological Research, Science Council of Japan (cooperative member), The assessment committee of specified experiments of Ministry of Agriculture, Forestry and Fishery, International Research Center for Japanese Studies

## 2.4.5 Laboratory of Insect Physiology

Staff      Professor                      : Sakuma, Masayuki, Dr. Agric. Sci.

Assistant Professor   : Fukui, Masao, Dr. Agric. Sci.

Students and research fellows

COE Postdoctoral Fellow: (1)

Doctor's program                : (4)

Master's program                : (1)

Undergraduate                   : (1)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects.

Despite the simple structure and organization, the insect interacts with complex environment by sophisticated behavior. We are studying the unique mechanisms of sensory-motor system of insects, aiming for bio-mimetic engineering as well as insect pest management. Current topics of our research are as follows.

##### a) Study on the spatial orientation mechanisms of insects

We have been, and still are, developing locomotion-compensator apparatus (LC), such as a servosphere LC, a micro LC, and a flight simulator, for precise analysis of sensori-motor context in insects and other arthropods. Since the apparatus confine a test insect at one spatial position owing to a mechanical or visual feedback system, cues can be presented to the freely walking animal in a controlled way. This enables us to analyse the algorithms of the insect orientation behavior.

The origin of chemo-orientation behavior in arthropods could be found in the mould mite, *Tyrophagus putrescentiae*, living in complete still air conditions. The mite in the micro LC exhibited characteristic turns, which returns the mite to the odorous zone, only after the cessation of an attractant odour. The context of odour exposure leading to the strategic turn is under investigation.

The german cockroach represents the odor conditioned anemotaxis toward an air stream laden with the aggregation pheromone. How the chemical cue modulates the mechanical sensation has been investigated by using a servosphere apparatus.

##### b) Study on the odor discrimination mechanisms in insects

Most insects have developed the olfactory system representing a great similarity to that of mammals. For the system analysis, it is advantageous to examine the neural network of insects rather than those of mammals, because of a reduced number of nerve cells in an insect brain. Although several models have been proposed for the information-processing algorithm, no decisive evidence has been presented yet. We are going to specify the model by measuring the process time of odor discrimination under task conditions in an American cockroach brain. We have developed an odor stimulator, which controls odorant concentration and stimulation time with millisecond accuracy.

##### c) Study on the semiochemicals of insects

The American cockroach is a model experimental animal in neurobiology as well as a notorious hygiene pest. Although its sex attractant pheromone was identified more than 30 years

ago, an aggregation pheromone has not been identified yet. We continue purifying the aggregation attractant pheromones of this species to isolate and identify the chemicals, not only for the application purpose but also for use in research.

d) Study on the evolution of signals relevant to sexual selection

Female preferences for “calling songs” in the crickets of genus *Teleogryllus* were examined. The songs of *Teleogryllus yezoemma* (*T<sub>y</sub>*), *T. emma* (*T<sub>e</sub>*), and *T. taiwanemma* (*T<sub>t</sub>*) were effective for species recognition and pre-mating isolation. Males of two allopatric species (*T<sub>y</sub>*, *T<sub>t</sub>*) with very similar songs were preferred by females of other species. *T<sub>e</sub>* males were discriminated by females of the two species. The male crickets produce “courtship songs” when mating. Playback trials with courtship songs revealed that *T<sub>y</sub>* females are attracted to the songs of partially sympatric species *T<sub>e</sub>* and its allopatric species *T<sub>t</sub>*. These results suggest that the courtship songs contribute little to species recognition at least by *T<sub>y</sub>*, and phylogenetic relationship between *T<sub>y</sub>* and *T<sub>t</sub>* is very close.

Male rice planthoppers of *Nephotettix* produce substrate-borne calling signals to communicate with a female on their host plants. After receiving a vibrational reply from a female responding to the signals, the calling male continues in a duet with the female. The function of the duet influencing pair formation has been studied from a perspective of sexual selection.

## A-2. Publications and presentations

a) Publications

### **Books**

Sakuma M. : Preface to the section three: Technology inspired by the structure and function of the insect. In: Entomomimetic sciences pioneering the future. (Fujisaki, K., Nishida, R. and Sakuma, M. eds.), p.309-320, Kyoto University Press, Kyoto, 2009 (in Japanese).

Sakuma M. : Insect searching behavior for odor source. In: Entomomimetic sciences pioneering the future. (Fujisaki, K., Nishida, R. and Sakuma, M. eds.), p.343-364, Kyoto University Press, Kyoto, 2009 (in Japanese)..

Okada, K. and M. Sakuma: Efficient odor information processing with a limited number of nerve cells. In: Entomomimetic sciences pioneering the future. (Fujisaki, K., Nishida, R. and Sakuma, M. eds.), p.365-388, Kyoto University Press, Kyoto, 2009 (in Japanese).

### **Original papers**

Moriyama, T., T. Kojima and M. Sakuma: Active antennal searching suggesting anticipatory capability in pill bugs (*Armadillidium vulgare*). International Journal of Computing Anticipatory Systems, 21: 37 - 44. Dubois, D.M. ed., Liège (ISSN 1373-5411), 2008.

Fukui, M.: Calling song preference in the field cricket *Teleogryllus taiwanemma*. Trans. Tech. Common. Psychol. Physiol. Acoust., The Acoustic Society of Japan. 38(3): 215-219, 2008.

b) Conference and seminar papers presented

The 12th International Society of Behavioral Ecology meeting (Cornell, Ithaca, 2008) : 1 poster presentation

The 53rd Annual Meeting of Japanese Society of Applied Entomology and Zoology (Sapporo. 2009): 4 presentations

The 56th Annual Meeting of Japanese Society of Applied Ecology (Morioka. 2009): 1 presentation

## A-3. Off-campus activities



### ***Research grants***

21<sup>st</sup> Century COE program: COE for Innovative Food and Environmental Studies Pioneered by Entomomimetic Sciences (Sakuma)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Courses given

*Undergraduate level:* Animal Physiology (Sakuma et al.), Outline of Bioresource Science IV (Sakuma et al.), Insect Physiology (Sakuma), Laboratory in Bioscience I, II (Sakuma and Fukui), Seminar in Plant Protection (Sakuma)

*Graduate level:* Seminar in Insect Physiology (Sakuma), Research in Insect Physiology (Sakuma), Insect Physiology Advanced Course (Sakuma), Applied Bioscience I (Sakuma et al.)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Fukui, M. Faculty of Engineering, Kyoto Sangyo University, (Fundamentals of Biological Experiments)

#### 2.4.6 Laboratory of Animal Breeding and Genetics

*Assistant Professor : Taniguchi, Yukio*

*Special research student : (1)*

### A-1. Main subjects

We had developed a genetic evaluation procedure using the restricted maximum likelihood (REML) method via average-information algorithm and the empirical best linear unbiased prediction (EBLUP) method, which is being used in the official genetic evaluation for Japanese native beef cattle, which is so-called Wagyu, in 42 prefectures. In recent years, because of rapidly increasing volumes of the official data sets and therefore larger memory spaces required, an alternative approach to the REML-EBLUP procedure has been necessary to be constructed. We then have developed a new genetic evaluation procedure using the Bayesian method. We have constructed the standard specification for estimating variance and covariance components and for predicting random effects employing the Bayesian framework via Gibbs sampling using the routine carcass field data in Wagyu cattle. Analyzing carcass records of approximately 400,000 Japanese Black fattening cattle and the pedigree records of about 600,000 animals with the current new procedure, it has been confirmed that the current procedure with relatively small memory requirement is quite valid as a national genetic evaluation procedure using large routine carcass data.

We are exploring beef marbling genes based on profiling information of differential gene expression pattern between the two groups of the high-marbled Japanese Black and the low-marbled Holstein steers. We have showed that +166 SNP in EDG1 gene, -652 SNP in TTN gene, and +22220 SNP in a novel gene MBL1 gene are associated with the breeding values for marbling trait in Japanese Black beef cattle, suggesting that these genes may be possible candidates for beef marbling genes. We tried to detect novel SNPs in 20 positional functional candidate genes other than EDG1, TTN, and MBL1, which exhibited differential gene expression pattern between the two groups, and to examine association of the SNPs with the breeding values for marbling trait. We here detected a total of 36 SNPs in the 20 genes. Among these SNPs, a -5354 SNP in the promoter region of RPL27A gene showed significant association ( $P < 0.05$ ) with the breeding values for marbling trait, by using Japanese Black sires and half-sib progeny of

superior sires, with the T allele over C at -5354 SNP resulting in high levels of marbling. We denied that the EDG1 +166 SNP is functional and a causal mutation for marbling, and found a novel SNP in the promoter region of EDG1 associated with marbling in Japanese Black beef cattle.

c) Study on the Molecular Mechanism Underlying Marbling in Beef

The expressions of matrix metalloprotease genes (MMP and ADAM family) in bovine muscle tissue were comprehensively analyzed, and expressions of 6 MMP genes and 9 ADAM genes were detected. Immunohistochemical analysis revealed that many of these proteases were located in intramuscular fat and/or blood vessels.

To establish the mouse model showing intramuscular fat deposition, transgenic mice expressing the bovine ADAM12 gene specifically in muscle tissue have been produced. In the analysis of the time course of intramuscular fat development, mature adipocytes were observed at 4 to 6 weeks of age.

d) Development of Markers Useful for Analysis of Genetic Diversity in Japanese Crested Ibis Population

It is desirable to incorporate marker information in the analysis of genetic diversity in Japanese crested ibis population in Sado Island. We tried to develop novel RFLP markers and to examine the applicability of known microsatellite markers predicted to be conserved in Japanese crested ibis, by utilizing genomic DNA from straw-necked ibis and white ibis or scarlet ibis, which are in most distant phylogenetic relationship among Threskiornithidae family. Among 32 genes obtained by retrieval of genomic database, RFLP markers located in intron region of 14 genes were PCR-amplified in both of straw-necked ibis and scarlet ibis, and suggested to be regarded as useful markers. Further, among wood stork-, roseate spoonbill-, scarlet ibis-, and black-faced spoonbill-derived microsatellite markers (11, 6, 10, and 23 markers, respectively), 1, 6, 9, and 15 markers, respectively, were PCR-amplified in both of straw-necked ibis and white ibis, and suggested to be regarded as useful markers.

## A-2. Publications and presentations

a) Publications

***Books***

Iwaisaki, H.: Summa Environments in Sado Island. Ed.: Working Group for Promotion of Ecological Education, Sado City Government, 2008.

***Original papers***

Yamada, T., S. Sasaki, S. Sukegawa, S. Yoshioka, Y. Takahagi, M. Morita, H. Murakami, F. Morimatsu, F.

Fujita, T. Miyake and Y. Sasaki: Association of a single nucleotide polymorphism in titin gene with marbling in Japanese Black beef cattle. BMC Res Notes 2;78, 2009

Kose, H., Y. Sado, T. Yamada and K. Matsumoto: Genetic mapping found major QTLs for antibody-induced glomerulonephritis in WKY rats. Exp Anim 58;193-198, 2009

Nakaoka, H., C. Gaillard, K. Fujinaka, N. Watanabe, M. Ito, K. Kawada, T. Ibi, Y. Sasae and Y. Sasaki: The use of link provider data to improve national genetic evaluation across weakly connected subpopulations. J Anim Sci 87;62-71, 2009

Yamada, T., M. Itoh, S. Nishimura, Y. Taniguchi, T. Miyake, S. Sasaki, S. Yoshioka, T. Fujita, K. Shiga, M. Morita and Y. Sasaki: Association of single nucleotide polymorphisms in the endothelial differentiation sphingolipid G-protein-coupled receptor 1 gene with marbling in Japanese Black beef cattle. Anim Genet 40;209-216, 2009

- Yamahira, K., T. Nishida, A. Arakawa and H. Iwaisaki: Heritability and genetic correlation of abdominal vs. caudal vertebral number in the medaka (*Actinopterygii: Adrianichthyidae*): genetic constraints on evolution of axial patterning?. *Biol J Linn Soc* 96; 867-874, 2009
- Arakawa, A. and H. Iwaisaki: REML estimation of genetic correlations between sexes on beef carcass traits using a procedure of the average information algorithm. *Jpn J Biometrics* 29; 97-110, 2008
- Kose, H., T. Yamada and K. Matsumoto: An OLETF allele of hyperglycemic QTL Nidd3/of is dominant. *Exp Anim* 57; 135-138, 2008
- Nakaoka, H., C. Gaillard, T. Ibi, Y. Sasae and Y. Sasaki: Adjusting for heterogeneity of variance for carcass traits affects single and multiple trait selections in genetic evaluation of Japanese Black cattle. *Anim Sci J* 79; 645-654, 2008
- Taniguchi, Y., K. Doronbekov, T. Yamada, Y. Sasaki, A. Takano and Y. Sugimoto: Genomic organization and promoter analysis of the bovine ADAM12 gene. *Anim Biotechnol* 19; 178-189, 2008

### ***Patents***

Patent pending/applied for

Patent no. 2009-038007 'SNP involved in bovine marking and its utilization', inventor: Yamada, T., T. Miyake, Y. Taniguchi, Y. Sasaki, M. Morita, S. Sasaki, H. Murakami, S. Sukegawa, Y. Takahagi, F. Morimatsu, T. Fujita, N. Watanabe, K. Shiga, registration date: Feb. 20, 2009

### ***Reviews***

- Yamada, T.: Genetic analysis: from laboratory animal to livestock. *Kansai Journal of Laboratory Animals* 30; 65-74, 2008
- Kose, H., T. Yamada and K. Matsumoto: Cloning of a gene responsible for T helper immunodeficiency in the LEC rat. *Journal of Animal Genetics* 36; 157-165, 2008

b) Conference and seminar papers presented

The 110th Annual Meeting of Japanese Society of Animal Science : 4 presentations

The 2009 Spring Meeting of Japanese Poultry Science Association : 2 presentations

The 9th Annual Meeting of Japanese Society of Animal Breeding and Genetics : 4 presentations

The 58th Annual Meeting of Kansai Animal Science Society : 1 presentation

## **A-3. Off-campus activities**

### ***Membership in academic societies***

Iwaisaki, H.: Japanese Society of Animal Science (Councilor)

Yamada, T.: Japanese Society of Animal Breeding and Genetics (director)

### ***Research grants***

Monbukagakusho Research Grants: Grant-in-Aid for Scientific Research (C) Developing a genetic evaluation system using the chromosome segment model (Iwaisaki), Grant-in-Aid for Scientific Research (C) Influence of global warming on age-change in geographical cline of elytra spots pattern genes in the multicolored Asian lady beetle *Harmonia axyridis* (Iwaisaki)

Research grant in collaboration with BIG Research Institute, Livestock Improvement Association of Japan, INC. and Nippon Ham Co. Ltd.: Identification of the genes associated with beef marbling and Development of technology for their application. (Head: Yamada, sharer:

Taniguchi)

Research aid from Japan Livestock Technology Association: Analysis of gene networks for beef marbling development using animal model. (Head: Yamada, sharer: Taniguchi)

Research aid from Japan Livestock Technology Association: Application of EDG1 genotyping to diagnosis for beef marbling. (Head: Yamada, sharer: Taniguchi)

#### **A-4. International cooperations and overseas activities**

##### ***International meetings (roles)***

10th World Conference on Animal Production, Cape Town (2 presentations: Iwaisaki, Arakawa)

##### ***Membership in academic societies (roles)***

Iwaisaki, H.: Asian - Australasian Association of Animal Production Societies (Associate editor)

#### **B. Educational Activities (2008.4-2009.3)**

##### **B-1. On-campus teaching**

###### **a) Courses given**

Undergraduate level: Outline of Bioresource Science II (Iwaisaki et al.), Applied Animal Genetics (Iwaisaki), Animal Breeding and Genetics (Iwaisaki, Yamada), Introduction to Foreign Literature in Bioresource Science II (Yamada et al.), Basic Laboratory Course in Bioresource Science I, II (Yamada, Taniguchi, et al.), Technology theory of Animal Husbandry and Practice II (Iwaisaki, Yamada, Taniguchi, et al.), Laboratory Course in Bioresource Science I, II (Yamada, Taniguchi, Miyake et al.), Cell Biology II (Yamada, et al.), Cell Biology III (Yamada, et al.), Seminar in Applied Animal Science I, II (Yamada et al.), Domestic Animal Genome Science Biotechnology (Yamada et al.),

Graduate level: Animal Breeding and Genetics (Iwaisaki), Seminar in Animal Breeding and Genetics (Iwaisaki, Yamada, Taniguchi), Laboratory Course in Animal Breeding and Genetics (Iwaisaki, Yamada, Taniguchi)

##### **B-2. Off-campus teaching, etc.**

###### ***Part-time lecturer***

Iwaisaki, H.: Faculty of Agriculture, Niigata University (Basic Concepts in Animal Genetics, Applied Animal Genetics); Faculty of Science, Niigata University (Genetics)

#### **C. Other remarks**

Iwaisaki, H.: Committee on wildlife conservation plan, Ministry of the Environment (Member); Committee on inspection of imported animal products, Ministry of Agriculture, Forestry and Fisheries (Member); Committee on research study project for utilization of genetic diversity in Wagyu cattle, National Beef Cattle Advancement Foundation Association (Member); Committees on the assessment (Member), on beef performance testing (Chairman), and on promotion of breeding (Chairman), Wagyu Cattle Registry Association; Committee on policy deliberation for “plan for promotion of producing value-added animal products”, Agriculture, Forestry and Fisheries Department, Kyoto Prefecture Government (Member).

Yamada, T.: Committee for National Bio-Resource Project “Rat” in Graduate School of Medicine, Kyoto University (Member), Committee on Promotion and Support of Establishment and

Maintenance for Bovine Superior Genetic Resource in Livestock Improvement Association of Japan, INC. (Member), Committee on Promotion of Achievement and utilization of Patent involved in Wagyu Resource in Japan Livestock Technology Association. (Member)

## 2.4.7 Laboratory of Reproductive Biology

*Staff      Professor                      : Imai, Hiroshi, Dr. Agric. Sci.*  
*Associate Professor: Yamada, Masayasu, Dr. Medic. Sci.*  
*Assistant Professor : Minami, Naojiro, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (3)                      Master's program : (6)*  
*Undergraduate     : (2)                      Research student : (1)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Development and Differentiation in Mammalian Embryos

The regulatory factors required for in vitro maturation, fertilization and development of eggs are studied. We found that IVM/IVF embryos require some unknown factors from follicle cells during maturation for their further development, so now we are focusing on elucidation of the molecular mechanisms of this intracellular communication between oocytes and follicle cells. In addition, genes and proteins that are involved in the preimplantation development and differentiation are also studied using mouse embryo culture system.

##### b) Production of clone animals derived from somatic cells

It has become possible to produce clone animals derived from differentiated somatic cells using nuclear transfer technique, however, it is still unknown how can differentiated cells acquire totipotency during development. In addition, the great majority of reconstituted embryos die after nuclear transfer without involvement of ontogenesis. In our laboratory, reprogramming mechanisms of differentiated cells and embryonic anomaly during embryogenesis are examined using cell and molecular biological techniques.

##### c) Establishment of germ-line stem cells and their use for producing transgenic animals

Development of techniques to establish embryonic and spermatic stem cells having pluripotency is undertaken. Reconstitution of embryos and production of transgenic animals using the stem cells are studied. We are intending to utilize embryonic stem cells to apply transgenic technique for improvement of livestock animals.

#### A-2. Publications and presentations

##### a) Publications

###### *Original papers*

- Miyamoto K., Yamashita T., Tsukiyama T., Kitamura N., Minami N., Yamada M. and Imai H.: Reversible Membrane Permeabilization of Mammalian Cells Treated with Digitonin and Its Use for Inducing Nuclear Reprogramming by Xenopus Egg Extracts. *Cloning Stem Cells.*, 10: 535-542. (2008)
- Fujihara M., Goel S., Minami N., Yamada M. and Imai H.: Cryopreservation in liquid nitrogen of gonocytes from neonatal porcine testes stored at 4°C. *Reprod. Med. Biol.*, 7: 153-160. (2008)
- Goel S, Fujihara M, Minami N, Yamada M, Imai H.: Expression of NANOG, but not POU5F1, points to the stem cell potential of primitive germ cells in neonatal pig testis.

Reproduction, 135: 785-795. (2008)

Miyamoto K, Tsukiyama T, Yang Y, Li N, Minami N, Yamada M, Imai H.: Cell-Free Extracts from Mammalian Oocytes Partially Induce Nuclear Reprogramming in Somatic Cells. Biol Reprod., in press. (2009)

### ***Review***

Oishi R, Imai H, and Yamada M., Recent findings of in vitro maturation of mammalian oocytes, Jpn. J. Embryo Transfer, 30: 87-98. (2008)

### ***Books***

Yamada M., Developmental Biology, ed. by Murai K., Kagaku-Dojin Publishing Co., Inc., (2008)

b) Conference and seminar papers presented

The 101<sup>th</sup> Annual Meeting of Japanese Society of Animal Reproduction: 3 presentations

49<sup>th</sup> Annual Meeting of Japanese Society of Mammalian Ova Research, 1 presentation

The 15<sup>th</sup> Annual Meeting of Japanese Embryo Transfer Society: 2 presentations

The 133<sup>th</sup> Annual Meeting of Japanese Society of Fertility and Sterility (Western Branch): 2 presentations

## **A-3. Off-campus activities**

### ***Membership in academic societies***

Imai, H.: Japanese Society of Animal Reproduction (Director), Japan Embryo Transfer Society (Vice President, Director), Japan Society for Reproductive Medicine (Director), Japan Society of Fertilization and Implantation (Director), Japanese Society of Zootechnical Science (Councilor), Kansai Society of Zootechnical Science (Councilor), Japanese Society of Reproductive Endocrinology (Councilor)

Yamada, M.: Japan Society for Reproductive Medicine (Councilor), The Japanese Society of Animal Reproduction (Councilor), Japan Embryo Transfer Society (Officer and Editorial Board),

Minami, N.: The Japanese Society of Animal Reproduction (Editorial Board), Japan Embryo Transfer Society (Officer), Japan Society for Reproductive Medicine (Deputy • Officer)

### ***Research grants***

Monbusho Research Grants, Grant-in-Aid for Scientific Research (B)(2): Functional analysis of a Oog1 and molecular basis of zygotic gene activation in the mouse (Head: Minami), Grant-in-Aid for Exploratory Research: Creation of mono-sexual animal using haploid-specific gene expression during spermatogenesis in mammals (Head: Minami),

Research project for the construction of management system for distribution of semen in Japanese Black cattle (Head: Imai, Sharer: Minami)

## **A-4. International cooperation and overseas activities**

### ***International meetings (roles)***

41<sup>st</sup> Society for the Study of Reproduction, Cona (1 presentation: Imai, Yamada, Minami)

16<sup>th</sup> International Congress on Animal Reproduction, Budapest (1 presentation: Imai, Minami)

International Congress of Animal Reproduction (Imai, Executive committee member), Molecular Reproduction and Development (Imai: Editorial Board)



## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Outline of Bioresource Science III (Imai et al), Developmental and Reproductive Technology (Yamada), Introduction to Animal Science Literature I (Yamada and Moriya), Methods and Techniques in Animal Reproduction Experimentation (Imai, Yamada, Minami), Biotechnology (Yamada et al), Reproductive Physiology (Minami), Pocket seminar (Minami)

Graduate level: Advanced Course of Reproductive Physiology (Imai), Reproductive Physiology-Seminar (Imai, Yamada, Minami), Laboratory Course in Reproductive Physiology (Imai, Yamada, Minami), Genetic Engineering in Developmental Biology (Yamada)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecture***

National Livestock Breeding Center (Imai)

Osaka City University Medical School (Yamada)

#### ***Open seminar, etc***

Imai, H.: Symposium of the Society of Artificial Insemination in Domestic Cattle, Current status and problem on preservation of genetic resources in Wagyu – The Management system for semen distribution in Japanese Black cattle.

Minami, N.: 2<sup>nd</sup> Academic Symposium (Kinki University) “New Trend in Animal Biotechnology” -Challenge in Clone, Reproduction and Regeneration-

### **B-3. Overseas teaching**

#### ***Lecture and seminars***

Students and research fellows from abroad

Graduate Student: 2 (China, Korea)

### **C-1. Other remarks**

Imai, H.: Committee of Research Investigation of, Agriculture, Forestry and Fisheries Technical Information Society, Committee of Kyoto University Livestock Farm, Assessment Committee of Project Research of Ministry of Agriculture, Forestry and Fisheries, Assessment Committee of Research Grant of Ministry of Agriculture, Forestry and Fisheries, Member of Administration Committee of Human Genome and Gene Analysis of Kyoto University

Yamada, M.: Guest Researcher of Gifu Prefectural Livestock Institute, Guest Researcher of Toyama Prefectural Agriculture Research Center

Minami, N.: Guest Researcher of National Institute of Radiological Sciences

# Chair of Animal Anatomy, Nutrition and Resources

## 2.4.8 Laboratory of Nutritional Science

*Staff*      *Professor*                      : Matsui, Tohru, Dr. Agric. Sci.  
                 *Associate Professor*: Funaba, Masayuki, Dr. Agric. Sci.  
                 *Assistant Professor* : Kawachi, Hiroyuki, Dr. Eng.

*Students and research fellows*

*Doctor's program* : (3)  
*Master's program* : (7)  
*Undergraduate*    : (4)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Mineral nutrition and metabolism

We study mineral nutrition and metabolism in animals using animals and cultured cells. Our goal is to develop optimal supply of minerals for animal production and health. This year, by use of stable isotope of magnesium, we focused to examine absorption of magnesium from drinking in rats suppressed absorption of magnesium in diet. It was clarified that intestinal absorption of feed magnesium as well as magnesium in drinking was decreased with age.

##### b) Vitamin nutrition and function

We study vitamin nutrition and metabolism in animals using animals and cultured cells. Our goal is to develop optimal supply of vitamins for animal production and health. This year, we focused to examine plasma concentrations of anti-oxidative vitamins in horses and cattle. Following points were clarified; 1) plasma concentrations of anti-oxidative vitamins including vitamin C in horses were lower in winter and higher in summer, 2) plasma concentrations of vitamin C were decreased in cattle after middle phase of fattening, and supplementation of vitamin C recovered the concentrations.

##### c) Roles of the TGF- $\beta$ family in mesenchymal cells

Members of the TGF- $\beta$  family regulate cell growth and differentiation. We study function and signal transduction of the TGF- $\beta$  family in mesenchymal cells in muscle and fat. Our goal is to provide basic information on animal growth. This year, we focused to examine factors affecting myoblast differentiation and expression of the TGF- $\beta$  family in myoblasts. It was clarified that oxidative stress inhibited differentiation of myoblasts, and simultaneously up-regulated expression of inhibin/activin  $\beta$ B, a member the TGF- $\beta$  family.

#### A-2. Publications and presentations

##### a) Publications

*Original papers*

- Chu, G.M., M. Komori, A. Nakayama, M. Asanagi, H. Yano and T. Matsui: Efficacy of a genetically modified yeast phytase on phosphorus bioavailability in a corn-soybean meal based diet for growing pigs. *Anim Sci J* 79; 466-471, 2008
- Ohata, A., S. Takasugi and T. Matsui: Magnesium supplementation did not affect the increasing bone zinc concentration in rats given excess calcium as carbonate. *Biol Trace Elem Res* 125; 179-184, 2008
- Ohashi, T., T. Matsui, M. Chujo and M. Nagao: Restraint stress up-regulates expression of zinc transporter Zip14 mRNA in mouse liver. *Cytotechnology* 57: 181-185, 2008
- Nakaya, K., M. Murakami and M. Funaba: Regulatory expression of Brachyury and Goosecoid in P19 embryonal carcinoma cells. *J Cell Biochem.* 105; 801-813, 2008
- Inoue, Y., A. Matsui, Y. Asai, F. Aoki, K. Yoshimoto, T. Matsui and H. Yano: Response of biochemical markers of bone metabolism to exercise intensity in Thoroughbred horses. *J Equine Sci* 19; 83-89, 2008
- Takasugi, S., T. Matsui and H. Yano: Iron supplementation by intraperitoneal injection eliminates the accumulation of hepatic copper induced by excess calcium in rats. *Br J Nutr* 13: 1-6, 2008
- Chu G.M., M. Komori, R. Hattori and T. Matsui: Dietary phytase increases the true absorption and endogenous fecal excretion of zinc in growing pigs given a corn-soybean meal based diet. *Anim Sci J* 80: 46-51, 2008
- Smith, S.B., H. Kawachi, C.B. Choi, C.W. Choi, G. Wu and J.E. Sawyer: Cellular regulation of bovine intramuscular adipose tissue development and composition. *J Anim Sci* 87; E72-E82, 2008
- Kaneko, M., J. Ishihara, Y. Asami and M. Funaba: Relationship between base excess of dry dog food and urine pH. *J Pet Anim Nutr* 11; 61-65, 2008 (in Japanese)
- Furutani, Y. and T. Matsui: The effect of pair-feeding or magnesium and calcium deficiency on insulin sensitivity in rats. *Trace Nutrients Res* 25; 57-60, 2008 (in Japanese)
- Suenaga, M., H. Kawachi and T. Matsui: Molecular mechanisms of ascorbate phosphate on differentiation in 3T3-L1 preadipocytes. *Trace Nutrients Res* 25; 61-64, 2008 (in Japanese)

b) Conference and seminar papers presented

- The 110th Meeting of Japanese Society of Animal Science: 4 presentations
- The 58th Meeting of Kansai Animal Science Society: 1 presentation
- The 21th Meeting of Japanese Society of Equine Science: 1 presentation
- The 25th Meeting of Japan Trace Nutrients Research Society: 2 presentations
- The 47th Meeting of Japanese Society of Nutrition and Food Science: 1 presentation
- The 28th Meeting of The Japanese Society for Magnesium Research: 2 presentations
- The 31th Meeting of The Molecular Biology Society of Japan: 3 presentations
- The 48th Meeting of The American Society for Cell Biology: 2 presentations

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

- Matsui, T.: Japanese Society of Animal Science (Editor), Japanese Trace Nutrient Research Society (Director, Editor), Japanese Society for Magnesium Research (Councilor, Editor),

Japanese Society of Animal Nutrition and Metabolism (Councilor, Editor), Japanese Association of Pet Animal Nutrition (Director, Editor), Society of Beef Cattle Science (Councilor), Kansai Society of Animal Science (Editor), Japanese Society of Nutrition and Food Science-(Councilor), Japanese Society of Nutrition and Food Science-Kinki Section (Councilor)

Funaba, M.: Japanese Association of Pet Animal Nutrition (Editor)

#### ***Research grants***

Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science: Grant-in-Aid for Scientific Research (C), Role of the TGF- $\beta$  family during differentiation from embryonic stem cells to mesodermal cells (Funaba, head), Grant-in-Aid for Scientific Research (C), Screening of novel ingredients from feedstuffs for high-quality beef production (Kawachi, head)

Collaboration Research Grant: Research Grant in collaboration with Japan Racing Association, Evaluation and improvement of vitamin K nutrition in horses with age (Matsui, head)

The Science Research Promotion Fund from The Promotion and Mutual Aid Corporation for Private Schools of Japan: Comprehensive understanding of the TGF- $\beta$  family signaling (Funaba, member)

Research Project for Utilizing Advanced Technologies in Agriculture, Forestry and Fisheries: Development of palatable beef by integration of breeding information (Kawachi, member)

### **A-4. International cooperations and overseas activities**

#### ***International joint researches, overseas research surveys***

Kawachi, H.: Difference of American Wagyu and Angus cattle (Texas A&M, USA)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Basic Bioresource Science (Matsui et al), Cell Biology I (Matsui et al), Outline of Bioresource Science II (Matsui et al), Animal Physiology (Matsui et al), Animal Nutrition (Matsui), Physiological Nutrition of Animals (Funaba), Fundamentals for the Experiments for Bioresource Science (Matsui, Kawachi et al), Laboratory Course in Bioresource Science I and II (Matsui, Funaba, Kawachi et al), Introduction to Foreign Literature in Bioresource Science II (Funaba et al), Seminar for Applied Animal Science I and II (Funaba et al)

Graduate level: Seminar in Nutritional Science of Animals (Matsui, Funaba and Kawachi), Laboratory Course in Nutritional Science of Animals (Matsui, Funaba and Kawachi), Metabolism and its Regulation of Animals (Funaba)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Matsui, T.: School of Environmental Science, University of Shiga Prefecture (Environmentology for Animal Production)

## **C. Other remarks**

Matsui, T.: Committee on Standard Methods for Feed Analyses, Fertilizer and Feed Inspection Services (Member). Subcommittee of Agricultural Industry, Evaluation Committee of Incorporated Administrative Agency, The Ministry of Agriculture, Forestry and Fishery (Specialist). Japanese Committee on ISO TC34/SC10, The Ministry of Agriculture, Forestry and Fishery (Specialist), Committee on Preparation of Tables of Feed Composition for Animals, The Ministry of Agriculture, Forestry and Fishery (Member).

Funaba, M.: Collaborative researcher at Azabu University Institute of Bioscience, Technical adviser of Narc Corporation

## 2.4.9 Laboratory of Animal Physiology and Functional Anatomy

*Staff Professor : Kume, Shin-ichi, Dr. Agric. Sci.*

*Assistant Professor : Sugimoto, Miki, Dr. Agric. Sci.*

*Assistant Professor : Ikeda, Shuntaro, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's Program : (1)*

*Master's Program : (8)*

*Undergraduate : (1)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

- a) The effect of functional food ingredients and endocrine disruptors on physiology, immune and reproductive functions.

Human foods and livestock feeds contains a variety of ingredients that improves reproduction and immune functions. On the other hand, endocrine disruptors can bind to nuclear receptors including estrogen receptors and interfere with the reproductive functions in animals. We have been evaluating the effects of these substances on the biological functions in mammals and developing a method for effective utilization of functional ingredients.

- b) The effect of global warming and environmental loading substances on physiology and productivity of mammals

Animals convert ingested feed into heat energy and maintain their body temperature by homeostasis, while they yield livestock products for human food. Global warming, however, impairs the physiology and productivity of mammals. Effects of heat stresses on metabolism at the organ- to whole-body levels are being examined using biochemical and pathological techniques. In addition, methods for effective utilization of energy and materials upon environmental changes are being developed.

- c) Functional morphology of mammalian reproduction and its regulation mechanism

Domestic animals with high productivity often have low reproductive ability. We are analyzing the factors involved in different processes in mammalian reproduction and are developing techniques for efficient utilization of germ cells and for avoidance of reproductive disorders.

#### A-2. Publications and presentations

- a) Publications

##### *Original papers*

Nishioka, T., Y. Ishizuka, K. Yasumatsuya, S. Kume and M. Irie: Effects of carcass and physiochemical fat traits on carcass price of Japanese Black cattle Nihon Chikusan Gakkaiho 79; 515-525, 2008 (in Japanese).

Kume, S., K. Numata, Y. Takeya, S. Miyagawa, S. Ikeda, M. Kitagawa, K. Nonaka, T. Oshita and T. Kozakai: Evaluation of urinary nitrogen excretion from plasma urea nitrogen in dry and lactating cows. Asian-Aust.J.Anim.Sci. 21; 1159-1163, 2008

Kume, S., K. Nonaka, T. Oshita, T. Kozakai and H. Hirooka: Effects of urinary excretion

of nitrogen, potassium and sodium on urine volume in dairy cows. *Livestock Science* 115; 28-33, 2008

Murai, I., S. Imanishi, M. Sugimoto and S. Kume: Effects of high KCl supplementation on growth rate and renal function in mice. *Animal Science Journal* 79; 243-247, 2008

### ***Patents***

Patent pending/applied for

No. 2009-037625 Medium composition for artificial insemination and in vitro fertilization. inventor: Namekawa, T., A. Suzuki, S. Ikeda, M. Sugimoto and S. Kume, patentee: Kyowa Hakko Bio Co., Ltd., registration date: Feb. 20, 2009

### ***Reports***

Kume, S and J.Takahashi: The Role of Greenhouse Gases and Animal Agriculture (GGAA) on the Climatic Change and Livestock Agriculture in Japan. 215-234. Proc. International Symposium on Measures to Climatic Change in Agricultural Sector. Korea. 2008.

b) Conference and seminar papers presented

The 13th Animal Science Congress of the Asian -Australasian Association of Animal Production Societies(AAAP) : 2 presentations

The 58th Meeting of Kansai Society of Animal Science: 1 presentation

The 101th Annual Meeting of Japanese Society of Animal Reproduction: 1 presentation

The 110th Meeting of Japanese Society of Animal Science: 1 presentation

The 41st Annual Meeting of the Society for the Study of Reproduction : 1 presentation

The 35th Annual Conference of the International Embryo Transfer Society : 1 presentation

## **A-3. Off-campus activities**

### ***Membership in academic societies***

Kume, S.: Japanese Society of Animal Science (Councilor), Kansai Society of Animal Science (Vice President), Japanese Society of Equine Science (Editor), Japanese Society of Animal Nutrition and Metabolism (Councilor)

### ***Membership in Science Council of Japan etc.***

Kume, S.: Science Council of Japan (Associate member)

### ***Research grants***

Kume, S.: Grant-in-Aid for Scientific Research from the Japanese Society for Promotion of Science (B) (Kume Sharer), Research project for utilizing advanced technologies in agriculture, forestry and fisheries (Kume Head), Research Grant in collaboration with Japan Racing Association (Kume Head)

Sugimoto, M: Research Grant in collaboration with Japan Racing Association (Kume Head, Sugimoto Sharer)

Ikeda, S.: Grant-in-Aid for Young Scientists from Monbu Kagakusho (B) (Ikeda Head)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Outline of Bioresource Science II (Kume et al.), Animal Physiology (Kume et al.), Animal Physiology and Anatomy (Kume), Introduction to Foreign Literature in Bioresource Science II (Sugimoto et al.), Laboratory Course in Bioresource Science I and II (Sugimoto, Ikeda et al.), Animal Environmental Physiology (Kume), Livestock Production Techniques and Practice II (Kume et al.), Seminar for Applied Animal Science I and II (Sugimoto et al.)

Graduate level: Animal Physiology and Anatomy (Kume), Seminar in Animal Physiology and Anatomy (Kume, Sugimoto, Ikeda), Laboratory Course in Animal Physiology and Anatomy (Kume, Sugimoto, Ikeda)

**C. Other remarks**

Kume, S.: Subcommittee of Japanese Standard for Beef Cattle (member), Agricultural Establishment Research Committee of Kinki, Chugoku, Shikoku Region in National Agriculture and Bio-oriented Research organization (member).



## 2.4.10 Laboratory of Animal Husbandry Resources

*Staff Professor : Hirooka, Hiroyuki, D. Agric. Sci.*

*Associate Professor: Kumagai, Hajime, D. Agric. Sci.*

*Assistant Professor : Oishi, Kazato, MSc. Agric. Sci.*

*Postdoctoral fellow: Yousuke, Choumei*

*Students and research fellows*

*Doctor's program: (4)*

*Master's program: (5)*

*Undergraduate : (2)*

*Research student: (2)*

### **A. Research Activities (2008.4-2009.3)**

#### **A-1. Main subjects**

a) Total evaluation for animal production systems.

Data and information on genetic performance, nutrition, management and economic situations for beef, dairy, pigs, sheep and goats were collected from various research fields concerning animal sciences in order to evaluate total animal production systems. Modeling and simulation of such systems were carried out.

b) Studies on livestock production systems in tropical areas.

Surveys have been conducted to investigate various performances of native livestock, nutrient requirements of the livestock, feeding system, quality of feeds and grassland production in tropical areas. Such information will be used to search better strategies for improving the existing systems. Sustainable farming systems integrated between livestock and crops in smallholders in the developing countries were evaluated through modeling works. The surveys have been conducted in the south area of Thailand and in the central area of Nepal.

c) Studies on environmental problems in animal production.

Since animal industries have been specialized and scaled up, environmental pollution caused by such animal industries led to serious problems in society in Japan. Models for predicting excretion of nitrogen and phosphorus from animal production systems were developed and a country-wide fact-finding studies of the connection between crop and animal industries were performed in order to define the role of animal industry in establishing a sustainable agriculture.

d) Studies on effective utilization of unused resources as fodders of animals.

Use of by-products as feeds of ruminants have been considered as one of the ways to do resources recycling effectively. Therefore, evaluation of several by-products as feed resources, development of organic, chemical and physical treatments to improve forage quality of the by-products, and use of forages made from the by-products in dairy cattle and beef cattle productions have been carried out. The by-products included woody resources such as bamboos, residues of Yam production, fermented by-products, etc.

e) Other themes.

Evaluation for production system of grazing animals using GPS and GIS, Studies on conservation of useful genes, evaluation of similarity of clones, ethical studies about advanced reproductive technologies, theoretical studies on system analysis and statistics, anthropological

studies on ways of use of milk and meat, economical studies on consumption of animal products, setting of breeding objectives, etc.

## **Publications and presentations**

### **a) Publications**

#### ***Books***

- Kumagai, H: Section 8 Utilization of residues for animal feeding and reduction of environmental load – focus on using foliage of *Discorea*. Construction of sustainable production system and its assessment for production systems aiming to crop and animal integration (edited by Hirooka, H., S. Kume, T. Mato and T. Inamura), Agriculture and Forestry Statistics Publishing Inc., Tokyo, 2009 (in Japanese)
- Kitagawa, M. and Y. Tabata: Section 3 Farm level resources cycling and assessment of environmental load. Construction of sustainable production system and its assessment for production systems aiming to crop and animal integration (edited by Hirooka, H., S. Kume, T. Mato and T. Inamura), Agriculture and Forestry Statistics Publishing Inc., Tokyo, 2009 (in Japanese)
- Hirooka, H., Section 2 Environmental load and basic unit in animal husbandry. Construction of sustainable production system and its assessment for production systems aiming to crop and animal integration (edited by Hirooka, H., S. Kume, T. Mato and T. Inamura), Agriculture and Forestry Statistics Publishing Inc., Tokyo, 2009 (in Japanese)
- Hirooka, H., S. Kume, T. Mato and T. Inamura: Construction of sustainable production system and its assessment for production systems aiming to crop and animal integration, Agriculture and Forestry Statistics Publishing Inc., Tokyo, 2009 (in Japanese)
- Hirooka, H: Section 1 1.3. Protein, Section 7 Calculation formula of nutrition demand. Japanese feeding standard for beef cattle (2008), Japan Livestock Industry Association, Tokyo, 2009 (in Japanese)

#### ***Original papers***

- Tsukahara, Y., Y. Choumei, K. Oishi, H. Kumagai, A.K. Kahi, J.M. Panadam, T.K. Mukherjee and H. Hirooka: Effect of parental genotypes and parental heterosis on litter traits in crossbred goats. *Journal of Animal Breeding and Genetics* 125; 84-88, 2008
- Nishio, M., A.K. Kahi and H. Hirooka: Economic implications of using Japanese Black sires carrying recessive genes associated with genetic defects. *Animal* 2.7; 1013-1018, 2008
- Choumei, Y., K. Mori, T. Senda, M. Kinoshita, M. Ito, T. Kurahara and H. Hirooka: Effects on carcass traits by individual attributions and management awareness of beef cattle producers – a case study of private managements in Oita prefecture. *Nougyou Keiei Kenkyu* 46(1); 53-58, 2008 (in Japanese)
- Tsukahara, Y., Y. Choumei, K. Oishi, A.K. Kahi, J.M. Panadam, T.K. Mukherjee and H. Hirooka: Analysis of growth patterns in purebred Kambing Katjang goat and its crosses with the German Fawn. *Small Ruminant Research* 80; 8-15, 2008
- Ogino A., M. Ishida, T. Ishikawa, A. Ikeguchi, M. Waki, H. Yokoyama, Y. Tanka and H. Hirooka: Environmental impacts of a Japanese dairy farming system using whole-crop rice silage as evaluated by life cycle assessment. *Animal Science Journal* 79; 727-736, 2008
- Tabata, Y., M.K. Shah, N.R. Devkota, S.K. Shah, H. Hirooka and H. Kumagai: Monthly changes in major mineral contents of feed in dairy farms in South-Valley of Nepal. *Trace*

Nutrients Research 25; 51-56, 2008 (in Japanese)

Takeuchi, K., Y. Tabata, Y. Choumei, H. Kumagai, K. Sato and H. Hirooka: Influence on availability of nitrogen, phosphorus and potassium in beef cattle breeding farms by producing rice crop forage. Nikuyougyu Kenkyukaihou 86; 14-21, 2008 (in Japanese)

Ieiri, S., T. Nomura and H. Hirooka: A comparison of restricted selection procedures to control genetic gains in closed herds of Swine. Nihon Youton Gakkaihou 45; 193-200, 2008 (in Japanese)

Hirooka, H., T. Ishikawa, K. Kusa and M. Ishida: Modeling approach for nitrogen use efficiency and cycling in beef cow-calf production systems integrated with forage rice production. Nihon Chikusan Gakkaihou 80; 17-25, 2009 (in Japanese)

Kikuhara, K. and H. Hirooka: Application of a simulation model for dairy cattle production systems integrated with forage crop production: the effects of whole crop rice silage utilization on nutrient balances and profitability. Asian-Australasian Journal of Animal Science 22; 216-224, 2009

Kikuhara, K., H. Kumagai and H. Hirooka: Development and evaluation of a simulation model for dairy cattle production systems integrated with Forage crop production. Asian-Australasian Journal of Animal Science 22; 57-71, 2009

b) Conference and seminar papers presented

The 46th Annual Meeting of Society of Beef Cattle Science: 2 presentation

The 58th Annual Meeting of Association for Regional Agricultural and Forestry Economics: 1 presentation

The 110th Annual Meeting of Japanese Society of Animal Science: 5 presentations

The Annual Meeting of Japanese Agricultural Systems Society in spring symposium of 2008: 1 presentation

The 9th Annual Meeting of Japanese Society of Goats: 1 presentation

The 25th Annual Meeting of Japanese Trace Nutrients Research Society: 1 presentation

The 9th International Conference on Goats: 1 presentation

The 13th Animal Science Congress of the Asian Australasian Association of Animal Production Society: 5 presentations

The 12th International Grassland Congress and the 8<sup>th</sup> International Rangeland Congress: 1 presentation

**A-3. Off-campus activities**

***Membership in academic societies***

Hirooka, H.: Japanese Society of Animal Science (Representative), Japanese Agricultural System Society (Director, Editor), Kansai Society of Animal Science (Councilor), Society of Beef Cattle Science (Councilor), Japanese Society of Animal Breeding and Genetics (Editor), Japanese Animal Production System Society (Councilor)

Kumagai, H.: Society of Beef Cattle Science (Editor), Japanese Animal Production System Society (Secretary)

Oishi, K.: Kansai Society of Animal Science (Accounting), Japanese Animal Production System Society (Secretary)

***Research grant***

Hirooka, H.: Monbushou Research Grants: Grant-in-Aid for Scientific Research (B): Studies on development and evaluation of environmentally sound animal production systems aiming to crop and animal integration (Head: Hirooka, Part: Kumagai, Oishi), Promotion Research: Studies on the use of genetic information in animal production sites in post-genomic era (Head: Hirooka, Part: Kumagai, Oishi), Other Research Grants: Research aid from National Agriculture and Food Research Organization: Development of Japanese animal production system providing large amounts of forage, Agriculture & Livestock Industries Corporation: Studies on establishment of beef production systems which utilize domestic forages (Head: Hirooka)

Kumagai, H.: Monbushou Research Grants: Grant-in-Aid for Scientific Research (B) for foreign studies: Evaluation of the relationships among production efficiency, nutrient use efficiency and plane of nutrition for indigenous cattle in South-East Asia. (Head: Kumagai, Part: Hirooka, Oishi)

Oishi, K.: Monbushou Research Grants: Grant-in-Aid for Young Scientists (B): The grazing animal and native grassland: quantification of animal productivity and control of native grassland under grazing production system (Head: Oishi)

#### **A-4. International cooperation and overseas activities**

### **B. Educational Activities (2008.4-2009.3)**

#### **B-1. On-campus teaching**

##### **a) Courses given**

Undergraduate level: Outline of Bioresource Science II (Hirooka et al.), Production of Animal Husbandry Resources (Hirooka), Fundamentals for the Experiments of Bioresource Science (Kumagai et al.), Introduction to Foreign Literature in Bioresource Science II (Kumagai et al.), Laboratory Course in Bioresource Science I, II (Kumagai, Oishi et al.), Applied Animal Sciences (Kumagai et al), Seminar in Applied Animal Science I, II (Kumagai, Oishi et al.), Livestock Production Techniques and Practice II (Hirooka et al.)

Graduate level: Seminar of Animal Husbandry Resources (Hirooka, Kumagai, Oishi), Laboratory Course of Animal Husbandry Resources (Hirooka, Kumagai, Oishi), System Science for Animal Production (Hirooka), Livestock Production and Technology in Overseas (Kumagai)

#### **B-3. Overseas teaching**

##### ***Students and research fellows from abroad***

Doctor course student: 1 (Honduras)

Master course student: 1 (Indonesia)

Special research student: 1 (Indonesia)

#### **C. Others**

## Chair of Marine Biological Resources

### 2.4.11 Laboratory of Fisheries and Environmental Oceanography

*Staff      Professor                      : Fujiwara, Tateki, Dr. Agric. Sci*

*Associate Professor: Kasai, Akihide, Dr. Agric. Sci.*

*Assistant Professor : Kobayashi, Shiho, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (1)*

*Master's program : (7)*

*Undergraduate : (4)*

#### **A. Research activities (2008.4-2009.3)**

##### **A-1. Main subjects**

a) Analysis of the mechanism maintaining high productivity of coastal seas

Coastal seas are highly productive areas. To reveal mechanisms maintaining this high productivity and to find effective measures to sustain this productivity, we are studying nutrient dynamics in coastal areas. In recent years, shortage of nutrients has become prominent and economically damaged to the aquaculture of seaweed. We are trying to quantify the amount of nutrient input both from outer sea and rivers, elucidate nutrient dynamics in coastal seas, and develop a three-dimensional numerical model consisting of hydrographical and biological parts. Using this model, we aim to determine the adequate anthropogenic load which sustains both abundant biological production and preferable water quality. This year, dynamics of carbon, as well as those of nitrogen and phosphorous, has been elucidated.

b) Study on eutrophication and hypoxia in semi-enclosed coastal seas

Excess amount of loads of anthropogenic nitrogen and phosphorus flowing into Ise Bay, Tokyo Bay and Seto Inland Sea causes eutrophication and hypoxia in these seas. Basin-scale mechanisms generating hypoxic water mass have been studied. This year, we have studied on hypoxia in harbors which are important as water amenity zone.

c) Analysis of long term variability in coastal water qualities

To restore water qualities in semi-enclosed coastal seas (Ise Bay, Tokyo Bay and Seto Inland Sea), reduction of anthropogenic loads of organic matter (COD), phosphorus and nitrogen have been conducted for more than 30 years. Owing to these measures, near-shore water quality has been significantly improved. However, water qualities in basin-wide scale (WQBS) are still deteriorated. We gathered data of water qualities, hydrographic parameters and meteorological parameters over 20 ~ 30 years to make data-base. It was revealed that WQBS is not correlated with the amount of pollutant loads, but varies in relation to hydrographic and meteorological conditions. In Seto Inland Sea, variations in WQBS are governed mainly by the through flow of SIS.

d) Analysis of marine Ecosystem

Marine food webs have been analyzed by stable isotope ratio of nitrogen and carbon in

muscular tissue of marine animals and particulate organic matter. Depending on the habitat environments, some bivalves can digest terrestrial organic matter, while others mainly digest only phytoplankton or benthic micro algae which are produced in the sea. It is found that most animals in estuaries digest marine produced organic matter but cannot digest terrestrial matter. It is likely that there are a few key species, which support food webs in coastal areas. The biomass of the species can determine the whole production and biomass of higher trophic levels in coastal areas.

e) Modeling physical-biological interaction in coastal waters

The needs to understand the integrated physical-biological functioning of marine ecosystem are increasing in response to the concern about the depletion of living marine resources both in local and global scales. In coastal regions, horizontal flow systems such as density-driven circulations largely control water mass structure and hence biological productivity. Nutrient dynamics in the Seto Inland Sea in a large scale have been investigated, focusing on the mechanism of the variation of density-driven circulation and its impact. 30-year variation of nutrient transport has been simulated using coupled physical-biological and the model applied to predict the productivity of seaweeds.

## A-2. Publications and presentations

a) Publications

### ***Books***

Fujiwara, T.: River and Osaka bay. River and the sea (edited by Unoki), pp. 121-126, Tokiji Shokan, Tokyo, 2008 (in Japanese)

Fujiwara, T.: River and Japan Sea. River and the sea (edited by Unoki), pp. 222-233, Tokiji Shokan, Tokyo, 2008 (in Japanese)

Kasai, A.: Food sources for animals estimated by analytical models. Discoveries in aquatic animal ecology presented by stable isotope scope (edited by Tominaga and Takai), pp. 46-57, Koseisha-Koseikaku, Tokyo, 2008 (in Japanese)

### ***Original papers***

Nagao, K., K. Hata, S. Yoshikawa, M. Hosoda, and T. Fujiwara: Biogeochemical model with benthic-pelagic coupling applied to Tokyo Bay. Coastal Engineering 55; 1191-1195, 2008

Kobayashi, S. and T. Fujiwara: Long-term variability of shelf water intrusion and its influence on hydrographic and biogeochemical properties of the Seto Inland Sea, Japan. J. Oceanography 64; 595-603, 2008

Zenitani, H., Y. Onishi, S. Kobayashi and T. Fujiwara: Spawning season, spawning grounds, and egg production of red sea bream in Hiuchi-nada, Seto Inland Sea, Fish. Sci. 75; 55-62, 2009

Kobayashi, S. and T. Fujiwara: Modeling the long-term variability of shelf water intrusion into the Seto Inland Sea, Japan. J. Marine Research 77; 341-349, 2009

Kobayashi, S., T. Fujiwara, Y. Hori, M. Fujiwara and S. Takagi: Carbon and nitrogen stable isotope of *Porphyra* in the eastern Seto Inland Sea. Seto Inland Sea 57; 44-48, 2009

Suzuki, K.W., A. Kasai, T. Ohta, K. Nakayama and M. Tanaka: Migration of Japanese temperate bass *Lateolabrax japonicus* juveniles within the Chikugo River estuary revealed by  $\delta^{13}\text{C}$  analysis. Marine Ecology Progress Series 358; 245-256, 2008

Suzuki, K.W., A. Kasai, T. Isoda, K. Nakayama, and M. Tanaka: Distinctive stable isotope ratios in important zooplankton species in relation to estuarine salinity gradients: Potential tracer of fish migration. *Estuarine, Coastal and Shelf Science* 78; 541-550, 2008

Sugimoto, R., A. Kasai, T. Miyajima and K. Fujita: Nitrogen isotope ratios of nitrate as a clue to the origin of nitrogen on the pacific coast of Japan. *Continental Shelf Research* 29; 1303-1309, 2009

### ***Reports***

Kobayashi, S., Zenitani, H. and T. Fujiwara: Density-driven circulation and the associated fluxes in a semi-enclosed shelf sea (the Seto Inland Sea, Japan). *PECS 2008 Process studies*; 259-262, 2008

Antonio, E., M. Ueno, A. Kasai, Y. Kurikawa and Y. Yamashita: Isotopic benthic community structure from downstream to offshore of Yura River. *Program & Abstracts of 5<sup>th</sup> World Fisheries Congress*; 233, 2008

Kasai, A., E. Antonio, Y. Kurikawa, M. Ueno and Y. Yamashita: Hydrodynamics and ecosystem in the Yura Estuary. *Program & Abstracts of 5<sup>th</sup> World Fisheries Congress*; 250, 2008

Sakamoto, K., K. Touhata, A. Kasai and H. Toyohara: Immunohistochemical, *in situ* hybridization, and biochemical studies on endogenous cellulase of *Corbicula japonica*. *Program & Abstracts of 5<sup>th</sup> World Fisheries Congress*; 358, 2008

Yamazaki, H., T. Hara, Y. Koyama, A. Kasai T. Hosokawa, M. Hara, M. Nagasaki, T. Higashino and N. Azuma: Ecosystem and biological production in Lake Jusan; nutrient cycles and spatiotemporal variability. *Program & Abstracts of 5<sup>th</sup> World Fisheries Congress*; 432, 2008

Shoji, J. and A. Kasai: Increase in moon jellyfish populations in the Seto Inland Sea, Japan: Possible effect on predator-prey interactions under summer hypoxia. *Book of abstracts of 8<sup>th</sup> EMECS*, 38-39, 2008

Kurikawa, Y., A. Kasai, M. Ueno and Y. Yamashita: Seasonal variation in seawater intrusion and primary production in the Yura Estuary, Japan. *Book of abstracts of 8<sup>th</sup> EMECS*, 130-131, 2008

Sugimoto, R., A. Kasai, T. Miyajima and K. Fujita: Modeling of phytoplankton production in Ise Bay, Japan: application of nitrogen isotopes to identification of DIN sources. *Book of abstracts of 8<sup>th</sup> EMECS*, 125, 2008

Suzuki, K., R. Sugimoto, A. Kasai, M. Ueno and Y. Yamashita: Origin of particulate organic matter in the Yura River, Japan. *Book of abstracts of 8<sup>th</sup> EMECS*, 96-97, 2008

Antonio, E., M. Ueno, A. Kasai, Y. Kurikawa, Y. Ishihi, H. Yokoyama and Y. Yamashita: Isotope evidence of seasonal variation in feeding niche of river and brackish gastropods. *Book of abstracts of 8<sup>th</sup> EMECS*, 222, 2008

b) Conference and seminar papers presented

55th Meeting of Coastal Engineering: 1 presentation

2008 Spring meeting of the Oceanographic Soc. Japan: 1 presentation

2008 Autumn meeting of the Oceanographic Soc. Japan: 1 presentation

Symposium of 2008 Autumn meeting of the Oceanographic Soc. Japan: 2 presentations

2008 Spring meeting of the Japan. Soc. Fish. Sci.: 4 presentations

5<sup>th</sup> world fisheries congress: 4 presentations

8<sup>th</sup> EMECS (Environmental Management of Enclosed Coastal Seas) conference: 6 presentations

2008 Annual meeting of the Japan. Soc. Fish. Oceanogr.: 5 presentations

2008 Spring meeting of Kinki Branch of the Fisheries Soc. Japan: 1 presentation

2008 Autumn meeting of Kinki Branch of the Fisheries Soc. Japan: 2 presentations

Physics in Estuaries and Coastal Seas (PECS) 2008: 1 presentation

American Geophysical Union (AGU) Fall Meeting 2008: 1 presentation

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

Fujiwara, T.: The Oceanographic Society of Japan (Councilor), Coastal Oceanography Division of the Oceanographic Society of Japan (Editor, Committeeman), The Marine Meteorological Society (Director, Editor), The Japanese Society of Fisheries Oceanography (Committeeman)

Kasai, A.: Coastal Oceanography Division of the Oceanographic Society of Japan (Editor, Committeeman), The Japanese Society of Fisheries Oceanography (Committeeman), The Japanese Society of Fisheries Science (Councilor of Kinki Branch)

Kobayashi, S.: The Japanese Society of Fisheries Science (Secretary of Kinki Branch)

#### ***Research grants***

Monbusho Research Grant: Scientific Research (C) The effect of increase of jerry fish accompanied by hypoxia on the ecosystem in coastal waters (Kasai), Scientific Research (B) Behavior of terrestrial organic matter and its effect on the production in coastal seas (Kasai), Scientific Research (A) The origin and characteristics of the ecosystem in the Ariake Bay head (Kasai), Scientific Research (B) Physics and high primary production in mixed waters (Kasai), Scientific Research Scientific Research (C) A study on variation mechanisms of particulate matter in coastal seas using long-term measurements of turbulent energy dissipation (Kobayashi)

Nagasaki Prefecture: Development of environmental restoration technologies using pearl oyster (Kasai)

### **A-4. International cooperation and overseas activities**

#### ***International meetings (roles)***

Fujiwara, T.: International EMECS Center (Science and Policy Committee), Science Asia (Editor)

Kasai, A.: University of Hawaii and University of Tokyo Joint Symposium on Ocean and Coastal Sciences, Tokyo (Invited presentation), 5<sup>th</sup> world fisheries congress (Oral and poster presentations), 8<sup>th</sup> EMECS (Environmental Management of Enclosed Coastal Seas) conference, Shanghai (Oral presentation)

Kobayashi, S.: Physics in Estuaries and Coastal Seas (PECS) 2008, Liverpool (Oral presentation), American Geophysical Union Fall Meeting 2008, San Francisco, (Poster presentation)

#### ***International Joint Researches, Overseas Research Surveys***

Kasai, A.: Cooperative research on the physics and high production in Menai Strait (UK)



## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### a) Courses given

Undergraduate level: Marine Environment (Fujiwara), Marine Ecosystem (Kasai), Practical Course in Marine Bioscience and Technology (Fujiwara, Kasai), Laboratory Course in Bioresource Science (Kasai, Kobayashi), Outline of Bioresource Science (Fujiwara), Seminar in Marine Bioresources Science (Fujiwara, Kasai, Kobayashi)

Graduate level: Physical Oceanography (Fujiwara), Marine Ecosystem Dynamics (Kasai), Seminar in Fisheries Physics (Fujiwara, Kasai), Laboratory Course in Fisheries Physics (Fujiwara, Kasai)

### **B-2. Off-campus teaching, etc**

#### *Part-time lecturer*

Kasai: Kinki University, Faculty of Agriculture (Statistics)

## **C. Other Remarks**

Fujiwara: Researcher of the Maritime Safety Agency, Researcher of the Disaster Prevention Research Institute, Researcher of the Disaster Science Research Institute, Kyoto University, Science and Policy Commissioner of International EMECS Center

Kasai: Researcher of the center for science and technology trends, Researcher of the GLOBEC committee, Researcher of the Tokyo Bay in Edo Era, Researcher of the ecology in the Iwaki River

Kasai: Best paper award of Fisheries Science (2008)

## 2.4.12 Laboratory of Marine Stock-Enhancement Biology

Staff      Professor                      :

(Nakabo, Tetsuji, Dr. Agric. Sci. Ichthyology, Kyoto University Museum)

Associate Professor: Tagawa, Masatomo, Dr. Sci.

Assistant Professor: Nakayama, Kouji, Dr. Agric. Sci.

Students and Research Fellows

Doctor's program : (1)

Master's program : (6)

Undergraduate : (4)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Early life history of fishes

Occurrence, distribution, food habits and growth of larvae and juveniles in coastal marine fishes as flounder, sea bass, sea breams, tunas, and mackerels have been observed in the sea, being combined with physiological laboratory experiments concerning endocrine, osmoregulatory, and digestive functions. Recent particular focuses have been placed on the stock structure and impacts of mass-release of juvenile flounder on coastal ecosystem, and origin of the Ariake sea bass population related to its amphidromous life history.

##### b) Studies of systematic ichthyology

We are proceeding to the systematic study of marine fishes based on the specimens from the Indo-Pacific region. We have another project to study the taxonomy of some common coastal fishes cooperated with the study of early life histories of them (supervised by Prof. T. Nakabo, Kyoto University Museum).

##### c) Endocrinological study of fish development

Controlling mechanisms of fish metamorphosis, neoteny and migration are investigated, mainly during early life history using endocrinological methods. Involvements of maternal hormones (thyroid hormones and cortisol contained in unfertilized eggs) in early survival and osmoregulation before the onset of larval endocrine organ are examined in flounders, ice goby, and tilapia.

#### A-2. Publications and Presentations

##### a) Publications

###### **Books**

Tanaka, M., M. Tagawa, and K. Nakayama Eds. : Studies on larval fish - exploration into diverse physiology and ecology. 365 pp, Seibutu-Kenkyu sha, Tokyo, 2008 (in Japanese)

Okada, N. and M. Tagawa : 3.6 Metamorphosis and mechanism of eye relocation in Japanese flounder. Studies on larval fish - exploration into diverse physiology and ecology (Tanaka, Tagawa, and Nakayama eds.) 131-140, Seibutu-Kenkyu sha, Tokyo, 2008 (in Japanese)

Seikai, T. and M. Tagawa : 3.7 Metamorphosis and malformed body coloration in flatfishes. Studies on larval fish - exploration into diverse physiology and ecology (Tanaka, Tagawa,

and Nakayama eds.) 141-153. Seibutu-Kenkyu sha, Tokyo, 2008 (in Japanese)

Nakayama, K. : 7.4 Genetic population structure of Japanese temperate bass in Ariake bay. Studies on larval fish - exploration into diverse physiology and ecology (Tanaka, Tagawa, and Nakayama eds.) 295-301, Seibutu-Kenkyu sha, Tokyo, 2008 (in Japanese)

Tanaka, M., M. Tagawa, and K. Nakayama : Larval fish - physiology and ecology in survival and metamorphosis. 387pp. Kyoto University Press, Kyoto, 2009 (in Japanese)

### ***Original papers***

Kikko T, Y. Kai and K. Nakayama: Relationships among tributary length, census population size, and genetic variability of white-spotted charr, *Salvelinus leucomaenis*, in the Lake Biwa water system. Ichthyol. Res. 56: 100-104, 2009.

Suzuki K.W., A. Kasai, T. Isoda, K. Nakayama and M. Tanaka: Distinctive stable isotope ratios in important zooplankton species in relation to estuarine salinity gradients: potential tracer of fish migration. Estuarine, Coastal and Shelf Science. 78: 541-550, 2008

### ***Reports***

Tagawa M. : Mechanisms of asymmetrical body formation during flatfish metamorphosis and prevention of malformed juveniles in seed production process. Report of Monbu-Kagaku-Sho Research Grant (Scientific Research (C)), 2008

### **b) Conference and seminar papers presented**

79th Annual Meeting of the Zoological Society of Japan : 1

33th Annual Meeting of the Japan Society for Comparative Endocrinology : 1

30th Larval Fish Meeting : 1

5th World Fisheries Congress : 2

2008 Annual Meeting of the Ichthyological Society of Japan : 4

2009 Annual Spring Meeting of the Japanese Society of Fisheries Science : 3

## **A-3. Off-campus activities**

### ***Membership in academic societies (roles)***

Tagawa: The Japanese Society of Fisheries Science (committee of fisheries education, publication committee)

Nakayama: The Ichthyological Society of Japan (committee of information technology)

### ***Research grants***

Monbusho Research Grant

Tagawa: Scientific Research (C): Mechanisms and prevention of flatfish malformation - studies on optimal speed before metamorphosis. (Head; Tagawa), Scientific Research (B); Synthetic research on the function of professional knowledge and its education and cultivation (Collaborator; Tagawa), Research for the future; Establishment of Oikopleura mass-culture and its effect on flounder development (Collaborator; Tagawa)

Nakayama: Scientific Research (A); Origin and characteristics of "continental coast relict ecosystem" conserved in the end-most part of Ariake bay (Collaborator; Nakayama)

### ***Foundation***

Tagawa: Kyoto University Foundation, 2008 grant-in-aid for publication

#### **A-4. International cooperations and overseas activities**

##### ***International Joint Researches, Overseas Research Surveys***

Nakayama, K.: Cooperative research on the sympatric distribution of spotted and non-spotted temperate bass in south-western Korea (Korea)

##### ***Scholars from abroad***

Visiting scientist 1 (Associate Professor, University of Kyongsang)

#### **B. Educational Activities (2008.4-2009.3)**

##### **B-1. On-campus teaching**

###### **a) Courses given**

Undergraduate level: Marine Physiology (Tagawa), Marine Ecology (Tagawa, Nakayama), Laboratory Course in Resource Biology I and II (Tagawa, Nakayama), Seminar in Fisheries Science (Tagawa, Nakayama), Course in Marine Bioscience and Technology II (Nakayama), Introduction to Foreign Literature in Bioresource Science III (Tagawa, Nakayama), Animal Physiology (Tagawa), Introductory Laboratory Course in Bioresource Science (Nakayama), Overview of Bioresource Science III (Tagawa, Nakayama), Laboratory Course in Forest-Sato-Sea Linkage Science C (Nakayama), Introduction to Marine Biology (Tagawa), Pocket Seminar “Introduction to fish biology for fish lovers” (Tagawa, Nakayama)

Graduate level: Seminar in Marine Resource Biology (Tagawa, Nakayama), Laboratory Course in Marine Resource Biology (Tagawa, Nakayama), Marine-Stock Enhancement Biology (Tagawa)

##### **B-2. Off-campus teaching, etc.**

###### ***Part-time Lecturer***

Tagawa: “Science detective lectures” in elementary school (2), and junior high school (1).

#### **C. Other remarks**

Tagawa, M.: Committee of Liberal Arts and General Education Courses System (Biology Section). External Reviewer of Fisheries Research Agency on “Development and validation of health evaluation in local resources by genetic parameters responding to environmental stresses”

# Chair of Marine Microbiology

## 2.4.13 Laboratory of Molecular Marine Microbiology

*Staff      Professor                      : Sako, Yoshihiko, Dr. Agric. Sci.*

*Associate Professor: Takashi Yoshida, Dr. Agric. Sci.*

*Assistant Professor : Yoshinaga, Ikuo, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (5)*

*Undergraduate : (2)*

*Master's program : (10)*

### A. Research Activities (2007.4-2008.3)

#### A-1. Main subjects

In the aquatic environments, there are many different environmental conditions such as open ocean, deep sea, hydrothermal vents, polar circles, red tide sea, coastal area, lakes, where many kinds of marine microbes (phage, bacteria, archaea, cyanobacteria and microalgae) live. We study their diversity and strategies how to live and survive and their mutual relationships in such conditions. We, further, aim to develop the genetic resources from these aquatic microbes.

Our main themes are as follows:

- a) Studies on novel marine hyperthermophilic microorganisms and their development of genetic resources
  - (1) Physiological and ecological studies on thermophilic microorganisms thriving at marine hydrothermal environments
  - (2) Isolation and characterization of novel hyperthermophilic microbes from marine hydrothermal vents
  - (3) Search for the useful genes and enzymes from hyperthermophilic microbes
- b) Ecology of microbes in the marine environments
  - (1) Bioremediation for marine environments by using coastal marine bacteria
  - (2) Molecular ecological studies on novel denitrifying bacteria and in coastal area
- c) Ecological and molecular biological studies on the harmful algae
  - (1) Molecular ecological studies of toxic cyanobacteria
  - (2) Genomics and molecular biology of cyanophage infecting toxic cyanobacteria

#### A-2. Publications and presentations

- a) Publications

##### ***Books***

Sako, Y. : Marine microbes living in hot waters. In "Agriculture of 21st century considering from biological resources" Ueda, M.(ed.) Kyoto University Academic Press, p91-123 (2008), Kyoto.

##### ***Original papers***

Kamikawa, R., Hosoi-Tanabe, S., Yoshimatsu, S., Oyama, K., Masuda, I., Sako, Y. Development of

- a novel molecular marker on mitochondrial genome in the toxic dinoflagellate *Alexandrium* spp., and its application in single cell PCR. J. Appl. Phycol. 20, 153-159, 2008.
- Kamikawa, R., Inagaki, Y., Sako, Y. Direct phylogenetic evidence for lateral transfer of elongation factor-like gene. Proc. Natl. Acad. Sci. USA 105, 6965-6969, 2008.
- Kamikawa, R., H. Nishimura and Y. Sako. 2009. Analysis of the mitochondrial genome, transcripts, and electron transport activity in the dinoflagellate *Alexandrium catenella* (Gonyaulacales, Dinophyceae). Phycol. Res. 57: 1-11.
- Yoshida, T., Nagasaki, K., Takashima, Y., Shirai, Y., Tomaru, Y., Takao, Y., Sakamoto, S., Hiroishi, S. and Ogata, H. Ma-LMM01 infecting toxic *Microcystis aeruginosa* illuminates diverse cyanophage genome strategies. J. Bacteriol., 190, 1726-1772, 2008.
- Yoshida, M., Yoshida, T., Satomi, M., Takashima, Y., Hosoda, N. and Hiroishi, S. Intra-specific phenotypic and genotypic variation in toxic cyanobacterial *Microcystis* strains. J. Appl. Microbiol., 105, 407-415, 2008.
- Yoshida, M., Yoshida, T., Kashima, A., Takashima, Y., Hosoda, N., Nagasaki, K. and Hiroishi, S. Ecological dynamics of the toxic bloom-forming cyanobacterium *Microcystis aeruginosa* and its cyanophages in freshwater. Appl. Environ. Microbiol., 74, 3269-3273, 2008.
- Yoshida, M., Yoshida, T., Takashima, Y., Hosoda, N., Hiroishi, S. Temporal changes in microcystin-producing *Microcystis* populations of a Japanese lake. In Proceedings of the 12<sup>th</sup> international conference on harmful algae, pp.144-146, 2008.
- Yoshida, T., Takahashi, Y., Ishikawa, K., Wang, M-K. and Hiroishi, S. Survival of *Heterocapsa circularisquama* (Dinophyceae) as a pellicle cyst induced by low temperature in the laboratory. In Proceedings of the 12<sup>th</sup> international conference on harmful algae. pp.47-49, 2008.

### **Reviews**

- Kamikawa, R. and Sako, Y. : rRNA sequences reveal the genetic diversity of *Gambierdicus* spp. distributing in the coastal area of Western-Japan. Nippon Suisan Gakkaishi 74(5), 911-912 (2008)
- Kamikawa, R. and Sako, Y. : Development of a molecular-based method for monitoring harmful algae. Bulletin of the plankton society of Japan 56(1), 43-46 (2009)

### **Reports**

Development of molecular identification method of harmful diatoms (in Japanese). Reports of counterplanning for protection of red tide damage (Ministry of Agriculture), 2008.

#### **b) Conference and seminar papers presented**

- The 2008 Annual Meeting of the Japanese Society of Fisheries Science: general presentation 11, symposium 1, mini-symposium 1
- The 2008 Kinki regional meeting of the Japanese Society of Fisheries Science: 1
- The 10<sup>th</sup> Meeting of the Japanese Society of Marine Biotechnology: 1
- The 24<sup>th</sup> Annual Meeting of the Japanese Society of Microbial Ecology: 5
- Blue Earth' 09 The 25<sup>th</sup> Deep sea Symposium : 1
- The 2<sup>nd</sup> Meeting of the Japanese Society for Research on Bacteriophage: 1
- 5<sup>th</sup> Aquatic Virus Workshop, Vancouver, Canada: 3

5<sup>th</sup> World Fisheries Congress, Yokohama, Japan: 3

13<sup>th</sup> International Conference on Harmful Algae, Hong kong, China: 1

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Sako, Yoshihiko: Japanese Society of Fisheries Science (Director, Chairman of Kinki Branch, Trustee in Kinki Branch), Japanese Society of Microbial Ecology (Trustee, Editor), Japan Society for Archaea (Executive Committee Member), Japanese Society of Marine Biotechnology(Trustee)

Yoshida, Takashi: Japanese Society of Fisheries Science (Secretary in Kinki Branch), Japanese Society of Microbial Ecology (Trustee)

Yoshinaga, Ikuo: Japanese Society of Microbial Ecology (Trustee)

#### ***Research Grant***

Sako, Yoshihiko: Monbukagakusho Grants-in-Aid for Scientific Research (A), Study on oil-independent production of next-generation energy and new materials based on deep-sea hydrothermal ecosystem (Head: Sako); Monbukagakusho Grants-in-Aid for Exploratory Research, Construction of the system for biodegradation of persistent plastics and production of useful matters using marine hyperthermophilic archaea (Head: Sako), Monbukagakusho Grants-in-Aid for Scientific Research (B), Research on the control of toxic cyanobacteria for water quality conservation using natural bacteriophages (Head: Takashi Yoshida [Div. of Applied Biosciences], Collaborator: Sako), Entrust Research Grant by Ministry of Agriculture, Forestry and Fisheries: Technical development in molecular detection of harmful diatoms (Head: Sako), Research Grant by Geo Biotechnology Development Organization : Study on useful new microbes from marine sediments and cores (Head: Sako), Research Aid from the NPO Foundation Institute for Fermentation, Osaka, “Studies on water quality and purification in Lake Biwa : Understanding the roles of reed communities and microorganisms in the reed surface (Project subleader: Sako)

Yoshida, Takashi: Monbukagakusho Grants-in-Aid for Scientific Research (B), Research on the control of toxic cyanobacteria for water quality conservation using natural bacteriophages (Head: Yoshida), Monbukagakusho Grants-in-Aid for Scientific Research (A), Study on oil-independent production of next-generation energy and new materials based on deep-sea hydrothermal ecosystem(Head: Yoshihiko Sako[Div. of Applied Biosciences], Collaborator: Yoshida); Monbukagakusho Grants-in-Aid for Exploratory Research, Construction of the system for biodegradation of persistent plastics and production of useful matters using marine hyperthermophilic archaea (Head: Yoshihiko Sako[Div. of Applied Biosciences], Collaborator: Yoshida)

Yoshinaga, Ikuo: Research Aid from the NPO Foundation Institute for Fermentation, Osaka, “Studies on water quality and purification in Lake Biwa : Understanding the roles of reed communities and microorganisms in the reed surface (Collaborator:Yoshida)

### **A-4. International cooperations and overseas activities**

#### ***Overseas research surveys***

Sako, Yoshihiko: Studies on isolation and characterization of hyperthermophilic archaea virus

(Institutur Pasteur, France)

## **B. Educational Activities (2007.4-2008.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Marine Microbiology I (Sako), Marine Microbiology II (Yoshida), Seminar of Marine Microbiology (Sako, Yoshida), Laboratory Course in Bioresource Science I, II (Sako, Yoshida, Yoshinaga, partaker), Fundamentals for Laboratory Course in Bioresource Science (Yoshinaga, partaker), Cell Biology III (Sako, partaker), Biotechnology - New Strategies in Agriculture- (Sako, partaker), Outline of Bioresource Science III (Sako, Yoshida partaker), Microbiology (Sako, partaker)

Graduate level: Physiology of Marine Microbiology (Yoshida), Seminar in Marine Microbiology (Sako, Yoshida), Laboratory Course in Marine Microbiology (Sako, Yoshida)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Sako, Yoshihiko: Nishinomiya High School (Specially Science Class)

#### ***Open seminar, etc***

Sako, Yoshihiko: Civilian Forum of Kansai Branch of The Japanese Society for Food Science and Technology (Energy producing by bio-power). Hydrogen produced by deep-sea microorganisms.

## **C. Other Remarks**

### ***Committees***

#### ***Committees in the Faculty***

Sako, Yoshihiko: Member of Research Promotion Committee of Research activities

Yoshinaga, Ikuo: Health Supervisor

#### ***Committees out of the University***

Sako, Yoshihiko: Member of Research Promotion Committee of Research activities Kinki Agri.High Technol.( Director ), Member of Research administrative committee of Geo Biotechnology Development Organization ( Director )

### ***Award***

Sako, Yoshihiko: Poster Award of Marine Biotechnology 2008



## 2.4.14 Laboratory of Marine Environmental Microbiology

Staff Professor :

Associate Professor: Imai, Ichiro, Dr. Agric. Sci

Assistant Professor: Ajisaka, Tetsuro, Dr. Agric. Sci.

Students and research fellows

Doctor's program : (3)

Research fellow : (2)

Master's program : (7)

Research student : (0)

Undergraduate : (4)

### A. Research Activities (2007.4 - 2008.3)

#### A-1. Main subjects

a) Ecophysiological studies on red tides and toxic algal blooms in coastal sea .

Red tide incidents with fishery damage and toxic algal blooms causing poisonings of bivalves have recently increased in frequency in the coastal seas of temperate and tropical areas. To understand the mechanisms of red tide and toxic algal bloom occurrences, the life history and physiological ecology of causative organisms are studied especially on toxic and fish-killing species. And further, algicidal bacteria are investigated for the trial for exterminating the red tides of harmful flagellates such as *Chattonella* spp. and *Heterosigma akashiwo* (Raphidophyceae). Diatom blooms occasionally cause fisheries damage to Nori culture in coastal sea such as Ariake Sea. The mechanisms for diatom bloom occurrences are investigated with reference to resting stage cell formation, vegetative growth and turbidity in the sea. In Lake Biwa, the biggest lake in Japan, studies are conducted on toxic cyanobacterial blooms and regulation of the blooms by using of algicidal bacteria.

b) Effects of inflow from land on coastal environments

Eutrophication has progressed in lakes and coastal seas in the world, and communities of marine organisms have been seriously affected. And inflow from land give great effects on the physiology and ecology of microalgae, primary producers in coastal seas. Investigations are carried out on the effects of inflow on coastal ecosystems and on the conservation of coastal environments both in the sea and lakes.

c) Taxonomical and ecological study of *Sargassum* (marine algae)

Populations variations of *Sargassum* plants from East Asia area (Japan, China and Korea) are studying from DNA analysis (co-operation with other scientists) and taxonomical/statistical analysis. Main target plants are *Sargassum patens*, *S. piluliferum*, *S. horneri* and *S. filicinum*, which are very common in the coasts. On the other hand, subgenus *Sargassum* those are growing in southern part of Japan, Southeastern Asia and Pacific countries, are studying by the taxonomical and ecological analysis.

d) Multilateral studies of freshwater green algae in the Mekong

Freshwater algae (Chlorophyta, Rhodophyta and Cyanophyta) have been used for food in the vicinity of the Mekong, South-east Asia. Multilateral studies on these algae is now studying in Laos.

#### A-2. Publications and presentations

a) Publications

**Books**

Ajisaka, T., Y. Kosaka, I. Wakana, and T. Akimichi: Diversity of Utilization of Freshwater Plants in the Mekong, In Anthology: Ecological History of Monsoon Asia No. 1, Ecological History of Business (ed. by Y. Kawano), pp. 183-202,. Kobun-sha, Tokyo, 2008 (In Japanese)

Nakamura, T., T. Ajisaka, Y. Fujita, H. Midorikawa, S. Habe, T. Akimichi, S. Takenaka and Y. Tomokawa: Water· Food· Body, In Anthology: Ecological History of Monsoon Asia No. 3, Ecological History of Life and Body (ed. by T. Akimichi), pp. 65-84, 2008. Kobun-sha, Tokyo, 2008 (in Japanese)

Ajisaka, T. and A. Ikeguchi: Blessing from fishing and ‘sarai’ collection in Laos, *In* Life in the Vientiane Plane (ed. by K. Nonaka), pp.191-212, Mekon-sha, Tokyo, 2008 (in Japanese)

**Original papers**

Imai, I. and S. Kimura: Resistance of the fish-killing dinoflagellate *Cochlodinium polykrikoides* against algicidal bacteria isolated from the coastal sea of Japan. Harmful Algae 7; 360-367, 2008

Imai, I., T. Yamamoto, K. Ishii and K. Yamamoto: Promising prevention strategies for harmful red tides by seagrass beds as enormous sources of algicidal bacteria. Proceedings of 5th World Fisheries Congress, 6c 0995, TerraPub, 2009

Naito, K., I. Imai, M. Takase and K. Nakamura: Iron utilization and biochemical properties of red tide-causing microalgae. Proceedings of 5th World Fisheries Congress, 6c 0999, TerraPub, 2009

Yamada, C., N. Iwasaki, T. Shiraishi and I. Imai: Effect of harmful dinoflagellate *Heterocapsa circularisquama* on the survival of juvenile mussels, *Mytilus galloprovincialis* and *Perna viridis*. Proceedings of 5th World Fisheries Congress, 6c 1004, TerraPub, 2009

Shiraishi, T., S. Hiroishi, R. Kamikawa, Y. Sako, S. Taino, T. Ishikawa, Y. Hayashi and I. Imai: Population dynamics of the shellfish-killing dinoflagellate *Heterocapsa circularisquama* monitored by an indirect fluorescent antibody technique and a real-time PCR assay in Uranouchi Inlet, Kochi Prefecture, Japan. Proceedings of 5th World Fisheries Congress, 6c 1006, TerraPub, 2009

Nishikawa, T. and I. Imai: Population dynamics of the harmful diatom *Eucampia zodiacus* causing bleaching of aquacultured “Nori” (*Porphyra thalli*) in Harima—Nada, the Seto Inland Sea, Japan. Proceedings of 5th World Fisheries Congress, 6c 1009, TerraPub, 2009

Sugawara, T., K. Yamashita, A. Asai, A. Nagao, T. Shiraishi, I. Imai and T. Hirata: Esterification of xanthophylls by human intestinal Caco-2 cells. Arch. Biochem. Biophys. 483: 205-212, 2009

Notiraksar, T. and T. Ajisaka : Taxonomy and distribution of *Sargassum* (Phaeophyceae) in the Gulf of Thailand. Applied Phycology 20; 513-527, 2008

**Reviews**

Imai, I.: Prevention strategies for red tides by using of environment-friendly algicidal microbes. Aquaculture Magazine 45 (7); 26-29, 2008 (in Japanese)

Itakura, S., M. Yamaguchi and I. Imai: Distribution of resting stage cells of the diatoms in

Ariake Bay and Harima Nada, and their physiological characteristics. Laver and Seaweed 75: 15-22, 2008 (in Japanese)

Imai, I.: Red tides and coastal environments. Saience 79: 10-17, 2008 (in Japanese)

Imai, I.: Biology and ecology of harmful algal blooms. Aquabiology 31: 80-84, 2009 (in Japanese with English abstract)

Imai, I., S. Kimura, T. Yamamoto, Y. Tomaru, K. Nagasaki, K. Sakurada and K. Murata: Possible prevention strategies for red tides of the fish-killer dinoflagellate *Cochlodinium polykrikoides* using microorganisms. Bull. Plankton Soc. Jpn 56: 64-68, 2009 (in Japanese with English abstract)

Komatsu, T., A. Mikami, T. Ajisaka, S. Uwai, M. Aoki, K. Tanaka, M. Fukuda, Y. Kokubu, K. Tanaka, Y. Michida and T. Sugimoto: Ecological characteristics of drifting seaweed rafts composed of *Sargassum* species. Bull. Coast. Oceanog. 46: 127-136, 2009 (in Japanese with English abstract)

### **Reports**

Imai, I., and K. Ishii: Recruitment of diatoms from resting stage cells in bottom sediments of coastal waters. Report of Counter-planning for Fisheries Damages by Diatom Red Tides (Fisheries Agency); pp.20-28, 2008 (in Japanese).

Imai, I., T. Yamamoto and K. Yamamoto: Effects of intracellular bacteria on the growth of *Cochlodinium polykrikoides* and relationship with algicidal bacteria. Report of Counter-planning for Fisheries Damages by *Cochlodinium polykrikoides* Red Tides (Fisheries Agency); pp.32-43, 2008 (in Japanese).

Imai, I. and S. Seino: "Environmental education and the sea"; 19<sup>th</sup> Joint symposium of liaison council among the societies on coastal environments. Nippon Suisan Gakkaishi 74: 9773-9778 (in Japanese).

### **b) Conference and seminar papers presented**

2008 Spring Meeting of the Japanese Society of Scientific Fisheries: 3 presentations

2007 Meeting of the Japanese Society of Fisheries Oceanography : 1 presentations

2008 Spring Symposium of the Plankton Society of Japan: 1 presentation

5th International Conference on Interfaces against Pollution 2008: 1 presentation

2008 Joint Meeting of the Plankton Society and the Benthos Society: 3 presentations

Salt Science Symposium 2008:1 presentation

1<sup>st</sup> Seminar 2008, Perspective of Environmentally-Friendly Aquaculture-, The Steering Committee for Colloquium on Aquaculture, JSFS: 1 presentation

5<sup>th</sup> World Fisheries Congress: 6 presentations

North Pacific Marine Science Organization, 17<sup>th</sup> Annual Meeting : 1 presentations

13th International Conference on Harmful Algae: 2 presentations

20th Joint symposium of liaison council among the societies on coastal environments: 1 presentation

The 33rd Annual Meeting of Phycological Society of Japan: 4 presentations

## **A-3. Off-campus activities**

### **Membership in academic societies**

Imai, Ichiro: The Plankton Society of Japan (Vice President, Editor of Plankton & Benthos

Research), The Japanese Society of Scientific Fisheries (Council Member, Chairman of Committee Environmental Problem Research, Convener of the 20th joint symposium of liaison council among the societies on coastal environments “Basic Plan of the Sea and Coastal Environments”, Member of the Executive Committee of 5th World Fisheries Congress, Council Member of Kinki Branch), The Japanese Society of Phycology (Member of Editorial Board, Member of the Executive Committee of 9th International Phycological Congress), The Japanese Society of Fisheries Oceanography (Council Member)

### ***Research grant***

Imai, Ichiro: Monbukagakusho Grant-in-Aid for Exploratory Research, “Studies on development of mass culture of appendicularians and effects of appendicularians on the growth and developments of the larvae of Japanese flounder” (Head: Yo Yamashita [Field Science Education and Research Center], Collaborator: Imai), Entrust Research Fund by Ministry of Agriculture, Forestry and Fisheries “Urgent counter-planning for red tides” (Head: Imai), Subsidy Grant Project of Fisheries Research Agency, “Studies on mechanisms, forecasting and countermeasures for harmful red tides of *Cochlodinium polykrikoides*” (Head: Mineo Yamaguchi [National Research Institute of Inland Sea], Collaborator: Imai), Research Aid from the NPO Foundation Institute for Fermentation, Osaka, “Studies on water quality and purification in Lake Biwa: Understanding the roles of reed communities and microorganisms in the biofilms on the reed surface (Project leader: Imai)

Ajisaka, Tetsuro: Monbukagakusho Grant in Aid for Scientific Research (A), Studies of Natural resources and sustainable use in the South-Eastern Asia plane area (collaborator: Ajisaka); Monbukagakusho Grant in Aid for Scientific Research (B) Sustainable model of fisheries resources at the estuary area and its apply to Asian countries (Collaborator: Ajisaka); Monbukagakusho Grant-in Aid for Scientific Research (A), Distribution and ecological study of *Sargassum* beds in China and its contribution for drifting seaweeds (Collaborator: Ajisaka); JSPS Multilateral Cooperative Research Program, Studies on the biological diversity on the coastal area in South-east Asia (Collaborator: Ajisaka); Monbukagakusho Grant in Aid for Scientific Research (A), Nature and people’s life at islands around Surawesi, Indonesia (Collaborator: Ajisaka).

## **A-4. International cooperation and overseas activities**

### ***International meetings***

Imai, Ichiro: 5th International Conference on Interfaces against Pollution 2008, Kyoto (Poster presentation); 5th World Fisheries Congress, Yokohama (Session convener 6c Harmful Algal Blooms); North Pacific Marine Science Organization 17th Annual Meeting (PICES), Dalian, China Oral presentation, Delegate of Harmful Algal Bloom section)

Ajisaka, Tetsuro: 7th IOC/WESTPAC Science Symposium in Malaysia (Oral presentation)

### ***Membership in international academic society***

Imai, Ichiro: International Society for the Study of Harmful Algae (International Council Member), North Pacific Marine Science Organization (Delegate of Japanese committee members in Harmful Algal Bloom section); American Society of Phycology, International

Phycological Society  
Ajisaka, Tetsuro: International Phycological Society

***International Joint Researches, Overseas Research Surveys***

Imai, Ichiro: Prevention of harmful red tides of the dinoflagellate *Cochlodinium polykrikoides* (Korea)

Ajisaka, Tetsuro: Biodiversity in Southeast Asian coastal area (Malaysia), Sustainable model of fisheries resources at the estuary area and its apply to Asian (China and Vietnam), Distribution and ecological study of *Sargassum* beds in China and its contribution for drifting seaweeds (Taiwan), Studies of Natural resources and sustainable use in the South-Eastern Asia plane area (Thai, China and Cambodia)

**B. Educational Activities (2007.4 - 2008.3)**

**B-1. On-campus teaching**

a) Courses given

Undergraduate level: Aquatic Microbial Ecology (Imai), Practical Course in Marine Bioscience and Technology (Imai, Ajisaka, partaker), Seminar in Marine Microbiology (Imai, Ajisaka, partaker), Laboratory Course in Bio-resource Science I, II (Imai, Ajisaka, partaker), Fundamentals for Laboratory Course in Bio-resource Science (Imai, Ajisaka, partaker), Marine Practice I, II (Imai, Ajisaka, partaker), Marine Practice III (Faculty of Science) (Ajisaka, partaker), Water World Biology (Open seminar) (Ajisaka, partaker)

Graduate level: Aquatic Microbial Ecology (Imai), Seminar of Aquatic Environmental Microbiology (Imai and Ajisaka), Laboratory Course of Aquatic Environmental Microbiology (Imai)

**B-2. Off-campus teaching, etc.**

***Part-time lecturer***

Ajisaka, Marine Practice II, Faculty of Science, Nara Women's University

***Open seminar***

Imai, Ichiro: 20th Joint symposium of liaison council among the societies on coastal environments "Basic Plan of the Sea and Coastal Environments" Symposium convener, Tokyo

**B-3. Overseas teaching**

***Students and research fellows from abroad***

Doctor Course Student 1 (Korea), Research fellow 1 (China)

**C. Other remarks**

Imai, I.: North Pacific Marine Science Organization (Delegate of Japanese Committee Member of Harmful Algal Bloom section); Fisheries Agency of Japan (Committee member: Training course of harmful algal blooms, Counter measures for harmful algal blooms); Ministry of Environments (Committee member: Advisory committee of harmful algal blooms); Ministry of Environments (Committee member: Advisory panel of a project of Global Environment Research Fund), Hyogo

Prefecture (Committee member: Advisory committee for reforming laver culture grounds); Kansai Airport Research Institute (Committee member: Research Committee for effects of airport on fisheries environments); Guest Investigator of Ehime University (Center for Marine Environmental Studies), Guest Scientist of Kyoto University (Center for Ecological Research)

## Chair of Marine Bio-production

### 2.4.15 Laboratory of Technology of Marine Bio-products

Staff      Professor                      : Hirata, Takashi, Dr.Agric.Sci.  
Associate Professor: Sugawara, Tatsuya, Dr.Agric.Sci.

*Number of Students and research fellows*

*Post doctoral fellow : (1)*

*Doctor's program : (2)*

*Undergraduate : (4)*

*Master's program : (6)*

*Special research student : (2)*

#### A. Research Activities (2007.4-2008.3)

##### A-1. Main subjects

- a) Studies on functional components extracted from oceanic lives

Oceanic life has adapted itself to the specific environment different from land. For this adaptation, various bio-active substance are incorporated into or biosynthesized in their bodies. The objectives of this work are to screen these components and to elucidate their functions for human use. The progress hitherto made is summarized as follows; (1) We found that pigment-proteins from *Porphyra* sp. ,carotenoids from brown algae, and glucosamine possess anti-inflammatory activities. We've been trying to elucidate their mechanisms. (2)We found, for the first time, that siphonaxanthin from green algae has a strong apoptosis-inducing activity. (3) To elucidate the effect of natural compounds on skin functions, anti-photoaging effect of fucoxanthin and skin barrier effect of dietary sphingolipids were evaluated.b) Our object of this study is to elucidate the mechanism of intestinal absorption of lipophilic functional compounds for regulation of their functions in vivo. We demonstrated that sphingoid bases originated from plant sphingolipids can be absorbed from lymph. Archaeal lipids possibly enhances the absorption of lipophilic compounds, such as carotenoids and cholesterol in intestinal cells.

- c) Studies on post-harvest development of melanogenesis cascade in crustaceans.

Invertebrates including crustaceans lack acquired immunity system. And a phenoloxidase system, which is non-inducibly present, is one candidate for recognition of foreign materials. However, this cascade system is often triggered during post-mortem storage, resulting in black spot development and seriously reducing the market quality of crustaceans. So far we suggested that hemocyanin-related phenoloxidase activity plays an important role in the black spot development, and that phenoloxidase activity of hemocyanin in kuruma prawn is effectively suppressed by carbon dioxide. It is suggested that carbon dioxide can also suppress proliferation of spoilage bacteria especially *Vibrio* spp.

##### A-2. Publications and presentations

- a) Publications

***Books and Review***

- Hirata, T: Pigments of fisheries products, Agricultural science series 5, Creation of Foods, ed Adachim S. , Kyoto University Press
- Sugawara, T. and M. Ohnishi: Variety and intake amount of sphingolipids in diet. Science of Food Function, p.578-580, 2008 (in Japanese)
- Sugawara, T.: Digestion and intestinal absorption of sphingolipids. Science of Food Function, p.580-582, 2008 (in Japanese)

### ***Original papers***

- Hossain Z. and T. Hirata: Molecular mechanism of intestinal permeability: interaction at tight junctions, Molecular BioSystems, 2008, 4, 1181-185 (Review)
- Okada T., R. Noguchi, M. Hosokawa, K. Fukunaga, T. Nishiyama, N. Zaima, T. Hirata and K. Miyashita: Effects of trans and conjugated LC N-3 polyunsaturated fatty acids on lipid composition and abdominal fat weight in rats, J Food Sci. 2008 Oct; 73(8): H201-6.
- Kurauchi, K., T. Hirata, M. Kinoshita : Characteristics of ChgH.GFP transgenic medaka lines, an in vivo estrogenic compound detection system , Marine Pollution Bulletin, 57 (2008) 441-444
- Tao, C., T. Sugawara, S. Maeda, X. Wang and T. Hirata: Antioxidative activities of a mycosporine-like amino acid, porphyra-334. Fish. Sci. 74; 1166-1172, 2008
- Sugawara, T., K. Yamashita, A. Asai, A. Nagao, T. Shiraishi, I. Imai and T. Hirata: Esterification of xanthophylls by human intestinal Caco-2 cells. Arch. Biochem. Biophys. 483; 205-212, 2009

### b) Conference and seminar presented

- The 62th Annual Scientific Meeting of Japanese Society of Nutrition and Food Science: 1 presentation
- Annual Meeting of the Society of Scientific Fisheries, 2008 spring: 1 presentation
- The 55th Annual Meeting of the Japanese Society for Food and Technology: 1 presentation
- The 51st Annual Meeting of the Japanese Conference on the Biochemistry of Lipids: 1 presentation
- The 1<sup>st</sup> Annual Meeting of the Japanese Society for Ceramides: 1 presentation
- The 11<sup>th</sup> Annual Meeting of the Japanese Society for Marine Biotechnology: 2 presentations
- The 47th Annual Meeting of the Japan Oil Chemists' Society: 1 presentation
- Kinki branch meeting of the Society of Scientific Fisheries: 1 presentation
- Annual Meeting of the Japan Society for Bioscience, Biotechnology, and Agrochemistry, 2009: 2 presentations
- 5th World Fisheries Congress: 4 presentations
- The 15th International Symposium on Carotenoids: 1 presentation

### c) Invited lectures

- Hirata, T: The Royal Society ,London (Invited speaker)
- Hirata, T: Ocean University of Shanghai (Invited lecture)
- Sugawara, Tatsuya: The 15<sup>th</sup> International Symposium on Carotenoids
- Sugawara, Tatsuya: The 62th Annual Scientific Meeting of Japanese Society of Nutrition and Food Science, Evening seminar
- Sugawara, Tatsuya: The 1<sup>st</sup> Annual Meeting of the Japanese Society for Ceramides, Luncheon



seminar

Sugawara, Tatsuya: Forum for Coordination of Industrials, Academe and Public, Kyoto Industrial Association, 2008

Sugawara, Tatsuya: New Technology Presentation Meeting, Kyoto University

### **A-3. Off-campus activities**

#### ***Membership in academic societies (role)***

Hirata, Takashi: The Japanese Society of Fisheries Science, World fisheries congress (Program committee), The Society of Packaging Science and Technology (President), The Japanese Society for Food Science and Technology (Councilor, President of the 55<sup>th</sup> annual meeting of the Japanese Society for Food Science and Technology)

Sugawara, Tatsuya: The Conference on Lipid Peroxide Biology and Medicine (Executive Committee Member), The Japanese Society of Fisheries Science (Fisheries science education committee), The Japanese Society for Food Science and Technology (Staff for meeting place and young researchers' session of the 55<sup>th</sup> annual meeting of the Japanese Society for Food Science and Technology)

#### ***Research grants***

Monbusho Research Grant: Scientific Research (A); Studies on the inactivation mechanism of the melanin synthetic enzyme in crustaceans during post-harvest distribution by inert gases (Hirata, Sugawara), Young Research; Studies on the Lipid-lowering effect of oxidized poly-unsaturated fatty acids (Sugawara), The Program for Promotion of Basic and Applied Researches for Innovations in Bio-oriented Industry; (Head: Sugawara), Japan Science and Technology Agency Seeds Innovation Study (Sponsor: Sugawara), The Salt Science Research Foundation (Head: Sugawara)

### **A-4. International cooperations and overseas activities**

#### ***International Activity***

Hirata, T: The Royal Society, London (Invited speaker)

Hirata, T: Marine bioresources research commission (Leader, England and Scotland)

Hirata, T: Ocean University of Shanghai (Invited lecture)

Hirata, T: Journal of Aquatic Food Product Technology, Editor

Sugawara, Tatsuya: The 15th International Symposium on Carotenoids (Invited speaker)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Outline of Bioresource Science II (Hirata), Fundamentals for the experiments of Bioresource Science (Sugawara), Technology of Marine Bioproducts I (Hirata), Technology of Marine Bioproducts II (Hirata), Introduction to Foreign Literature in Bioresource Science III (Hirata), Seminar in Marine Bio-production (Hirata, Sugawara), Laboratory in Bioresource Science I, II (Hirata, Sugawara), Practical Course in Marine Bioscience and Technology III (Hirata), Technology of Marine Biological System (Sugawara), Basic Bioresource Science (Sugawara)

Graduate level: Laboratory Course in Technology of Aquatic Biological Products (Hirata,

Sugawara), Seminar in Technology of Aquatic Biological Products (Hirata, Sugawara),  
Technology of Aquatic Biological Products (Hirata), Biochemistry of Aquatic Animals  
(Sugawara)

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Hirata, Takashi: Fukui Prefectural University

### ***Open seminar***

Hirata, Takashi: Packaging manager course (Lecturer)

Hirata, Takashi: Kyoto university extension lecture

## **C. Other Remarks**

Hirata, Takashi: Kinki Agri.High Technol.( Director )

Sugawara, Tatsuya: Journal of Oleo Science Impact Award, Japan Oil Chemists' Society

## 2.4.16 Laboratory of Marine Biological Function

*Staff Associate Professor : Toyohara, Haruhiko, Dr. Agric. Sci.*

*Assistant Professor : Kinoshita, Masato, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (3)*

*Master's program : (10)*

*Undergraduate : (5)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Production of a marine extract library and development of its application

Due to the difficulties in the collection and species identification, marine organisms remain undeveloped as seeds for pharmaceutical use. We are now attempting to establish a chemical compounds library of marine organisms that have been collected by scuba diving or with cooperation of fishermen and marine stations for the purpose of screening of pharmaceutically active compounds useful for human health. We collected more than 500 species of marine organisms including mainly algae and invertebrates. After alcohol extraction and following hexane, ethylacetate, n-butanol and water, we screened the anti-allergy activity by using extracts. We successfully identified the anti-allergy substances, enzyme inhibitors and antagonists through the collaborations with companies.

##### b) Ecological and biochemical studies on benthos in estuaries and coastal area

Estuaries and coastal areas play important roles in degrading man-made and natural substances eluted from rivers. Marine organisms mainly benthos living these areas are possibly involved in the degrading process, but the biochemical mechanism of it still remains unknown. Particularly, cellulose is the most abundant biomass on the earth and is suggested to contribute to the carbon circulation at the global level.

##### c) Studies on the biomineralization of marine organisms

The shell is made of calcium carbonate and a small amount of proteins that give a variety of structural properties specific for each species including pearls. We recently found that spider silk proteins play important roles in the biomineralization process of shell formation. We searched the genes specifically expressed in the edge of oyster mantle to identify the gene involved in the biomineralization process and isolate two genes that showed the homology with spider silk proteins.

##### d) Development of transgenic medaka as a vertebrate model

We started to evaluate the effects of nano-particles on medaka (small freshwater teleost). We also investigate the function of MATP gene, which is thought to concern in development of melanophore.

#### A-2. Publications and presentations

##### a) Publications

###### **Books**

Anchalee T, Tipachai V, Premruethai S, Sureerat T, Piti A, Kunlaya S, Sirinit T, Toyohara

H.:“Fisheries for Global Welfare and Environment” “Biotechnology of Marine Invertebrates – Recent Advances in Shrimp and Shell Science” Terra Scientific Publishing Company (Tokyo), 2008, p.222-239.

Toyohara H.: Essentila of aquatic biochemistry (ed. By Watabe S.), P.177-202、 Asakura

Shoten.

Toyohara H.:Studies on fish muscle tenderization and improvement of fish meat by transgenic technology, Bull. Fish. Res. Agen. No. 26. 69—75, 2008.

Iguchi A, Ito K, Takai S, Ueno M, Maeda K, Minami T, Toyohara H, Hayashi I.: Studies on the genetic variation of deep sea shell Ezobora in Japan sea. Kaiyo to seibutusu . 30:676-684

### **Original papers**

Hosoi M, Yoshinaga Y, Toyohara M, Shiota F, Toyohara H.: Freshwater bivalve *Corbicula sandai* uses free amino acids as osmolytes under hyperosmotic condition. Fish. Sci., 74, 1339-1341 (2008).

Iguchi A, Ueno M, Maeda T, Minami T, Toyohara H, Hayashi I. :Molecular-based method to distinguish sympatric deep-sea whelks, *Buccinum striatissimum* and *Buccinum tenuissimum* in the Sea of Japan. Plankton and Benthos Research 3, 101-103 (2008).

Sakurai T, Murai M, Yasuda T, Kugimiya S, Ozawa R, Toyohara H, Takabayashi J, Miyoshi H. Nishioka T.: Identification of receptors of main sex pheromone components of three Lepidopteran species, Eur.J.Neuroscience., 28,893 (2008).

Sawada H, Saito H, Hosoi M, Toyohara H. : An Evaluation of PCR methods on Fixed Bivalve Larvae. J. Mar. Biol. Assoc. U. K., 88, 1441-1449 (2008).

Sakamoto K, Kurokawa T, Uji K, Toyohara H.: Immunohistochemical, in situ hybridization and biochemical studies on endogenous cellulase of *Corbicula japonica* Comp. Biochem. Physiol B.150, 216-221 (2008).

Inoue K, Tsukuda K, Koito T, Miyazaki Y, Hosoi M, Kado R, Toyohara H. : Taurine transporter of the deep-sea mussel *Bathymodiolus septemdierrum* transports thiotaurine and hypotaurine. FEBS Letters, 582, 1542-1546 (2008).

Kanamori A, Toyoama K, Kitagawa S, Kamehara A, Higuchi T, Kamachi Y, Kinoshita M, Hori T.:Comparative genomics approach to the expression of *figa*, one of the earliest marker genes of oocyte differentiation in medaka (*Oryzias latipes*). Gene, 423, 180-187 (2008).

Kurauchi K, Hirata T, Kinoshita M.: Characteristics of ChgH-GFP transgenic medaka lines, an in vivo estrogenic compound detection system. Mar Pollut Bull. 57(6-12): 441-444, (2008).

Bubenshchikova ,E., Kaftanovskaya ,E., Hattori, M., Kinoshita, M., Adachi, T., Hashimoto, H., Ozato, Kenjiro; Wakamatsu, Y.: Nuclear transplants from adult somatic cells generated by a novel method using diploidized eggs as pecipients in medaka fish (*Oryzias latipes*). Cloning and Stem Cells, 10 (4), 443-452, (2008).

Fukamachi, S., Kinoshita, M., Tsujimura, T., Shimada, A., Oda, S., Shima, A., Meyer, A., Kawamura, S., Mitani, H.: Rescue from ocuocutaneous albinism type 4 using medaka *slc45a2* cDNA driven by its own promoter. Genetics, 178, 761-769 (2008)

## ***Reports***

Toyohara, H: 2007 Annual report on the Bio-Design Project by the Ministry of Agriculture, Forestry and Fisheries, Japan.

### **b) Conference and seminar papers presented**

World Fisheries Conference (6)

Autumn meeting of Japan Fisheries Science autumn (5)

Spring meeting of Japan Fisheries Science autumn (2)

Meeting of Japan molecular biologists (2)

Marine biotechnology conference (2)

Biom mineralization workshop (1)

Meeting of Japan animal scientists (1)

## **A-3. Off-campus activities**

### ***Research grants***

Toyohara, Haruhiko: Grant-in-Aid for Scientific Research (B)(2), Studies on shell formation based on spider silk proteins (Head: Toyohara); Grant-in-Aid for Scientific Research, Studies on chemoreceptor of crustacean (Head: Toyohara); Research aid from Nippon Suisan Kaisha (Head: Toyohara), JST Innovation plaza feasibility study (Head: Toyohara), Grant from Salt science foundation

Kinoshita Masato: Creative Scientific Research; Establishment of Neuroglycobiology (Glycobiological approach for Neuroscience), Grant-in-Aid for Scientific Research on Priority Areas 'Mechanisms of Sex Differentiation'; Initiation of oogenesis in medaka, Grant-in-Aid for Scientific Research (Scientific Research B); Screening of sex determining environmental factors with female-germcell labeled transgenic fish.(Head)

## **A-4. International cooperations and overseas activities**

Toyohara, Haruhiko: Japan-Thailand Symposium (Thai, invited speaker)

Kinoshita, Masato: Collaboration with Burapha University, Thailand and University Putra Malaysia, Malaysia

## **B. Education activities (2008.4 – 2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

*Undergraduate level:* Basic Applied Biosciences II (Toyohara), Biotechnology-New Strategy in Agriculture- (Toyohara), Outline of Bioresource Science III (Toyohara), Molecular Biology (Toyohara), Practical Course in Marine Bioscience and Technology I (Toyohara, Kinoshita), Cell Technology of Marine Organisms (Toyohara), Laboratory Course in Bioresource Science I and II (Toyohara, Kinoshita), Introduction to Foreign Literature in Bioresource Science III (Toyohara), Seminar in Marine Bio-production (Toyohara, Kinoshita), Marine Biology (Toyohara)

*Graduate level:* Seminar in Function of Marine Organisms (Toyohara), Laboratory Course in Function of Marine Organisms (Toyohara)

## **B-2. Off-campus teaching, etc.**

Toyohara, Haruhiko: Lecture (JAICA)

Kinoshita, Masato: Lecturer (Kyoto Prefectural University of Medicine)

Koudai project lecture

10<sup>th</sup> Japan Medaka Meeting (Invited speaker)

## **C. Other remarks**

### ***Committees in the Faculty***

Toyohara, Haruhiko: Committee of Evaluation of Post-Doctoral Fellows in JASP

## 2.5 DIVISION OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY

The division of Environmental Science and Technology currently numbers 7 chairs and 16 laboratories, i.e. Chair of Comparative Agricultural Science which is researching on the regions from international viewpoints (Lab. of Comparative Agricultural Science), Chair of Bio-environmental Science which is based on the forest and biomaterial science (Lab. of Forest Ecology, Lab. of Forest Hydrology and Lab. of Forest Biochemistry), Chair of Agro-ecosystem Science which is based on bio-ecology and bioscience (Lab. of Tropical Agriculture, Lab. of Soil Science. Lab. of Environmental Mycoscience and Lab. of Ecological Information), Chair of Environmental development Engineering which aims engineering improvement of rural production site (Lab. of Agricultural Facilities Engineering and Lab. of Water Resources Engineering), Chair of Land and Water Resources Management which aims physical and social improvement of rural area (Lab. of Irrigation, Drainage and Hydrological Environmental Engineering, and Lab. of Rural Planning), Chair of Bioproduction Engineering which aims creation and application of various engineering techniques in fields (Lab. of Agricultural Systems Engineering, Lab. of Field Robotics and Lab. of Agricultural Process Technology), and Chair of Nuclear Science and Engineering (Research Reactor Institute) which aims application of radiation science to environmental science (Lab. of Radiation Safety Control).

This division has a large Graduate program with 133 students enrolled: (97 in the Master's Program including 1 foreign student and 36 in the Doctor's Program including 4 foreign students) in this year.

## Chair of Bio-environmental Science

### 2.5.1 Laboratory of Forest Ecology

*Staff      Lecturer : Naoya OSAWA, Dr. Agri.*

*Students and research fellows:*

*JSPS Research Fellow: (1) (PD:1,)*

*Doctor's program      : (2)*

*Master's program      : (8)*

*Undergraduate      : (2)*

#### **A. Research Activities (2008.4-2009.3)**

##### **A-1. Main subjects**

a) Decomposition process of leaf litter in forest ecosystems

Decomposition process of leaf litter has been studied at a cool temperate forest in Ashu and a pine plantation in Kamigamo, both at Experimental Forest, and Mt. Tanakami, Shiga, mainly focused on the interaction among leaf litter, decomposer-microorganisms, and soil.

b) Fine root dynamics and the role of soil animals in a forest soil

Fine root dynamics at a forest ecosystem is studied at Kamigamo Experiment Station, Japan, and evergreen forest, Thailand. The manipulated experiments for the analysis of community structure and the function of soil animal are mainly performed at Kamigamo Experiment Station, and that for the fine root dynamics are mainly done at evergreen forest, Thailand.

c) Module Dynamics of Forest trees

Forest trees are characterized by their foraging behaviors for capturing the nutrients and light. Foraging behavior of trees has been studied through the population dynamics of modules, such as buds, current shoots, and leaves. The knowledge of module dynamics is important for the understandings of plant community.

d) Community structure of insect community and the role of herbivore in forest ecosystem

We are performing our research to clarify the impact of herbivorous insects on the community structure and its dynamic of the forests in Ashu and Tanakami experimental station, from a view point of the seasonal and spatial variation of plant quality and plant growth.

e) Impacts on ground arthropod community by artificial logging

Arthropod community at the Kamigamo Experiment station has been studied to clarify the impact of logging on forest ecosystem since July 1999.

##### **A-2. Publications and presentations**

a) Publication

***Reviews***

none

***Original papers***

Fujii, S. and N. Kasuya: Fine root biomass and morphology of *Pinus densiflora* under competitive



stress by *Chamaecyparis obtusa*. J For Res 13; 185-189, 2008

Osawa, N. and Ohashi K. Sympatric coexistence of sibling species *Harmonia yedoensis* and *H. axyridis* (Coleoptera: Coccinellidae) and the roles of maternal investment through egg and sibling cannibalism. Eur J Entomol 105; 445-454, 2008

Saitoh, S., Mizuta H., Hishi T., Tsukamoto J., Kaneko N. and H. Takeda: Impact of deer overabundance on soil macro-invertebrates in a cool temperate forest in Japan: a long-term study. For Res Kyoto 77; 63-75, 2008

b) Conference and seminar papers presented

The 120th annual meeting of Japan Forestry Society. (Kyoto University, 2009, March). Number of presentations 3 (Osawa et al.)

The 56th annual meeting of The Japan Ecological Society (Iwate Prefectural University, 2009, March) Number of presentations 5 (Osawa et al.)

The 68th annual meeting of The Japan Entomological Society (Kagawa University, 2008, September). Number of presentations 1 (Osawa)

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

H. Takeda: The Japan Society of Ecology (Kansai Area Councilor)

#### ***Research grants***

Grant-in-Aid for Scientific Research from the Ministry of Education, Science and Culture, Japan.  
Applied ecological study on management system for Japan-originated invaders in foreign countries. (N. Osawa).

### **A-4. International cooperation and overseas activities**

#### ***International joint researches, overseas research surveys***

none

## **B. Educational activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### a) Courses given

Undergraduate level: Practice of Forest Ecology (N. Osawa), Seminar of Forest Ecology (N. Osawa), Community Ecology (N. Osawa), Practice of Forest Sciences II & III (N. Osawa). The Practice of Ecology (N. Osawa).

Graduate level: Practice of Forest Ecology (N. Osawa), Seminar of Forest Ecology (N. Osawa). Special Lecture of Community Ecology (N. Osawa).

### **B-2. Off-campus teaching**

#### ***Part-time Lectures***

none

### 2.5.2 Laboratory of Forest Hydrology

*Staff Professor : Tani, Makoto, Dr. Agric. Sci.*

*Assistant Professor : Kosugi, Yoshiko, Dr. Agric. Sci.*

*Post Doctoral Fellow: Ohkubo Shinjiro, Dr. Agric. Sci.*

*Matsumoto, Kazuoho, Dr. Agric. Sci.*

*Dannoura, Masako, Dr. Agric. Sci.*

### *Student and research fellows*

*Master's program* : (7),      *Undergraduate* : (2)

### A. Research activities (2008.4-2009.3)

a) Gas exchange between forest and the atmosphere

Our laboratory is conducting long-term observations on gas exchange processes between forest and the atmosphere using the eddy covariance method to evaluate the physical and physiological control by forest ecosystem. Our main fields are a Hinoki Cypress forest in Japan and a tropical rainforest in Malaysia. This year, we studies on the estimation of methane flux in the foliage in our Hinoki and tropical forest sites, and a newly developed method (TDLS) was also tested for its continuous monitoring. Our study was extended to validating vegetation indices surveyed from satellites by comparisons of filed data in various study forests, and estimating distribution characteristics of wind direction and velocity within a forest on the complex terrain.

## b) Water quality and biogeochemistry

Detailed runoff processes and effects of their heterogeneities on biogeochemistry in forested catchments are studied to evaluate roles of forest in water and nutrient cycles. Biogeochemical processes on hillslope have been mainly studied to evaluate stream-water quality in small mountainous catchments. The topic of this year was the dynamics of dissolved organic carbon, and an analysis using the carbon isotope ratio demonstrated the dependencies of its adsorption and decomposition processes on hydrological heterogeneities.

### c) Runoff control through forest management

Effects of geology, topography, soil and vegetation on rainfall-runoff responses are investigated from the forest management point of view. This year focused our study on an comparative analysis of the runoff responses in several catchments in granite and sedimentary-rock mountains and evaluated forest-soil effects on the responses in each mountain.

## A-2. Publications and Presentations

### a) Publications

### Original papers

Tani, M.: Analysis of runoff-storage relationships to evaluate the runoff-buffering potential of a sloping permeable domain. *Journal of Hydrology* 360; 132-146, 2008

Kosugi, Y., Takanashi, S., Matsuo, N. and Abdul Rahim, N: Midday depression of leaf CO<sub>2</sub> exchange within the crown of *Dipterocarpus sublamellatus* in a lowland dipterocarp forest in Peninsular Malaysia, *Tree Physiology*, 29; 505-515, 2009

Saito, T., Yokouchi, Y., Kosugi, Y., Tani, M., Philip, E. and Okuda, T.: Methyl chloride and isoprene emissions from tropical rain forest in Southeast Asia, *Geophys. Res. Lett.*, 35, L19812, doi:10.1029/2008GL035241, 2008

- Ohkubo, S., Kosugi, Y., Takanashi, S., Tani, M., Matsuo, N. and Abdul Rahim, N.: Vertical profiles and storage fluxes of CO<sub>2</sub>, heat, and water in a tropical rainforest at Pasoh, Peninsular Malaysia, *Tellus*, 60B; 569-582, 2008
- Dannoura M., Kominami Y., Oguma H., and Kanazawa Y., The development of an optical scanner method for observation of plant root dynamics. *PlantRoot*, 2; 14-18, 2008
- Dannoura M., Hirano Y., Igarashi T., Ishii M., Aono K., Yamase K. and Kanazawa Y. Detection of *Cryptomeria japonica* roots with ground penetrating radar. *Plant Biosystems*, 142; 375-380, 2008
- Fujimoto, M., Ohte, N. and Tani, M.: Effects of hillslope topography and hydrological responses in a weathered granite mountain, Japan: comparison of the runoff response between the valley-head and the side slope. *Hydrological Processes* 22; 2581-2594, 2008
- Okumura, M., Tani, A., Kosugi Y., Takanashi S., Miyama T., Kominami, Y. and Tohno, S.: Diurnal and seasonal variations of monoterpene emissions from leaves of *chamaecyparis obtusa*. *Eco-Engineering*, 20; 89-95. 2008
- Okumura, M., Tani, A., Kominami, Y., Takanashi, S., Kosugi, Y., Miyama, T. and Tohno, S.: Isoprene emission characteristics of *Quercus serrata* in a deciduous broad-leaved forest. *Journal of Agricultural Meteorology*, 64; 49-60, 2008

b) Conference and seminar papers presented

The 119th Annual Meeting of Japanese Forestry Society: 2 topics. The Annual Meeting of Japan Society of Hydrology and Water Resources: 1 topic. The 56th Annual Meeting of Japanese Ecological Society: 1 topic. Japan Geoscience Union Meeting: 1 topic. AsiaFlux Workshop 2008: 2 topics. International Symposium on Agricultural Meteorology (ISAM2009): 1 topic. Advection workshop and ADVEX final conference 2008: 1topic

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Tani: Vice president, Japan Society of Hydrology & Water Resources.

Kosugi: Japan Society of Revegetation Technology (Secretary of Editorial Review Board), and AsiaFlux Network (Member of News Letter Editorial Board).

#### ***Research grant***

Grants-in-Aid for Scientific Research (A): Prediction of flood and drought runoff from ungauged basins based on the development of bedrock-soil-vegetation-atmosphere continuum model (Tani, Head and Kosugi, member)

Grants-in-Aid for Scientific Research (A): Gas exchanges of Southeast Asian tropical rainforest(Kosugi, Head and Tani, ,member)

Global COE: In Search of Sustainable Humansphere in Asia and Africa (Tani and Kosugi, members)

### **A-4. International cooperation and overseas activities**

#### ***International meetings***

Tani: The 5th World Water Forum (Presesntation), Istanbul

#### ***International joint researches, overseas research surveys***

Tani, Kosugi and Itoh: Investigation on carbon balance in tropical rainforest (Malaysia).

## **B. Educational Activities (2006.4-2007.3)**

### **B-1. On-campus teaching**

#### a) Courses given

Undergraduate level: Basic Science for Forest and Biomaterials 3 (Tani), Forest and Biomaterials Science 3 (Tani), Forest Hydrology (Tani), Interaction of Forest and Environment (Kosugi, Tani), Laboratory Course in Forest and Biomaterials Science 3 (Tani, Kosugi), Laboratory Course in Physics of Forest and Biomaterials (Kosugi), Laboratory Course in Forest Hydrology and Erosion Control (Tani, Kosugi), Practice in University Forest 2 (Tani, Kosugi).

Graduate level: Seminar of Forest Hydrology (Tani), Special Laboratory Work in Forest Hydrology (Tani).

### **B-2. Off-campus teaching, etc.**

#### *Part-time lecturer*

Tani: Faculty of Agriculture of Kyoto Prefectural University, Forest Training Institute, Forestry Agency

#### **C. Other remarks.**

Tani: Convener of the 53th Symposium on Wind Science

### 2.5.3 Laboratory of Forest Biochemistry

*Staff*      *Professor*                                : Azuma, Jun-ichi, D. Agric. Sci.  
                 *Maitre de Conferences* : Sakamoto, Masahiro, D. Agric. Sci.

*Students and research fellows*

<i>Doctor's program</i>	: (3)	<i>Master's program</i>	: (6)
<i>Undergraduates</i>	: (4)	<i>JSPS Research Fellow</i>	: (1)
<i>Foreign undergraduate</i>	: (1)		

#### A. Research Activities (2008.4-2009.3)

##### A-1. Main subjects

###### a) Biosynthesis and improvement of plant biomass constituents

Characterization of biosynthetic mechanism of biomass constituents is a key step for their better use. In this theme, biochemical and molecular biological approach is carried out for characterization of photosynthetic products and secondary metabolites in woody and monocotyledonous plants. In addition, enzymatic approach is carried out to give information about biosynthesis of cell-wall polysaccharides/glycol-conjugates and elongation growth of monocot. For improvement of biomass production, a system of chloroplast DNA from bamboo and cotton, the very important non-woody biomass-plants, is also investigated. Especially whole genome system of chloroplast DNA of sea-island cotton which produces the longest fiber among cotton plants was characterized and its partial base sequences were found to be usable for identification of species name of cotton plants.

###### b) Structure and function relationships of biomass constituents and their biodegradation mechanism

Carbohydrates, which comprise more than 70% weight of cell-walls of higher plants, not only play various physiological functions but also are important for recycling of C on the earth. In this theme, characterization of interactions between cellulose and hemicellulose in the helical fibrous network of plant cell-wall was carried out to find out ways to produce biodegradable artificial woody materials and improve the physical properties of lignocelluloses. In addition, because of importance of cellulolytic enzymes in the ecosystem, biodegradation mechanisms of cellulose by termite-protozoa and termite-fungi symbiotic systems are also investigated.

###### c) Recycling of biomass and conversion of lignocellulosic materials to biofuel

Biomass plays a key role in recycling of organic matters on earth. Therefore, the behaviors of environmental aspects of biomass in ecosystem are very important problems. The object of this study is to develop new technologies which make recycling of biomass possible, utilization of lignocellulosic materials for production of bio-fuel, leading to attaining zero-emission.

In addition, microwave energy is used to develop comprehensive method for utilization of diverse woody, agricultural and food-waste biomass materials. Hydrothermal effects of microwave on diverse biomass materials are mainly studied under high temperature and high pressure as well as low temperature and low pressure.

##### A-2. Publications and presentations

a) Publications

**Books and reviews**

Sakamoto, M.: Dictionary for Plant Genome Science ( edited by K.Saito, S. Tabata, T. Fujimura, Y. Machida and M. Mii ) Asakura Publishing, Tokyo, 2009

Sakamoto, M.: Basic and Advanced Technologies for Industrial Applications of Bamboo. (edited by T. Fujii ), CMC Publishing, Tokyo, 2008

Azuma, J.: Degradation of wood by dry-wood termites and development of anti-termite reagents by using inhibitors for carbohydrate degrading enzymes, 116<sup>th</sup> Symposium of Sustainable Humanosphere, DOL/LSF Cooperative Research Symposium, Research Institute for Sustainable Humanosphere, Kyoto University, Feb.26, 2009

**Original papers**

Delage, L., Giegé, P., Sakamoto, M. and Maréchal-Drouard, L.: Four paralogues of RPL12 are differentially associated to ribosome in plant mitochondria. *Biochimie*, **89** (2007) 658-668

Osono, T., Takeda, H. and Azuma, J. : Carbon isotope dynamics during leaf litter decomposition with reference to lignin fractions. *Ecol.Res.*, **23**, 51-55, 2008

Ookushi, Y., Sakamoto, M. and Azuma, J.:  $\beta$ -Glucans in the Water-insoluble Residue of *Hericium erinaceum* with Combined Treatments of Enzyme and Microwave Irradiation, *Journal of Applied Glycoscience*, **55**, 225—229, 2008

Ookushi, Y., Sakamoto, M. and Azuma, J.: Extraction of  $\beta$ -Glucans from the Water-insoluble Residue of *Hericium erinaceum*, *Journal of Applied Glycoscience*, **55**, 231—234, 2008

Yudianti R., Indrarti, L., Karina, M., Sakamoto, M. and Azuma, J.: Chemical composition of *Salvia* hydrogel. *Journal of Tropical Wood Science and Technology*, **5** (1), 12-16, 2007

Yudianti, R., Karina, M. and Azuma, J.: Rheological Behaviour of *Salvia* Hydrogel at Temperature and pH Variation, *Journal of Indonesia Technology*, **30** (2), 69-74, 2008

Yudianti, R. and Indrarti, L.: Effect of water soluble polymer on structure and mechanical properties of bacterial cellulose composite. *Journal of Applied Science*, **8** (1), 1-13, 2008

Azuma, J., Okahara, K., Sakamoto, M., Kono, T., Nomoto, H. and Higuchi, M.: Solubilization of barley malt feed by microwave heating in water, “The New Flame for Humanity”, Global Congress on Microwave Energy Applications, GCMEA 2008 Majic 1<sup>st</sup>, Proceedings, August 4-8, ISBN978-4-904068-04-5 (Japan Society of Electromagnetic Wave Energy Applications), pp.763-766, 2008

Tsubaki, S., Iida, H., Sakamoto, M. and Azuma, J.: Utilization of Microwave heating for Production of Plant Biopolyester from Black Tea Residue, “The New Flame for Humanity”, Global Congress on Microwave Energy Applications, GCMEA 2008 Majic 1<sup>st</sup>, Proceedings, August 4-8, ISBN978-4-904068-04-5 (Japan Society of Electromagnetic Wave Energy Applications), pp.779-782, 2008

Matsumoto, A., Tsubaki, S., Sakamoto, M. and Azuma, J.: Oligosaccharides adsorbed on activated charcoal powder escaped from hydrolysis by microwave heating in water, “The New Flame for Humanity”, Global Congress on Microwave Energy Applications, GCMEA 2008 Majic 1<sup>st</sup>, Proceedings, August 4-8, ISBN978-4-904068-04-5 (Japan Society of Electromagnetic Wave Energy Applications), pp.785-782-788, 2008

Azuma, J., Yamada, A., Takeda, H., Fukasawa, T., Tsunoda, K. and Yoshimura, T. : Difference in Digestibility of Pine Wood by Two Subterranean Termites, *Coptotermes formosanus* Shiraki and *Reticulitermes speratus* Kolbe (Blattodea: Rhinotermitidae): Proceedings of The Sixth Conference of the Pacific-Rim Termite Group, Bali, Indonesia, 1-6, 2009

b) Conference and seminar papers presented

***International Conference and Seminars:***

Azuma, J.: The Fifth Conference of the Pacific-Rim Termite Group, Bali, Indonesia, 113-117, 2008 (1 paper in English) (Azuma, J. et al.)

***Domestic Annual Meeting:***

26th Annual Meeting of the Japanese Society for Plant Cell and Molecular Biology (3 papers in Japanese): (Sakamoto, M. et al.)

58th Annual Meeting of the Japan Wood Research Society (4 papers in Japanese): (Azuma, J. et al.; Sakamoto, M. et al.)

Annual Meeting of the The Japan Society for Bioscience, Biotechnology, and Agrochemistry (2 papers in Japanese): (Azuma, J. et al., Sakamoto, M. et al.)

International Conference on Advanced and Sustainable Polymer (Bandung, Indonesia)  
(1 paper in English) (Presented as a keynote speech) (Azuma, J. et al.)

**A-3. Off-campus activities**

***Membership in academic societies (roles)***

Azuma, J.: The Japan Society for Bioscience, Biotechnology, and Agrochemistry (Councilor of the Kansai Branch)

The Japan Society for Carbohydrate Research (Councilor)

Japan Radioisotope Association (Councilor of Life Science Division)

Azuma, J.: Councilor of NPO 'Society of Maintenance of Earth Environment by Recycling'.

***Research grants:***

***Monbusho Research Grant:***

Cooperative Basic Research (B) Utilization of Gellous Biomass Containing Cellulose (Main, Azuma, J., cooperative, Sakamoto, M.), Scientific Research (B) Transition of traditional utilization of biological resources under the economic development and globalizaton. (Main, Nawata, E., Cooperative, Sakamoto, M.)

NEDO Research Grant: High Efficient Conversion Technology of Biomass Energy (Cooperative, Sakamoto, M.)

Agrigenome Project (Main, Umezawa, T., Cooperative, Sakamoto, M.)

***Cooperative Research Grant between University and Others:***

Recycling use of waste biomass (Main, Azuma, J.)

Innovation Project for Functional Materials of Marin Products and Black Beans, 2008 (cooperative, Azuma, J.).

**A-4. International cooperations and overseas activities**

***International meetings (roles)***

**B. Educational Activities (2008.4-2009.3)**

**B-1. On-campus teaching**

a) Courses given

Undergraduate level: Laboratory course in the basic forest and biomaterials chemistry, (Azuma, J.,

Sakamoto, M.), Laboratory course in the biomaterials chemistry I (Azuma, J., Sakamoto, M.), Laboratory course in the biomaterials science II (Sakamoto, M.), Basic Science for Forestry II (Azuma, J., Sakamoto, M.), Forest biochemistry I (Azuma, J., Sakamoto, M.), Forest biochemistry II (Sakamoto, M., Azuma, J.), Seminar in forest and biomaterials science (Azuma, J., Sakamoto, M.), Forest analytical science (Azuma, J.), Basic Science for Agriculture (Azuma, J.)

Graduate level: Laboratory Course in Forest Biochemistry (Azuma, J., Sakamoto, M.), Seminars in Forest Biochemistry (Azuma, J., Sakamoto, M.), Plant Biomass (Sakamoto, M.)

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Sakamoto, M.: Faculty of Human Life and Science of Doshisha Women's College of Liberal Arts.

## **C. Other remarks**

### ***Miscellaneous***

#### ***University level***

Azuma, J.: Member of Committee of University Students, Kyoto University, Member of Committee of Safe Committee for Radioisotopes and Radiation, Kyoto University Radioisotopes and Radiation

Azuma, J.: Member of Committee of Chemistry for University Students, Kyoto University, Member of Committee for Education System of Chemistry of Kyoto University

Azuma, J.: Member of Consolidating Committee for Atomic Force of Kyoto University

#### ***Faculty level***

Azuma J.: Member of Safeguard Committee of Faculty of Agriculture for Radioisotopes and Radiation



## Chair of Agro-ecosystem Science

### 2.5.4 Laboratory of Tropical Agriculture

*Staff*      *Professor: Nawata, Eiji, D. Agric. Sci.*

*Associate Professor*                      *: Higuchi, Hirokazu, D. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (3)*                      *Master's program : (9)*

*Undergraduates : (3)*                      *Research fellow : (3)*

#### **A. Research Activities (2008.4-2009.3)**

##### **A-1. Main subjects**

- a) Bio-resources, farming and cropping systems and sustainability in Mainland Southeast Asia

In northeast Thailand and middle south Laos, studies on traditional plant utilization were practiced and species used and construction of home gardens were clarified in comparison to those in home gardens in the world.

- b) Evaluation of agricultural resources and sustainability in upland crop areas, developed on a large scale, in the tropics

In central Thailand, studies on the diversity of farming and cropping systems were carried out, and GIS maps of cropping systems in this area were drawn. In addition, agricultural productivity maps were also drawn, based on yield estimation models and resource databases using a feed maize variety "NK-48". In north Thailand, sampling of river water was practiced and dynamics of cropping systems were investigated and mapped, in upland fields, in which formerly shifting cultivation was carried out, in a village of Karen, one of the ethnic minorities in the north. In northeast Thailand, the dynamics of productivity of sugarcane were analyzed in the selected farmers' fields.

- c) Distribution and dissemination of tropical crops

In north Laos, technologies of DNA analyses were examined to analyze the cause of the increase in bamboo species in fallow forests of shifting cultivation systems. In order to clarify the distribution and dissemination of coriander in South and Southeast Asia, analyses on morphological, ecological and biochemical properties of coriander varieties were carried out.

- d) Evaluation of crop tolerance to environmental stresses

The analyses of the mechanisms of plant responses to partial environmental stresses were practiced. A series of experiment in maize revealed that partial heat treatments in leaves induced the appearance of heat stress mitigation systems in other parts of the plants. Partial waterlogging in roots of chilli pepper appeared to induce two kind of signals transferred from roots to leaves.

- e) Utilization of tropical plant resources

Field survey on the utilization and recognition and sample collection of wild mango species were conducted through north-east Thailand to middle-south Lao, as a part of "Study on the traditional plant utilizations remained in the tropics". DNA samples were analyzed to clarify the differences of

the distributions of the wild mango species between Thailand and Lao as well as the differences in the utilizations and recognitions. The remained wild mango trees found in crop fields were tended to be conserved in the community in Thai villages, whereas in Lao villages the wild mangos were often found in the natural forests apart from human sphere.

f) Agro-ecological physiology of tropical fruit trees

The research to develop the new cultivation technique to solve the fruit flesh disorder of mangosteen, in which the flesh turns to be hard and translucent and to be unpalatable was continued. Among the factors of plant nutrient such as Ca, soil water content, the development of rizosphere, and water stress that influence the flesh disorder, especially the water stress surrounding the fruit, was found to be substantially effective. Cultivation practice to promote the surface transpiration of the fruit possibly contributes to reduce the incidence of the fruit disorder.

## A-2. Publications and presentations

a) Publications

***Original papers***

Yamamoto S., M. Misumi and E. Nawata: Effects of photoperiod on vegetative growth, flowering and fruiting of *Capsicum frutescens* L. and *C. annuum* L. in Japan. *Envir. Cont. Biol.*, 46 : 39-47, 2008.

Pagamas P. and E. Nawata: Sensitive stages of fruit and seed development of chili pepper (*Capsicum annuum* L. var. Shishito) exposed to high temperature stress. *Sci. Hort.*, 117 : 21-25, 2008.

Hirota I., E. Nawata, A. Nakanishi and S Sipasak: Allometric equations to estimate aboveground biomass of four bamboo species in shifting cultivation fields in northern Laos. *Bamboo J.*, 25 : 18-25, 2008.

Pagamas P. and E. Nawata: Effects of Heat Stress to Flower and Fruit on Seed Quality of Chili Pepper. *Trop. Agric. Dev.*, 52 : 82-87, 2008.

b) Conference and seminar papers presented

103th Meeting, Japan. Soc. Trop. Agric. (4)

104th Meeting, Japan. Soc. Trop. Agric. (2)

## A-3. Off-campus activities

***Membership in academic societies***

Nawata, E.: Japanese Society for Tropical Agriculture (Vice-President, Council member, Editorial board member, Secretary for public relations).

***Research grants***

JSPS Research Grant: Research (A); Evaluation and restoration of environmental degradation caused by agricultural intensification in mainland Southeast Asia (leader Nawata), Research (A); Proposal of optimized land use based on C dynamics model in humid tropics (leader Kosaki, Faculty of Urban Environmental Science, Tokyo Metropolitan University, collaborator Nawata), Research (A); What has agriculture destroyed in ecosystems? - Towards the recovery of homeostasis of soil ecosystems (Leader Funakawa, Laboratory of Soil Science, collaborator Nawata), Research (B); Changes in traditional utilization of plant resources under the progress of economic development and globalization (Leader Nawata, collaborator Higuhi), Research (B); Land Use Dynamics of Mainland Southeast Asia:

Combining Field Works with RS (leader Kono, Center for Southeast Asian Studies, collaborator Nawata), Research (S); Integrated Research on African Way of Rural Development Based on Area Studies (leader Kakeya, Graduate School of Asian and African Area Studies, collaborator Higuchi), Research (C); Comparative community ecology of flower visitors and frugivorous insects in the primitive pollination system of *Annona* fruit trees (Leader Tsukada, Faculty of Bioresources, collaborator Higuchi)

#### **A-4. International cooperation and overseas activities**

##### ***International meetings (roles)***

Nawata, E.: International Society of Food, Agriculture and Environment (Editorial board member)

##### ***International joint researches, overseas research surveys***

Nawata, E.: Evaluation and restoration of environmental degradation caused by agricultural intensification in mainland Southeast Asia (Thailand, Kasetsart University)

Nawata, E.: Evaluation and restoration of environmental degradation caused by agricultural intensification in mainland Southeast Asia (Thailand, Khon Kaen University)

Nawata, E.: Evaluation and restoration of environmental degradation caused by agricultural intensification in mainland Southeast Asia (Thailand, Chiang Mai University)

Nawata, E.: Evaluation and restoration of environmental degradation caused by agricultural intensification in mainland Southeast Asia (Thailand, ICRAF),

Nawata, E.: Utilization of bio-resources in homegardens in Phuthai people in Laos (Laos, National Agriculture and Forestry Research Institute)

Higuchi, H.: The international project of low tree height cultivation techniques (Thailand, Chantaburi Horticultural Research Center)

Higuchi, H.: The international project of low tree height cultivation techniques (Vietnam, South East Fruit Research Center)

Higuchi, H.: The integrated research on African way of rural development based on area studies; - Towards the endogenous development through the thoroughly understanding of the reality of the areas and the appreciating a new value of the indigenusness - (Tanzania, Sokoine University)

#### **B. Education Activities (2008.4-2009.3)**

##### **B-1. On-campus teaching**

a) courses given

Undergraduate level: Outline of Bioresource Science IV (Nawata), Social and Environmental Changes under Sustainable Development in Monsoon Asia (Nawata), Introduction to Tropical Agriculture (Nawata), Environmental Stresses for plants (Higuchi, Nawata), Laboratory Course in Bioresource Science I • II (Higuchi, Nawata), Seminar in Tropical Agriculture (Nawata, Higuchi)

Graduate level: Agricultural ecology in the tropics (Nawata), Seminar in Tropical Agronomy (Nawata, Higuchi), Special Laboratory Work in Tropical Agronomy (Nawata, Higuchi)

##### **B-3. Overseas teaching**

***Students and research fellows from abroad***

Research fellow 1 (Thailand)

## 2.5.5 Laboratory of Soil Science

*Staff*      *Professor*                      : Funakawa, Shinya, Dr. Agric. Sci. (since 1st Nov)  
                 *Associate Professor*       : Funakawa, Shinya, Dr. Agric. Sci. (until 31st Oct)  
                 *Assistant Professor*       : Shinjo, Hitoshi, Dr. Agric. Sci.  
                 *Assistant Professor*       : Watanabe, Tetsuhiro, Dr. Agric. Sci.

*Students and research fellows*

*Doctor's program*: (7)                      *Research fellow* : (1)  
*Master's program*: (7)                      *Undergraduate* : (1)

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

- a) Soil characterization, development of the soil management and environment conservation in the tropics and arid regions:

The laboratory of soil science widely concerns soil management strategies for sustainable use and conservation of environment in the tropics and the arid regions. In Central Asia (Kazakhstan, and northwestern China), researches on soil degradation due to continuous cereal cropping in the steppe region were conducted. In Southeast Asia (Thailand and Indonesia), soil processes under traditional shifting cultivation systems were investigated with special reference to soil organic matter dynamics and the agro-ecological degradation due to excessive land use under increasing population pressure was also analyzed to establish a sustainable land use system there. In Sub-Sahara Africa (Tanzania, Zambia and Niger), human-environment relationship was investigated through the research on the response of soils to the soil management practices under conventional farming systems by small-scale farmers.

- b) Dynamic pedology on the soil acidification processes:

The acid-buffering and/or storing capacity of the amorphous sesquioxides in the course of pedogenetic acidification of soils derived from several parent materials were studied in the cool and warm temperate forests in Japan and in the tropical forests in Southeast Asia. Conditions for formation and weathering of expandable 2:1 type soil clay minerals in leaching environments were investigated and simultaneous dynamics of organic matter and soil acidity in different soil ecosystems were analyzed.

- c) Studies on dynamics of organic matter and soil microbes under different soil ecosystems:

The dynamics of organic matter and soil microbes in ecosystems are key processes in terms of different environmental problems such as global warming and nutrient leaching. The soil organic matter-decomposing characteristics and microbial activities were analyzed for soil collected from different environments (Thailand, Indonesia, Kazakhstan, etc).

#### A-2. Publications and presentations

- a) Publications

##### ***Books***

J. Yanai, S. Funakawa, H. Shinjo, N. Moritsuka: Soils. Translated to Japanese from the original by William Dubbin, Kokon Shoin, Tokyo, 2009 (in Japanese)

### *Original papers*

- Takata, Y., Funakawa, S., Yanai, J., Mishima, A., Akshalov, K., Ishida, N., and T. Kosaki: Influence of crop rotation system on the spatial and temporal variation of soil organic carbon budget in northern Kazakhstan. *Soil Science and Plant Nutrition* 54; 159–171, 2008
- Kadono, A., Funakawa, S., and T. Kosaki: Factors controlling mineralization of soil organic matter in Eurasian steppe area. *Soil Biology and Biochemistry* 40; 947–955, 2008
- Fujii, K., Funakawa, S., Hayakawa, C., and T. Kosaki: Contribution of different proton sources to pedogenetic soil acidification in forested ecosystems in Japan. *Geoderma* 144; 478–490, 2008.
- Sawada, K., Funakawa, S., and T. Kosaki: Soil microorganisms have a threshold concentration of glucose to increase the ratio of respiration to assimilation. *Soil Science and Plant Nutrition* 54; 216–223, 2008
- Funakawa, S., Hirooka, K., and K. Yonebayashi: Temporary storage of soil organic matter and acid neutralizing capacity during the process of pedogenetic acidification of forest soils in Kinki District, Japan. *Soil Science and Plant Nutrition* 54; 434–448, 2008
- Sugimori, Y., Funakawa, S., Pachikin, K.M., Ishida, N., and T. Kosaki: Soil salinity dynamics in irrigated fields and its effects on paddy-based rotation systems in southern Kazakhstan. *Land Degradation and Development* 19; 305–320, 2008
- Nakao, A., Thiry, Y., Funakawa, S., and T. Kosaki: Characterization of the frayed edge site of micaceous minerals in soil clays influenced by different pedogenetic conditions in Japan and northern Thailand. *Soil Science and Plant Nutrition* 54; 479–489, 2008
- Funakawa, S., Watanabe, T., and T. Kosaki: Regional trends in the chemical and mineralogical properties of upland soils in humid Asia: With special reference to the WRB classification scheme. *Soil Science and Plant Nutrition* 54; 751–760, 2008
- Takata, Y., Funakawa, S., Akshalov, K., Ishida, N., and T. Kosaki: Regional evaluation of the spatio-temporal variation in soil organic carbon dynamics for rainfed cereal farming in northern Kazakhstan. *Soil Science and Plant Nutrition* 54; 794–806, 2008
- Watanabe, T., Ogawa, N., Funakawa, S., and T. Kosaki: Relationship between chemical and mineralogical properties and rapid response to acid load for the soils of humid Asia: Japan, Thailand and Indonesia. *Soil Science and Plant Nutrition* 54; 856–869, 2008
- Fujii, K., Funakawa, S., Uemura, M., Hayakawa, C., Sukartiningih, S., and T. Kosaki: Quantification of proton budgets in soils of cropland and adjacent forest in Thailand and Indonesia. *Plant and Soil* 316; 241–255, 2009
- Nakao, A., Funakawa, S., Watanabe, T., and T. Kosaki: Pedogenic alterations of illitic minerals represented by Radiocesium Interception Potential in soils with different moisture regimes: Japan, Thailand, and Indonesia. *European Journal of Soil Science* 60; 139–152, 2008
- Nakao, A., Funakawa, S., and T. Kosaki: Hydroxy-Al polymers block the frayed edge site of illitic minerals in acid soils: Studies in southwestern Japan with special reference to their weathering stages. *European Journal of Soil Science* 60; 127–138, 2008
- Hayashi, K., Abdoulaye, T., Matsunaga, R., Shinjo, H., Tanaka, U., Tobita, S. and R. Tabo: Sustainable management of soil organic matter for agricultural land in the Sahel, West Africa. *Advances in Geocology* 39; 371–378, 2008
- Shinjo, H., Hayashi, K., Abdoulaye, T., and T. Kosaki: Management of livestock excretion through corraling practice by sedentary pastoralists in the Sahelian region of West Africa – a case study in

southwestern Niger -. Tropical Agriculture and Development 52; 97-103, 2008

b) Conference and seminar papers presented

Annual meeting of Japanese Society of Pedology (Tsukuba, 2008.4): 3 papers

Annual meeting of Japanese Society of Soil Science and Plant Nutrition (Nagoya, 2008.9.9-13): 8 papers

The 104th meeting of Japanese Society of Soil Science and Plant Nutrition for Kansai area (Tokushima, 2008.11.28): 3 papers

The 2nd meeting of Japanese Society of Ecology for Kansai area (Kyoto, 2008.12.13): 1 paper

The 56th conference of Japanese Society of Ecology (Morioka, 2009.3.17-21): 1 paper

The 105th conference of Japanese Society of Tropical Agriculture (Fujisawa, 2009.3.27-28): 3 papers

### **A-3. Off-campus activities**

#### ***Research grants***

Funakawa, S.: Grant-in-Aid for Scientific Research (B), Changes of agro-ecological environments in Central Eurasia during the last millennium (Funakawa, chief; Shinjo, member); Grant-in-Aid for Scientific Research (A), Integral database for regional studies based on realization of virtual global space (Funakawa, member); Grant-in-Aid for Scientific Research (A), Evaluation of environmental degradation along with intensification of agriculture in continental Southeast Asia (Funakawa, member); Grant-in-Aid for Scientific Research (A), What has agriculture destroyed in ecosystems? – Towards the recovery of homeostasis of soil ecosystems – (Funakawa, chief; Watanabe, member); Grant-in-Aid for Scientific Research (A), Identification of stress factors in soil organic matter dynamics in humid regions and its agricultural use (Funakawa, member)

Shinjo, H.: Grant-in-Aid for Scientific Research (B), Changes of agro-ecological environments in Central Eurasia during the last millennium (Funakawa, chief; Shinjo, member); Grant-in-Aid for Scientific Research (B), South to south transfer of technology to combat desertification in inland semiarid region in West Africa (Shinjo, member)

Watanabe, T.: What has agriculture destroyed in ecosystems? – Towards the recovery of homeostasis of soil ecosystems – (Funakawa, chief; Watanabe, member); Grant-in-Aid for Young Researchers, Influences of geological conditions on biogeochemical processes of forest ecosystems in Japan (Watanabe, chief)

Entrust Research Fund by Japanese International Research Center for Agricultural Sciences: Characterization of the natural resources in the sandy soils in the semiarid tropics of Africa (Shinjo)

Sumitomo Foundation: Study on carbon cycle in tropical ecosystems and its changes by human activities. (Funakawa, chief)

#### **A-4. International cooperation and overseas activities**

##### ***International joint researches, overseas research surveys***

Funakawa, S.: Study on agricultural ecosystems in tropical Asia. (Thailand, Indonesia); Study on agricultural ecosystems in tropical Africa. (Tanzania, Cameroon); Recent agro-environmental alteration in Central Asia.

Shinjo, H.: Study on desertification in West Africa. (Niger); Study on social-ecological resilience in semi-arid Tropics (Zambia)

Watanabe, T.: Study on organic matter dynamics in mountainous region of Central Asia (Kazakhstan), Study on weathering rate of soil minerals in humid Asia (Thailand, Indonesia)

#### **B. Educational Activities (2008.4-2009.3)**

##### **B-1. On-campus teaching**

###### **a) Courses given**

Undergraduate level: Outline of Biological and Environmental Science IV, Science of Biosphere, Environmental Science, Soil Science- Part I, Basic Laboratory Course in Biological and Environmental Science II, Soil Science- Part II (Funakawa); Practice in University Forest III, Livestock Production Techniques and Practice, Introduction to Plant Investigations, Laboratory Course in Biological and Environmental Science IV, Seminar in Soil Science, (Funakawa, Shinjo, Watanabe).

Graduate level: Research in Soil Science, Seminar in Soil Science (Funakawa, Shinjo, Watanabe); Biogeochemistry (Funakawa)

##### **B-2. Off-campus teaching**

Shinjo, H.: Special lecture (Seminar on natural environment at Bampaku Park)

##### **B-3. Overseas teaching**

###### ***Students and research fellows from abroad***

Doctor course student: 1 (New Zealand)



### 2.5.6 Laboratory of Environmental Mycoscience

*Staff Professor : Futai, Kazuyoshi, D.Agric.Sci*  
*Associate Professor: Tanaka, Chihiro, D.Agric.Sci*  
*Assistant Professor : Takeuchi, Yuko, D.Agric.Sci*  
*Guest Proffesor : Zaki Anwar Siddiqui, Ph.D. (1 Oct. 2007 – 30 Sept. 2008)*  
*Guest Professor :Wang Jianguo, Ph.D. (15 Dec. 2008 – 14 Dec. 2009)*

### *Students and research fellows*

Research student : (1)  
 Doctor's program : (6)  
 Master's program : (9) Undergraduate : (4)

### A. Research Activities (2008.4-2009.3)

### A-1. Main subjects

a) Ecological Studies on the Microorganisms-mediated interactions

The mechanisms of disease development have been studied both for the pine wilt disease and for the Japanese oak wilt. As for the pine wilt disease, proteomics studies have been conducted to reveal the causative factors of the disease. Another approach is AFLP profiling of the pathogenicity using pure lines of the nematode with different virulences. Concerning the mechanism of Japanese oak wilt, to understand the host response to the infection of this disease, spatiotemporal dynamics of secondary products produced in oak trees were surveyed after artificial inoculation of pathogenic fungus on to the trunks, and some interesting phenomena were discovered. Long term studies on mycorrhizal fungi in two forests of Fagaceous species, one is deciduous *Quercus* forest, and the other is ever green *Castanopsis* forest, have closed after three-year survey with fruitful results. Several studies on the vector beetle, *Platypus quercivorus* have also been conducted. Among them are intensive ecological studies of the yeast species on which beetle larvae feed, and studies on reproductive and social behavior of the beetles in the gallery. Both of these studies have been progressing very favorably with some new findings. Further, some basal researches were carried out to develop biological control method for these forest epidemics using several candidate microorganisms.

b) Biochemical and ecological genetics on fungi

1. The two classes of fungicides, Dicarboximides and Phenylpyrroles are effective and used for control of gray mold (*Botrytis cinerea*) diseases of several plants. The modes of the actions of these fungicides were unclear. However, our studies using the mutants of *Cochliobolus heterostrophus* revealed that these fungicides improperly activate the filamentous-fungus specific high-osmolarity stress signaling pathway. This signaling pathway has a great attention as a target of the fungicides. The pathway is involved not only in the adaption for high osmotic environment but also in the adaption for the host plant. The pathway seems to have a critical role in the lifecycles of plant pathogenic filamentous fungi. To elucidate the roles of this pathway in *Botrytis cinerea*, we have cloned the 6 genes (*BcOs1*, *BcSsk1*, *BcSsk2*, *BcPbs2*, *BcHog1* and *BcSkn7*). The results of disruption-studies showed that these genes were involved not only in high osmolarity adaptation but also in the mode of the action of the fungicide.

Improper activation of genes under controls of both BcSSK1 and BcSKN7 were required for full lethality by the fungicide. However, different from the case of *C. heterostrophus*, partial improper activation of the genes by BcSSK1 or BcSKN7 still causes severe effects on *B. cinerea*.

2. To elucidate the mechanism of heavy-metal tolerance in filamentous fungi, we focused on heavy-metal ATPases (HMAs), which plays important roles in heavy-metal-metabolism in a budding yeast, but of which functions in filamentous fungi are still unknown. We searched homologues of the genes coding HMAs in fungal genome databases, and performed a phylogenetic analysis of HMAs in fungi. The result showed that HMAs can be divided into three groups, A, B, and C. Group A is predicted to deliver copper ions to copper-containing proteins, while Groups B and C are thought to function as cell-membrane copper-efflux pumps. Furthermore, Groups B and C consist of fungal-specific HMAs, while HMAs of Group A are orthologues that have been well conserved in eukaryotes. Cloning and characterizations of Group A-type HMA genes in filamentous plant pathogens, *C.heterostrophus* and *B. cinerea* are under progress.

## A-2. Publications and Presentations

### a) Publications

#### **Books**

- Futai, K.: 3. The world of symbiotic microbes. In: Agriculture in 21st Century in Consideration with Bioresources 6 – Exploiting Microbial Functions (edited by Ueda, M.). pp 63-89. Kyoto University Press, Kyoto, 2008 (in Japanese)
- Futai K.: Plants and ectomycorrhizal fungi. Parasitism and Symbiosis (edited by Ishibashi, N. and Y., Nawa). pp 238-263. Tokai University Press, Kanagawa, 2008
- Futai, K.: Pine wilt in Japan: from first incidence to the present. In: Pine Wilt Disease (edited by Zhao, B.G., K. Futai, J.R. Sutherland and Y. Takeuchi). pp 5-12. Springer, 2008
- Futai, K. and Mota, M.M.: Biology and microbial inter-relationships. In: Pine Wilt Disease: A worldwide threat to forest ecosystems (edited by Mota, M. M. and P. Vieira). pp. 89-90. Springer, 2008
- Futai, K., and Y. Takeuchi: Field diagnosis of the asymptomatic carrier of pinewood nematode. In: Pine Wilt Disease: A Worldwide Threat to Forest Ecosystems (edited by Mota, M.M., and P. Vieira). pp 279-289. Springer, 2008
- Futai, K., T. Taniguchi, and R. Kataoka: Ectomycorrhizae and their importance in forest ecosystems. In: Mycorrhizae: Sustainable Agriculture and Forestry (edited by Siddiqui, Z.A., M.S. Akhtar and K. Futai). pp 241-285. Springer, 2008
- Siddiqui, Z.A., M.S. Akhtar, and K. Futai eds.: Mycorrhizae: Sustainable Agriculture and Forestry, 359 pp. Springer, 2008
- Takeuchi, Y.: Host fate following infection by the pine wood nematode. In: Pine Wilt Disease (edited by Zhao, B.G., K. Futai, J.R. Sutherland and Y. Takeuchi). pp 235-249. Springer, 2008
- Tanaka, C., and T. Okuno: Protecting plants from diseases. In: Agriculture in 21st Century in Consideration with Bioresources 3 – Plant Protection (edited by Sakuma, M.). pp 195-241. Kyoto University Press, Kyoto, 2008 (in Japanese)
- Zhao, B.G., K., Futai, J.R. Sutherland, and Y. Takeuchi eds.: Pine Wilt Disease, 459 pp. Springer, 2008

### ***Original papers***

- Endoh, R., M. Suzuki and Y. Benno: *Pichia rarassimilans* sp. nov., a novel yeast species isolated from body surface of the ambrosia beetle *Platypus quercivorus*. J. Gen. Appl. Microbiol. 54: 181–186, 2008
- Endoh, R., M. Suzuki and Y. Benno: *Ambrosiozyma kamigamensis* sp. nov. and *A. neoplatypodis* sp. nov., two new ascomycetous yeasts from ambrosia beetle galleries. Antonie Van Leeuwenhoek. 94: 365–376, 2008
- Endoh, R., M. Suzuki, Y. Benno and K. Futai: *Candida kashinagacola* sp. nov., *C. pseudovanderkliftii* sp. nov. and *C. vanderkliftii* sp. nov., three new yeasts from ambrosia beetle-associated sources. Antonie Van Leeuwenhoek. 94: 389–402, 2008
- Ishihara, A., Y. Hashimoto, C. Tanaka, G.J. Dubouzet, Y. Nakao, F. Matsuda, T. Nishioka, H. Miyagawa and K. Wakasa: The tryptophan pathway is involved in the defense responses of rice against pathogenic infection via serotonin production. Plant J. 54: 481–495, 2008
- Kataoka, R., T. Taniguchi, H. Ooshima and K. Futai: Comparison of the bacterial communities established on the mycorrhizae formed on *Pinus thunbergii* root tips by eight species of fungi. Plant and Soil 304: 267–275, 2008
- Shinya, R., Takeuchi, Y. and Futai, K. (2009) A technique for separating the developmental stages of the propagative form of the pine wood nematode (*Bursaphelenchus xylophilus*). Nematology, 11: 305–307, 2009
- Takeuchi, Y. and K. Futai: Diagnosis and quantification of the pine wood nematode, *Bursaphelenchus xylophilus*, in wood of *Pinus thunbergii* with real-time PCR. Jpn. J. Nematol., accepted.
- Tanaka, E., T. Ashizawa, R. Sonoda and C. Tanaka: *Villosiclava virens* gen. nov., comb. nov., the teleomorph of *Ustilaginoidea virens*, the causal agent of rice false smut. Mycotaxon 106: 491–501, 2008
- Tanaka, E., K. Shimizu, Y. Imanishi, F. Yasuda and C. Tanaka: Isolation of basidiomycetous anamorphic yeast-like fungus *Meira argovae* found on Japanese bamboo. Mycosci. 49: 329–333, 2008
- Tanaka, E. and C. Tanaka: Phylogenetic study of clavicipitaceous fungi using acetaldehyde dehydrogenase gene sequences. Mycosci. 49: 115–125, 2008
- Taniguchi T., R. Kataoka, and K. Futai: Plant growth and nutrition in pine (*Pinus thunbergii*) seedlings and dehydrogenase and phosphatase activity of extomycorrhizal root tips inoculated with seven individual extomycorrhizal fungal species at high and low nitrogen conditions. Soil Biol. Biochem. 40: 1235–1243, 2008
- Taniguchi, T., C. Tanaka, S. Tamai, N. Yamanaka and K. Futai: Identification of *Cylindrocladium* sp. causing damping-off disease of Japanese black pine (*Pinus thunbergii*) and factors affecting the disease severity in a black locust (*Robinia pseudoacacia*)-dominated area. J. For. Res. 13: 233–240, 2008
- Yamasaki, M. and K. Futai: Host selection by *Platypus quercivorus* (Murayama) (Coleoptera: Platypodidae) before and after flying to trees. Appl. Entomol. Zool. 43: 249–257, 2008

b) Conference and seminar papers presented

5th International Congress of Nematology: 2 papers  
12th International Congress on Yeasts: 1 paper  
Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry: 1 paper  
The 119th Annual Meeting of the Japanese Forestry Society: 6 papers  
The 16th Annual Meeting of the Japanese Nematological Society: 3 papers  
The 12th Annual Meeting of the Japanese Soc. of Mushroom Sci. and Biotechnol.: 1 paper  
The 52st Annual Meeting of the Mycological Society of Japan: 1 paper  
The 56th annual meeting of the Ecological Society of Japan: 2 papers  
The Annual Meeting of the Phytopathological Society of Japan, 2008: 1 paper  
The Annual Meeting of the Fungal Molecular Biology Society of Japan, 2008: 2 papers  
The Annual Meeting of the Japanese Society of Soil Microbiology, 2008: 1 paper

### **A-3. Off-campus activities**

#### ***Memberships in Academic Societies***

Futai, K.: Japanese Society of Nematology (Fellow), Tree Health Research Society (member of editorial board), Japanese Forest Society (member of organizing committee of the 120th annual meeting)  
Tanaka, C.: The Mycological Society of Japan (trustee, member of editorial board, member of database committee), Japanese Society of Pesticide Science (member of editorial board), Plant Pathological Society of Japan (member of editorial board).

#### ***Research grants***

Futai, K.: Grant-in-Aid for Scientific Research (A) from the Ministry of Education, Science and Culture, Japan, (Molecular biological study on the pathogenic mechanisms of drastic tree wilting diseases)  
Tanaka, C.: Grant-in-Aid for Scientific Research (B2) from the Ministry of Education, Science and Culture, Japan, (Studies on exotic ectomycorrhizal fungi invaded into New Zealand native forest)  
Takeuchi, Y.: Grant-in-Aid for Young Scientists (start-up) from the Ministry of Education, Science and Culture, Japan, (Cloning of acetylcholine esterase genes of the pine wood nematode)

### **A-4. International cooperation and overseas activities**

#### ***International meetings (roles)***

Futai, K.: International Conference of Nematologists (session organizer)

#### ***International joint researches, overseas research surveys***

Futai, K.: Lecture on forest diseases at Gyeongsang National University (Korea)  
Tanaka, C.: A study on fungal flora in a tropical and monsoon South-East Asia (Malaysia).  
Tanaka, C.: Studies on exotic ectomycorrhizal fungi invaded into New Zealand native forest (New Zealand).

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Course given**

Undergraduate level: Microbes in Ecosystem (Futai), Seminar in Environmental Microbiology (Futai,

Tanaka), Laboratory course in Biological and Environmental Science III, IV (Futai, Tanaka), Outline of Bioresource Science IV (Futai, Tanaka), Microbiology (Futai, Tanaka), Pesticide Science (Tanaka).

Graduate level: Seminar in Environmental Mycoscience (Futai, Tanaka), Research in Environmental Mycoscience (Futai, Tanaka),

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Futai, K.: Minami Kyushu University (Conservation Biology)

## **B-3. Overseas teaching**

### ***Students and research fellows from abroad***

Guest Professor: Zaki Anwar Siddiqui, Ph.D. (1 Oct. 2007 - 30 Sept. 2008) (India)

Guest Professor: Wang Jianguo, Ph.D. (15 Dec. 2008 – 14 Dec. 2009) (P.R. China)

Doctor's program: Qi Hongye (P.R. China)

Hagus Tarno (Indonesia)

## 2.5.7 Laboratory of Ecological Information

*Staff Associate Professor: Osakabe, Masahiro, Dr. Agric. Sci.*

*Assistant Professor: Yano, Shuichi, Dr. Agric. Sci.*

*Postdoctoral Fellow: Fukaya, Midori, Ph.D.*

*JSPS Postdoctoral Fellow: Uesugi, Ryujū, Ph. D.*

*Students and research fellows*

*Master's Program: (4) Research Fellow : (4)*

*Undergraduate : (3) Research Student : (1)*

### A. Research Activities (2008.4–2009.3)

#### A-1. Main subjects

The major research topic in this laboratory is the ecological, molecular and biochemical analysis of the interactions among plants, herbivores and predators, along with basic ecological and genetical studies of individual components comprising of these systems.

##### a) Inter- and intra-specific variations in the ecological performance of spider mites

Phytophagous mites of the family Tetranychidae occur in a variety of environments, while their adaptive traits such as diapause, dispersal and host plant range vary within species and between them. We have studied experimentally and theoretically, the genetic basis of this variation, and the ecological factors responsible for and the significance of the variation.

##### b) Management of spider mite population in orchards

We have compared the abundance of spider mite populations in pear and persimmon orchards that have different cultural and control programs, and determined the artificial factors responsible for outbreaks of the mites. Based on this survey, we proposed strategies for controlling the mite population, including the use of natural enemies, such as phytoseiid mites, and the development of new cultural management techniques.

##### c) Ethological interactive studies of spider mites and their predators

In general, herbivores and their predators are involved in complex food webs. Moreover, members within a trophic level also interact through inter-specific competition and/or intra-guild predation. We have investigated direct and indirect impacts of these interactions on the population dynamics of herbivores.

##### d) Evolutionary ecology of plant-herbivore interactions

Diverse interactions between plants and herbivores are maintained by the balance between defense of plants against herbivores and counter adaptation of herbivores. From this viewpoint, we have examined the reason why host ranges of phytophagous insects and mites are generally restricted to a small range of plant fauna available to them. We also investigated proximate factors responsible for the interactions such as secondary metabolites of host plants.

##### e) Meta-population structure and maintenance of genetic variation in spider mites

Neutral mutations are frequently lost or fixed by genetic drift within a finite population. Nevertheless, genetic variations in pesticide susceptibilities are maintained in a selection-free, wild population of spider mites. Such variations may be maintained by the meta-population structure of spider mites. We have analyzed the structure using molecular markers such as DNA polymorphism, and discussed the maintenance mechanism of the genetic variations.

## A-2. Publications and Presentations

### a) Publications

#### **Books**

- Fukaya, M.: 3.4 Rational and elegant information systems, *Entomological Science and its Perspective* (edited by Fujisaki et al.), pp. 389–422, Kyoto Univ. Press., Kyoto, 2009 (in Japanese)
- Osakabe, Mh. and R. Uesugi: 1.5 How to cope with diffusion and internationalization of pesticide resistance, *Entomological Science and its Perspective* (edited by Fujisaki et al.), pp. 135–156, Kyoto Univ. Press., Kyoto, 2009 (in Japanese)
- Osakabe, Mh. and M. Umeda: Aerial dispersal of spider mites, *Entomological Science and its Perspective* (edited by Fujisaki et al.), pp. 461–467, Kyoto Univ. Press., Kyoto, 2009 (in Japanese)
- Yano, S. and Mh. Osakabe: 2.4 Microcosms on plant leaves, *Entomological Science and its Perspective* (edited by Fujisaki et al.), pp. 253–269, Kyoto Univ. Press., Kyoto, 2009 (in Japanese)

#### **Original papers**

- Kawasaki, T., S. Yano and Mh. Osakabe: Effect of wall structure and light intensity on the settlement of the predatory mite, *Euseius sojaensis* (Ehara) (Acari: Phytoseiidae). *Appl. Entomol. Zool.* 44; 81–84, 2009
- Kobayashi, T. and Mh. Osakabe: Pre-winter copulation enhances overwintering success of *Orius* females (Heteroptera: Anthracoridae). *Appl. Entomol. Zool.* 44; 47–52, 2009
- Ozawa, M. and S. Yano: Pearl bodies of *Cayratia japonica* (Thunb.) Gagnep. (Vitaceae) as alternative food for a predatory mite *Euseius sojaensis* (Ehara) (Acari: Phytoseiidae). *Ecol. Res.* 24; 257–262, 2009
- Uesugi, R., Y. Kunimoto and Mh. Osakabe: The fine-scale genetic structure of the two-spotted spider mite in a commercial greenhouse. *Exp. Appl. Acarol.* 47; 99–109, 2009
- Asahara, M., R. Uesugi and Mh. Osakabe: Linkage between one of polygenic hexythiazox-resistance genes and an etoxazole-resistance gene in the two-spotted spider mite (Acari: Tetranychidae). *J. Econ. Entomol.* 101; 1704–1710, 2008
- Ogawa, Y. and Mh. Osakabe: Development, long-term survival, and the maintenance of fertility in *Neoseiulus californicus* (Acari: Phytoseiidae) reared on an artificial diet. *Exp. Appl. Acarol.* 45; 123–136, 2008
- Ohzora, Y. and S. Yano: Fertilization of two-spotted spider mite mothers changes sons. *J. Acarol. Soc. Jpn.* 17; 87–92, 2008
- Oku, K. and S. Yano: Effects of predation risk on mating behavior of the Kanzawa spider mite. *J. Ethol.* 26; 261–266, 2008
- Osakabe, Mh., Y. Kotsubo, R. Tajima and N. Hinomoto: Restriction fragment length polymorphism catalogue for molecular identification of Japanese *Tetranychus* spider mites (Acari: Tetranychidae). *J. Econ. Entomol.* 101; 1167–1175, 2008
- Osakabe, Mh., H. Isobe, A. Kasai, R. Masuda, S. Kubota and M. Umeda: Aerodynamic advantages of upside down take-off for aerial dispersal in *Tetranychus* spider mites. *Exp. Appl. Acarol.* 44; 165–183, 2008

#### **Reviews**

- Osakabe, Mh. and Y. Ogawa: Possible new application of artificial diets. *Plant Protection* 63; 44–48, 2009

### b) Conference and seminar papers presented

53rd Annual Meeting of Japanese Society of Applied Entomology and Zoology: 8 papers

6th European Congress of Acarology: 4 papers

International Symposium on Mites and Whitefly: 2 papers

The 3rd International Symposium of Entomological Science COE: 5 papers

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Osakabe, M.: Japanese Society of Applied Entomology and Zoology, The Genetics Society of Japan, Pesticide Science Society of Japan, The Society of Population Ecology, The Acarological Society of Japan (Councilor), The Kansai Plant Protection Society

Yano, S.: Japanese Society of Applied Entomology and Zoology, The Society of Population Ecology, The Acarological Society of Japan, The Ecological Society of Japan

#### ***Research grants***

JSPS Research Grant: Basic Research (C) Molecular basis of counter-adaptation by agricultural pests against chemical defense of host plants (Osakabe, Head).

JSPS Research Grant: Encouragement of Young Scientists (B): Investigation on an evolutionary mechanism of pesticide-resistance instigated by apparent cross resistances (Uesugi, Head).

The 21st Century COE Program: Innovative food and environmental studies pioneered by entomomimetic sciences (Osakabe and Yano; Partial)

Research Project funded by the Japan Ministry of Agriculture, Forestry and Fisheries: Development of new biorational techniques for sustainable agriculture (Osakabe and Yano; Partial)

### **A-4. International cooperation and overseas activities**

#### ***International meetings (roles)***

Osakabe, Mh.: 6th European Congress of Acarology (Montpellier, France, 1 paper), International Symposium on Mites and Whitefly (Gyeongju, Korea, 1 paper), The 3rd International Symposium of Entomological Science COE (Kyoto, 1 paper)

Yano, S.: 6th European Congress of Acarology (Montpellier, France, 1 paper)

#### ***Membership in international academic societies***

Osakabe, Mh.: The Entomological Society of America

## **B. Educational Activities (2008.4–2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Ecological Management (Osakabe), Seminar in Ecological Management (Osakabe), Outline of Bioresource Science IV (Osakabe), Fundamentals of the Experiments of Bioresource Science (Yano), Laboratory Course in Bioresource Science I•II (Yano), Introduction to Foreign Literature in Bioresource Science (Osakabe)

Graduate level: Special Lecture in Ecological Management (Osakabe), Seminar in Ecological Information and Management (Osakabe), Research in Ecological Information and Management (Osakabe and Yano)

### **B-2. Off-campus teaching**

#### ***Part-time lecturer***

Osakabe, Mh.: Ishikawa Prefectural University (Applied Entomology)

Osakabe, Mh.: Kyoto Prefectural University



## Chair of Environmental Development Engineering

### 2.5.8 Laboratory of Agricultural Facilities Engineering

*Staff Associate Professor : Kobayashi Akira, Dr. Eng. Sci.*

*Assistant Professor: Kiyama Shouichi, Dr. Agric. Sci.*

*Assistant Professor: Yamamoto Kiyohito, Dr. Agric. Sci.*

*Students and research Fellows*

*Doctor's Program : (2)*

*Undergraduate : (7)*

*Master's Program : (3)*

#### **A. Research Activities (2008.4-2009.3)**

##### **A-1. Main subjects**

a) Non-destructive method for long used hydraulic facilities for irrigation

To make the strategy for the maintenance of long used hydraulic facilities for irrigation activity, non-destructive methods such as impact acoustic method, electrical resistivity survey and electro-magnetic method to investigate the state of the structure or subsoil has been developed.

b) Maintenance and renewal or rehabilitation of the long used facilities

Nowadays, it is important decision making how to choose among rehabilitation work, repair, or renewal of facilities by the new project, based on the grasp of various functional loss of the deteriorated facilities. Also the need of the farmers to various facilities has been changed from the past. From this point what is the best strategy for the economical use of the finance is investigated.

c) Validation of the coupled mechanical, hydraulic and thermal analysis

By applying the simulation method for the coupled mechanical, hydraulic and thermal phenomena, the numerical method is tried to be validated.

d) Experimental research on failure mechanism of irrigation tank caused by overtopping and risk analysis of the irrigation tank damages

Many traditional irrigation tanks easily fail due to the overtopping of the pond water by a heavy rain. But the mechanism of the failure is not clarified because of the lack of the exact observation. So the experimental test of overtopping has been carried out. Also based on the data of many failed irrigation tanks in AWAJI Island caused by the heavy rain of a typhoon, a risk analysis was carried out.

e) Mechanics of solute transport through ground having sea water intrusion

To understand the environmental problem near coast area, the solute transport through the area having sea water intrusion is investigated by the 2-D tank and numerical approach.

f) Eco-efficiency assessment of eutrophication for the watershed environmental management

Quantifying watershed based integrated environment and economic accounting and eutrophication potential, we investigate how to manage the sustainable water environmental development in the future inter-sectoral and inter-regional activities.

g) Mechanical property change in rocks and concrete due to degradation

For long use of irrigation structure, mechanical characteristics of degraded rock and concrete are investigated. Mechanical characteristics of degraded mortar are grasped using compression strength test. Analysis model of damage mechanism is examined.

## A-2. Publications and presentations

a) Publications

***Original Papers***

- Makokha M., Kobayashi A. and Aoyama S. : Numerical modeling of seawater intrusion management measures. *Journal of Rainwater Catchment Systems*, Vol.14, No.1; 17-24, 2008
- Bäckström, A, J. Antikainen, T. Backers, X. Feng, A. Kobayashi, T. Koyama, P. Pan, M. Rinne, B. Shen and J. A. Hudson : Numerical modelling of uniaxial compressive Failure of Granite with and without saline porewater. *International Journal of Rock Mechanics and Mining Sciences*, 45; 1126-1142, 2008
- Kobayashi A., Yamamoto K. and Tsunematsu H. : Improvement of elastic wave exploration as nondestructive investigation method of irrigation tank embankment, *Journal of Rainwater Catchment Systems*, Vol.14, No.1; 33-40, 2008
- Kobayashi A., Yamamoto K. and Hayashi T. : Selection of route of temporary irrigation water supply line with GIS in emergency situation. *Journal of Rainwater Catchment Systems*, Vol.14, No.1; 25-32, 2008
- Kobayashi A., Yamamoto K. and Momoki S. : Characteristics of strength for hydraulic fracturing, *Soils and Foundations*. Vol.48, No.4; 467-477, 2008
- Yamamoto K., Kobayashi A. and Aoyama S. : Behavior of acoustic emission of mortar degraded by mixing with expanded polystyrene beads. *Journal of the Society of Materials Science Japan*, Vol. 57, No. 10; 1011-1018, 2008 (in Japanese)
- Kobayashi A., Yamamoto K. and Hayashi T. : Asset management of embankment of irrigation tank. *Journal of Rainwater Catchment Systems*, Vol. 14, No.1; 41-47, 2008
- Kobayashi A., Yamamoto K. and Fukumoto Y. : Numerical examination of degradation of rock slope due to rainfall and ambient temperature by damage model. *Journal of Rainwater Catchment Systems*, Vol. 14, No.1; 49-56, 2008
- Fujisawa K., Kobayashi A. and Yamamoto K. : Erosion rate of compacted soils for embankments. *Journal of Geotechnical Engineering, Japan Society of Civil Engineering*, Vol.64, No.2; 403-410, 2008
- Kobayashi A., Yamamoto K., Chijimatsu M. and Fujita T. : Effect of degradation of rock on near field of HLW repository. *Journal of Geotechnical Engineering, Japan Society of Civil Engineering*, Vol.64, No.2; 411-422, 2008
- Kobayashi A., Yamamoto K., Chijimatsu M. and Fujita T. : Reliability analysis of numerical simulation in near field behavior. *Journal of Geotechnical Engineering, Japan Society of Civil Engineering*, Vol.64, No.2; 429-439, 2008
- Kobayashi A., Yamamoto K., Yanagimoto T., Tsunematsu H. and Aoyama S. : Nondestructive investigation of soil structure with radar. *Journal of Geotechnical Engineering, Japan Society of Civil Engineering*, Vol. 64, No.3; 629-638, 2008
- Yamamoto K., Kobayashi A. and Aoyama S. : Evaluation method for mechanical properties of

degraded mortar using damage parameter. Journal of Applied Mechanics, JSCE, Vol. 11; 919-928, 2008 (in Japanese)

Kiyama S.: GIS-aided cultivation abandonment modelling and an investigation of subsidy plan for sustainable farming. Environmental Systems Research, 36(1); 353-362, 2008 (in Japanese)

Kobayashi A., Fukumoto Y. and Yamamoto K. : Examination of degradation of rock slope by damage mechanics. The 4th International Conference on Advances in Structural Engineering and Mechanics; 1124-1133, 2008

Kobayashi A., Chijimatsu M., Fujita T. and Yamamoto K. : Assessing the long-term behavior of a radioactive waste disposal tunnel with a damage model incorporating chemical degradation effects. Proceedings of the 3rd International Symposium GeoProc' 2008, ISTE, John Wiley & Sons; 621-628, 2008

Yamamoto K., Kobayashi A. and Aoyama S. : Behavior of AE parameters due to increase in damage variable of mortar degraded by mixing with expanded polystyrene beads. Progress in Acoustic Emission XIV; 377-384, 2008

Kobayashi A. : Reliability analysis for near field behavior of HLW repository. EIT-JSCE Joint International Symposium, Monitoring & Modelling in Geo-Engineering; 10-15, 2008

Kiyama S.: Impact analysis of an agricultural subsidy policy on sustainable rural development and watershed water quality. Proceedings of the 8th International Conference on EcoBalance; 1-4, 2008

Kiyama S.: Watershed based agricultural land use management for the future inter-regional sustainable development: A compatible strategy to improve water quality and regional economic gap. Proceedings of 13th IWRA World Water Congress, Montpellier; 1-15, 2008

### ***Reports***

Kobayashi A. and Yamamoto K. : Estimation of state of water contents in irrigation tank by elastic inspection. Inspection Technology, 4 ; 33–38, 2008 (in Japanese)

Chijimatsu M., Tsukada Y., Kobayashi A. and Fujisaki K. : Chapter 3 JAEA team results for subtask A-2: model development and calibration of rock mass and bentonite. DECOVALEX-THMC Project, Task A, Report of Task A2, SKI Report 2008:41, ISRN SKI-R-08/41-SE; 41- 83, 2008

Antikainen J., Backers T., Backstrom A., Koyama T., Feng X., Pan P., Kobayashi A., Rinne M., Shen B., Lee H-S., Chijimatsu M. : DECOVALEX-THMC Project, Task B, Phase 3 Report, SKI Report 2008:42, ISRN SKI-R-08/42-SE, 2008

b) Conference and seminar papers presented

H-20 National conference of JSIDRE: 5 papers

11 th National symposium of applied mechanics: 1 paper

National Symposium of Environmental System, JSCE: 1 paper

EIT-JSCE Joint International Symposium, Monitoring & Modelling in Geo-Engineering: 3 papers

The 3rd International Symposium GeoProc' 2008: 4 papers

The seventeenth International Offshore and Polar Engineering Conference: 1 paper

Progress in Acoustic Emission XIV: 1 paper

The 4th International Conference on Advances in Structural Engineering and Mechanics: 3 papers

The 8th International Conference on EcoBalance: 1 paper

The 13th IWRA World Water Congress: 1 paper

### **A-3. Off-campus activities**

#### ***Membership in academic society***

Kobayashi, A.: Japanese Society of Irrigation, Drainage and Reclamation Eng. (member of committee of dam, Officer of Kyoto branch), Japanese Geotechnical Society (Domestic member of ATC8), Japan Soc. Civil Eng., Japanese Association of Groundwater Hydrology, J. Soc. Computational Eng., Int. Soc. of Rock Mechanics, Japan Rainwater Catchments System Association (councilor).

Kiyama, S.: Japanese Society of Irrigation, Drainage and Reclamation Eng. (member of committee of education organization of agricultural engineers, Kinki branch, JSIDRE.), Japanese Geotechnical Society, Japan Soc. of Civil Eng.

Yamamoto, K.: Japanese Society of Irrigation, Drainage and Reclamation Eng., Japanese Geotechnical Soc., Japan Soc. of Civil Eng., Japanese Soc. of Experimental Mechanics.

#### ***Research grants***

Monbusyo Grants-in-Aid : Basic research (B) Development of maintenance technique of agricultural hydraulic structures by considering its life cycle cost. (Kobayashi, head researcher)

Monbusyo Grants-in-Aid : Embryonic research Development of remote support system for daily check of agricultural hydraulic structure (Kobayashi, head researcher)

Monbusyo Grants-in-Aid : Basic research (C) Method of maintenance and control of agricultural resources based on the sound water cycle and fair regional benefit distribution . (Kiyama, head researcher)

Monbusyo Grants-in-Aid : Young researcher (B) Method of identification of degradation of structure by elastic wave. (Yamamoto, head researcher)

### **A-4. International cooperation and oversea activities**

#### ***International meeting (role)***

Kobayashi, A.: EIT-JSCE Joint International Symposium, Thailand, (presentation), The 3rd International Symposium GeoProc'2008, France (presentation), The 4th International Conference on Advances in Structural Engineering and Mechanics (presentation, chair)

Kiyama, S.: 8th International Conference on EcoBalance, Tokyo (presentation), 13th IWRA World Water Congress, Montpellier (presentation)

Yamamoto, K.: Progress in Acoustic Emission XIV, Kyoto (presentation)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Seminar in Rural Facility Engineering (Kobayashi, Kiyama and Yamamoto), Applied Mechanics (Kobayashi shear), Soil Mechanics and Concrete Engineering (Kobayashi), Laboratory Course in Soil Mechanics, Concrete Engineering and Environmental Geotechnique (Kobayashi, Kiyama and Yamamoto), Exercise in Information Processing, Basics (Kiyama, Yamamoto shear), Seminar in Agricultural and Environmental Engineering (Kobayashi shear), Design of facilities for agricultural engineering (Kobayashi)

Graduate level: Planning and Design of Rural Facilities (Kobayashi), Numerical Science of Structural Design (Kobayashi), Laboratory Course in Agricultural Facilities Engineering

(Kobayashi), Advanced Course of Data Processing for Design I (Kobayashi), Advanced Course of Data Processing for Design II (Kobayashi)

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Kobayashi, A.: Tokyo Institute of technology (Underground environment)

## **B-3. Overseas teaching**

### ***Students from abroad***

Foreign student (PhD Course): 1 (Bangladesh)

## **C. Other Remarks**

Kobayashi, A.: Member of council for huge earthquake countermeasure (Tokai agricultural administration office), Chair of committee for asset mangament of irrigation facilities (Shiga prefecture), Chair of committee of new technology introduction (Kinki agricultural administration office), Member of council for perfoemance of seismic countermeasure, Member of technical committee for Iwate-Miyagi earthquake, Member of council for engineering problems in design and construction of dams for irrigation use, Member of the committee for seismic technology of irrigation structures, Member of the committee of performance design of irrigation structures, JIID., Member of committee of dams for irrigation use, Member of committee on long use of dams for irrigation use, JSIDRE, Member of the committee on the research activity of geological disposal, Member of the committee on the advanced development of chemical effect on disposal system, Japan Nuclear Cycle Development Institute

Kiyama, S.: Party organizer KATSURA river network (voluntary organization), Committee member of lake planning of HIYOSHI dam water resource region, Ministry of land, infrastructure and transport, Committee member of environmental planning of HIYOSHI dam water resource region, Secretariat of AMAWAKA lake art project, Committee member of “Edu-tope” Project of Kyoto city Shirakawa high school of total support.

## 2.5.9 Laboratory of Water Resources Engineering

*Staff Professor : Kawachi, Toshihiko, Dr. Agric. Sci.*

*Associate Professor: Unami, Koichi, Dr. Agric. Sci.*

*Lecturer : Maeda, Shigeya, Dr. Agric. Sci.*

*Assistant Professor: Takeuchi, Junichiro*

*Students and research fellows*

*Doctor's program : (5)*

*Master's program : (8)*

*Undergraduate : (6)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Hydraulic and environmental modeling

Analytical approaches to assessment and prediction of water environment interacting with human activities are explored standing on environmental hydraulics. Major research effort is devoted to mathematical modeling of flows, transport phenomena, and ecology, in a wide variety of bodies of surface and subsurface water, with the ultimate aim of offering hydraulic and environmental engineers an integrated family of powerful tools that encompasses all possible water environmental problems encountered. Much attention is paid to development of robust, versatile and efficient computational methods.

##### b) Optimal management and control of water resources systems

Optimal strategies for management and control of water resources systems are fundamentally investigated to give better answers for tasks of water resources development, management and conservation. Both static and dynamic models are applied for supporting decision makers in agricultural water management, water quality control, and aquatic ecosystem restoration problems. Stochastic methods are applied for strategic management of floods, droughts, or aquatic ecosystems. Problems of optimal fertilizer application strategy in open fields using genetic algorithm, etc. are being tackled. Optimal allocation problems of allowable pollutant load are processed on GIS.

#### A-2. Publications and presentations

##### a) Publications

###### ***Books***

Unami, K., T. Kawachi, S. Maeda, J. Takeuchi: Computational methods supporting rainwater harvesting technology, Chapter 4 in Water Resources Research, Nova Science Publishers, 167-193, 2008

###### ***Original papers***

Unami, K., T. Kawachi, A. Miyauchi: Application of shallow water equations models for water hazards problems, Proceedings of WEES-2009; Volume I, 217-222, 2009

Chono, S., S. Maeda, T. Kawachi, K. Unami, and J. Takeuchi: Dynamics of nonpoint source pollutant loadings from agricultural watershed - A case Study in paddy-farming area with 122 drainage water outfalls Exactly identifiable -. Journal of Rainwater Catchment Systems

14(2); 21-28, 2009

Takeuchi, J., T. Kawachi, K. Unami, S. Maeda, T. Izumi: A distributed hydro-environmental watershed model with three-zoned cell profiling. Paddy Water Environ. 7; 33-43, 2009

b) Conference and seminar papers presented

2008's Annual Conf. of Jap. Soci. Irri. Drain. Recl. Eng.: 7 articles

65th Kyoto-Branch Conf. of Irri. Drain. Recl. Eng.: 8 articles

16th Congress of Jap. Rain. Catch. Sys. Associ.: 8 articles

2008 JSIDRE Workshop of Applied Hydraulics: 1 articles

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

Kawachi, T.: Rainwater Catchment Systems Association (Executive), Japanese Society of Irrigation, Drainage and Reclamation Engineering (President, Chairperson of Journal Editorial Board)

Unami, K.: Rainwater Catchment Systems Association (Councilor)

#### ***Research grants***

JSPS Grant-in-aid for scientific research (A): Hydro-environmental modeling and optimal management of water-network system in rural area (Kawachi, Unami, Maeda, Takeuchi)

JSPS Grant-in-aid for scientific research (A): Development options for rural water in West African savannas (Unami)

MEXT Grant-in-aid for young scientists (B): Development of simulation optimization model for environmentally sound fertilizer application to upland crop field on sloping land (Takeuchi)

### **A-4. International cooperation and overseas activities**

#### ***International meetings (roles)***

Unami, K.: International Conference on Water, Environment, Energy, and Society (WEES-2009), New Delhi (keynote speaker)

#### ***Membership in international academic societies***

Kawachi, T.: International Water Resources Association/IWRA (Member of Peer-reviewers Committee)

#### ***International joint researches, overseas research surveys***

Unami, K.: Development options for rural water in West African savannas (Ghana)

#### ***Scholars from abroad***

Invited research fellow 1 (Senior Research Assistant, University for Development Studies, Ghana)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Applied Mathematics (Maeda), Hydraulics (Unami), Water Resources Utilization (Kawachi), Water-Use Systems Engineering (Kawachi), Seminar in Computational Hydraulics (Kawachi, Unami, Maeda, Takeuchi), Laboratory Course in Hydraulics (Unami, Maeda, Takeuchi), Seminar in Agricultural and Environmental Engineering (Kawachi)

Graduate level: Water Resources Engineering (Kawachi), Seminar-I in Water Resources Engineering (Maeda), Seminar-II in Water Resources Engineering (Kawachi, Unami, Maeda), Laboratory

Course in Water Resources Engineering (Kawachi, Unami, Maeda)

**B-2. Overseas teaching**

*Students and research fellows from abroad*

Students: Master course/1 (Brazil)

**C. Other remarks**

Kawachi, T.: Member of the Japan National Council on Food, Agriculture and Rural Policies, Chair of the Consultation Committee for Restoration of Irrigation Tanks in Shiga, Chair of the Council for Environmentally Sound Rural Developments in Fukui, Member of the Council for Local Community Use of Irrigation Water in Yasu River Area, Chair of the Council for Environmentally Sound Kuzuryu-Project Implementation, Member of the Council for Building Flood-Proof Towns in Southern Biwa-Lake Areas



## Chair of Land and Water Resources Management

### 2.5.10 Laboratory of Irrigation, Drainage and Hydrological Environment Engineering

*Staff Professor : Kawashima, Shigeto, Dr. Agric. Sci.*

*Lecturer : Nakamura, Kimihito, Dr. Agric. Sci.*

*Assistant Professor : Hama, Takehide, Dr. Agric. Sci. (2008.4.1~)*

*Students and research fellows*

*Doctor's program : (3) Master's program : (8)*

*Undergraduate : (5) Research fellow : (1)*

#### A. Research Activities (2008.4-2009.3)

##### A-1. Main subjects

- a) Early detection and prediction of climate warming based on the long-term monitoring of alpine ecosystems on the Tibetan Plateau

The global warming observation system was constructed in the center part and the northern part of the Tibet plateau for the early detection of effects of global warming on ecosystem using the extremely high plateau and we started the long-term monitoring. The continuous meteorological observation at multi points in special high region with holding wide range in observation altitudes like this research is the first attempt in the Tibet plateau which is called the third pole of the earth. The meteorological data obtained by our observation network offers information on the reality how the status of global warming and the influence appear.

- b) Hydrological evaluation enhancement of multipurpose functions of agricultural lands and forest area

Evaluation of flood control of a basin (Oshinohara, Shiga). Evaluation of hydrological and meteorological characteristics in forested catchments (Oshinohara, Shiga and Kamigamo, Kyoto). Evaluation of purification function of air pollution by a forest basin and measurement of pH and EC of rainfall and stem flow (Oshinohara, Shiga).

- c) Hydro-geological environment management in agricultural area.

Water management of paddy fields as wetland in order to reduce nitrogen load to Lake Biwa (Omihachiman, Shiga). Optimal water management for the environmental agriculture (c.f. the physical and chemical consideration of cyclic irrigation system in paddy field district and groundwater level control for the reduction of nitrogen load) (Konohama, Shiga and Takashima, Shiga). Water management in paddy fields harmonized with ecological system (Yasu, Shiga). Agricultural land accumulation is necessary for sustainable agriculture. Merits of plot-to-plot irrigation system are investigated from standpoints of farming, water use amount and water quality (Takashima, Shiga). Development of methane fermentation manure liquid application design for sustainable paddy agriculture (Nantan, Kyoto)

- d) Modeling of mass transport of various substances in soil

Effect of infiltration rate on nitrogen transformation characteristics, Model of nitrogen transport

in paddy soil. Model of heavy metals transport in vadose zone. Measurement of continuous air content in soil using acoustic wave.

e) Development of the methodology for forecasting the hybridization mating rate of wind pollination crops

In order to promote the development and the popularization of GMO products, the establishment of a scientific technique to evaluate the influence of GMO on conventional crops is indispensable. The forecasting model of the pollen dispersal and the hybridization mating for wind pollination crops such as corn and rice plants is constructed based on the atmospheric diffusion equation and the ecological information of crops. The result of this research quantifies the cultivation conditions of GMO and conventional crops, and contributes to the establishment of the policy criterion to coexist of both.

f) Development of an automatic measurement method for airborne pollen

The environmental impact and safety of genetically modified organisms have become to a social problem. Especially in the wind pollination crops, the pollen diffuses distantly, and there is a possibility to generate the hybridization mating in wide area. It is important to develop the technique for measuring the amount of airborne pollen correctly and speedily in order to assess the environmental effect problems of pollen that causes the hybridization mating. However, conventional measurement method for airborne pollen in the past require much labour and long amount of time. Then, we develop the technique for automatically measuring the amount of airborne pollen. This method is able not only to decrease the amount of labor but also to catch a detailed change in the concentration of airborne pollen.

## A-2. Publications and presentations

a) Publications

### *Original papers*

Yuichi Takahashi, Masaaki Aoyama, Etsuko Abe, Takeshi Aita, Shigeto Kawashima, Nobuo Ohta, Masahiro Sakaguchi, 2008, Development of electron spin resonance radical immunoassay for measurement of airborne orchard grass (*Dactylis glomerata*) pollen antigens, *Aerobiologia*, 24, 53–59.

Toshiyuki Ohtsuka, Mitsuru Hirota, Xianzhou Zhang, Ayako Shimono, Yukiko Senga, Minguan Du, Seiichiro Yonemura, Shigeto Kawashima and Yanhong Tang, 2008, Soil organic carbon pools in alpine to nival zones along an altitudinal gradient (4400–5300 m) on the Tibetan Plateau, *Polar Science*, 2, 277-285.

Sakata, S., K. Nakamura, and T. Mitsuno: Influence of the Crop-Changed Paddy Plot on Water Balance in an Adjacent Paddy Plot in Low-lying Rice Field Area. *Trans. of the Japanese Society of Irrigation, Drainage and Rural Engineering* 257; 43-49, 2008 (in Japanese)

Hama, T., K. Nakamura, S. Kawashima, and T. Mitsuno: Effect of cyclic irrigation on reduction of net effluent loadings of nitrogen and phosphorous during sunny days in irrigation period after puddling season. *Trans. of the Japanese Society of Irrigation, Drainage and Rural Engineering* 257; 11-17, 2008 (in Japanese)

Sakata, S., K. Nakamura, and S. Kawashima: The Actual Condition Survey of the Irrigation for Japanese Apricot Field in Nanki-Irrigational District, Wakayama Prefecture. *Journal of the Agricultural Upland Development Association* 603; 11-17, 2009 (in Japanese)

Sakata, S., K. Nakamura, T. Mitsuno and S. Kawashima: The Usage of Lot-management Water on the Plots at the Green House. Trans. of the Japanese Society of Irrigation, Drainage and Rural Engineering 259; 87-92, 2009 (in Japanese)

#### ***Patents***

Patent pending/applied for Patent “Estimation method of groundwater contamination risk”, patentee: Yasutaka, T. and K. Nakamura, registration year: 2008

#### ***Reports***

Nakamura, K., S. Watanabe, Y. Hirono: Applications and Problems of Numerical Modeling of Nitrogen Transport in Agricultural Soils Using HYDRUS, Proceedings of the Third HYDRUS Workshop, Soil Water and The Japanese Society of Irrigation, Drainage and Reclamation Engineering Soil Physics HYDRUS Group, Tokyo, Japan; 58-69, 2008

Yasutaka, T. and K. Nakamura: Risk Assessment of Soil and Groundwater Contamination Using HYDRUS-1D, Proceedings of the Third HYDRUS Workshop, Soil Water and The Japanese Society of Irrigation, Drainage and Reclamation Engineering Soil Physics HYDRUS Group, Tokyo, Japan; 97-102, 2008

Seto, S., S. Kawashima, K. Nakamura, T. Hama, and N. Kojima: Seasonal change characteristics of stem flow in conifer forest; 81-84, Annual report of “Research for water conservation function of a forest”, 114p., 2009 (in Japanese)

Sato, K., S. Kawashima, K. Nakamura, T. Hama: Application of meteorological model to local wind and atmospheric cycle in Lake Biwa basin; 85-92, Annual report of “Research for water conservation function of a forest”, 114p., 2009 (in Japanese)

Nakamura, K. and S. Sakata: Annual report of “Research for revise of design criteria for irrigation and drainage water and land reclamation in Nanki district”; 38p., 2009 (in Japanese)

Nakamura, K. and S. Sakata: Annual report of “Research for revise of design criteria for irrigation and drainage water and land reclamation in Hino river district”; 18p., 2009 (in Japanese)

Horino, H., K. Nakamura, and H. Takimoto: Groundwater flow analysis in Tedor river fan, Annual report of “Studies on sound hydrological cycle based on agricultural water”; 136p., 2009 (in Japanese)

b) Conference and seminar papers presented

Annual Meeting of the Japanese Society of Irrigation, Drainage and Rural Engineering in 2008: 12 papers

The 49th Annual Meeting of the Palynological Society of Japan: 4 papers

The 50th Annual Meeting of Japanese Society of Soil Physics: 2 paper

The 65th Annual Meeting of the Japanese Society of Irrigation, Drainage and Rural Engineering Kyoto Branch: 4 papers

Annual Meeting of The National University Corporation Arid Land Research Center, Tottori University in 2008: 1 paper

The 5<sup>th</sup> International Conference Interfaces Against Pollution 2008: 2 papers

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

Kawashima, S.: Palynological Society of Japan, Japanese Society of Allergology, Meteorological Society of Japan, The Society of Agricultural Meteorology of Japan, Japanese Society of

## Irrigation, Drainage and Rural Engineering

Nakamura, K.: Japanese Society of Soil Physics (Councilor and Member of Editorial Board), Japanese Society of Irrigation, Drainage and Rural Engineering (Member of research council, Member of the subcommittee of strategically research, Member of subcommittee of annual meeting organization, Member of the committee of international technical training of agricultural engineers in irrigation and drainage)

### ***Research grants***

Kawashima, S. and K. Nakamura: Research on functions of forest for water environmental conservation (Shiga Prefecture).

Kawashima, S. and K. Nakamura: Mitsui & Co., Ltd. Environment Fund, Research on strategy for introducing various functions in water circulation of forest into valley management plan.

Nakamura, K. : Monbukagakusho Grant-in-aid Basic Research (B) Proposal of various techniques for environmental paddy water management based on agricultural soil functions (Head: Nakamura, K.), Research for revise of design criteria for irrigation and drainage water and land reclamation in Nanki district, Research for revise of design criteria for irrigation and drainage water and land reclamation in Hino river district (The Ministry of Agriculture, Forestry and Fisheries Entrust Research), Research for groundwater flow analysis in Tedori river fan in the research project of “Studies on sound hydrological cycle based on agricultural water” (Ishikawa Prefectural University)

## **A-4. International cooperations and overseas activities**

### ***International meetings (roles)***

Nakamura, K.: Interfaces Against Pollution 2008 (executive committee)

### ***International joint researches, overseas research surveys***

Kawashima, S.: A joint research on development of automatic measurement technique of airborne biological particles, with Meteo Swiss and Neuchatel University (Switzerland).

Kawashima, S.: Early detection and prediction of climate warming based on the long-term monitoring of alpine ecosystems on the Tibetan Plateau, with Chinese Academy of Science (The People's Republic of China).

Kawashima, S.: Investigation on the coexistence system of genetically modified organisms in EU and the technological development situation, with IPTS (Institute for Prospective Technological Studies) of the European Union.

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Environmental Hydrology (Kawashima), Irrigation and Drainage Engineering (Kawashima), Practice in Irrigation and Drainage Planning (Nakamura), Soil Physics (Nakamura), Laboratory Course in Soil Physics and Hydrological Environment Engineering (Nakamura), Exercises in Information Processing Basic (Nakamura), Seminar in Agricultural and Environmental Engineering (Kawashima and Nakamura), Practice in Data Processing I (Nakamura and Hama)

Graduate level: Seminar in Irrigation, Drainage and Hydrological Environment Engineering I

(Nakamura and Kawashima), Seminar in Irrigation, Drainage and Hydrological Environment Engineering II (Kawashima and Nakamura), Laboratory Course in Irrigation, Drainage and Hydrological Environment Engineering (Kawashima and Nakamura)

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Nakamura, K.: Lecture of “Cyclic irrigation and lake water quality” in Integrated Basin Management for Lake Environment Course, International Lake Environment Committee and JICA (Lecturer, Shiga Prefecture)

Nakamura, K.: Lecture of “Trials of farmers in Lake Biwa basin for beautiful water” in the 3<sup>rd</sup> Home Education Class, Omiya elementary school (Lecturer, Kyoto)

## **C. Other remarks**

Kawashima, S.: Committee member of the research committee concerning pollen dispersal (Ministry of the Environment)

Nakamura, K.: Member of committee on Public Information (Graduate School of Agriculture, Kyoto University), Member of the committee of water environmental conservation (Division of water quality) (Shiga Prefecture), Member of the council meeting of water environmental conservation in Nishinoko and Ibanai basin (Shiga Prefecture)

## 2.5.11 Laboratory of Rural Planning

*Staff      Professor: Hoshino, Satoshi, Dr. Agric. Sci.*

*Assistant Professor: Kuki, Yasuaki, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (1)*

*Master's program : (8)*

*Undergraduate : (10)*

### **A. Research Activities (2008.4-2009.3)**

#### **A-1. Main subjects**

- a) Restructuring of the systems of local resource management by introducing knowledge management

Local resources such as farmland, a mountain, reservoirs, etc. are maintained by the knowledge and skills that has been accumulated in the farmers over many generations. However, the tacit knowledge related to the resource management is not properly succeeded by the next generation but dispersed. There is concern that the resource management will be difficult in many places. The strategy for succeeding to the necessary knowledge for the local resource management is researched introducing the knowledge management as counter measures in this study.

- b) Analyse of social capital (SC) for the strategy of revitalisation of rural areas

Cooperation of the local residents is the key issue to accomplish the revitalisation of rural areas. We suppose that social capital is one of the most important factors to build up the system of cooperation. This study aims to analyse the correlation between the revitalisation of rural areas and social capital from the point of view of the policy of the decoupling for the mountainous area. Considering the strategy that strengthens the SC is also the part of this study aim as well

- c) Consideration of measures to prevent agricultural damage by wildlife in mountainous areas

The agricultural damage caused by wildlife, especially wild boar, and the measures to prevent the damage by farmers are investigated in Wakayama Prefecture. This study focus on the relation between the farmers' attitude and the farmers' profile, as well as the non-farmers' attitude toward the agricultural damage caused by wild lives. The goal of this study is consideration of the problems in order to set the measures to prevent the agricultural damage caused by wild lives under the residents' participation using workshop methods, and the measure suitable for the study area will be conducted and the effectiveness of the measures will be evaluated.

#### **A-2. Publications and presentations**

- a) Publications

##### ***Books***

Hoshino S. and R. Yamashita: Possibility of regional agriculture planning model applying the multi-agent simulation ( edited by Agricultural and rural information research section of JSIDRE), 29-34, Agricultural and Rural Development Information Center, Tokyo, 2008 ( in

Japanese)

### ***Original papers***

- Hoshino, S.: Conservation of local resources and applicability of knowledge management. *Nougyou To Keizai (Agriculture and Economics)* 74(8); 110-118, 2008 (in Japanese)
- Yamashita, R., S. Hoshino and M. Nakatsuka: Evaluation of autonomous body's reorganization by multi-agent analysis. *Journal of Rural Problems* 44(1); 116-121, 2008 (in Japanese)
- Nakatsuka, M. and S. Hoshino: A case study on difference of local knowledge in various residents. *Japanese Journal of Farm Management* 46(1); 160-164, 2008 (in Japanese)
- Takeyama, E. and Y. Kuki: Local agricultural characteristics and agricultural damage by wildlife where the physical prevention has priority as an animal attack control measure. *Transactions of the JSIDRE* 255; 23-29, 2008 (in Japanese)
- Kuki, Y.: Case study of the continuity of using abandoned farmlands to the allotment gardens. *Journal of the Japanese Society of Irrigation, Drainage and Rural Engineering* 76(7); 13-17, 2008 (in Japanese)
- Kuki, Y. and E. Takeyama: Study on the relation between farmers' intentions of the measures to decrease agricultural damage by wildlife and the characteristics of farming communities. *Transactions of the JSIDRE* 256; 25-32, 2008 (in Japanese)
- Takeyama, E. and Y. Kuki: Backgrounds and problems of animal attack control measure differed by choice behaviour of the measures –Analysis of the questionnaire to municipalities of Wakayama Prefecture–. *Transactions of the JSIDRE* 257; 27-33, 2008 (in Japanese)
- Yamashita, R. and S. Hoshino: Construction of the simulation model about evaluation of an effect of social capital on the process of consensus building for regional resource conservation. *Papers on Environmental Information Sciences* 22; 303-308, 2008 (in Japanese)
- Nakamura, S., S. Hoshino and M. Nakatsuka: A Study of the influence of social capital on community activation –A case of town of Kamikawa, Hyogo Prefecture–. *Journal of Rural Planning Association* 27 (Special Issue); 311-316, 2009 (in Japanese)
- Morimoto, H., K. Doi, S. Hoshino, Y. Yuyama and Y. Kuki: Development of integrated assessment model for biomass utilization and application of the model –Case study of 38 municipalities which released the biomass town design–. *Journal of Rural Planning Association* 27 (Special Issue); 317-322, 2009 (in Japanese)
- Kinoshita, D., Y. Kuki, S. Hoshino and E. Takeyama: Present state of the group activities to decrease agricultural damage caused by wildlife and possibility of non-farmers' cooperation on the activities in paddy areas –Cases study in Nantan region, Kyoto Prefecture–. *Journal of Rural Planning Association* 27 (Special Issue); 227-232, 2009 (in Japanese)
- Miyake, Y., K. Katayama, J. Enomoto and Y. Kuki: Characteristic analysis of “Sato-dzukuri” plans in Kobe City. *Research Reports of the School of Human Science and Environment of University of Hyogo* 11; 141-147, 2009 (in Japanese)

### ***Reviews***

- Yamashita, R.: Toward the realization of sustainable society –The new regional themes in the era of decrease in population and the approach for solution–. *Nougyou To Keizai (Agriculture and Economics)* 74(8); 127-130, 2008 (in Japanese)
- Morimoto, H.: Toward the making of sustainable society through agriculture and forestry. *Nougyou To Keizai (Agriculture and Economics)* 74(12); 122-125, 2008 (in Japanese)

Doi, K., Morimoto, H., Yuyama, Y., Nakagami, K.: Evaluation Method of Biomass Total Use Scenario in the Regions, *Kankyo Gijutsu* 38(3), 45-50, 2009 (in Japanese)

### ***Reports***

Hoshino, S.: Research report on rural development in China. *JIID*, 181-202, 2008 (in Japanese)

Kuki, Y.: Research project of the promotion of accumulating cultivation rights and the system of disposition of substitute lots. *National Federation of Land Improvement Associations*, 17-38, 2009 (in Japanese)

### **b) Conference and seminar papers presented**

2008 spring conference of the Association of Rural Planning: 3 papers

2008 autumn conference of the Association of Rural Planning: 3 papers

2008 annual meeting of the Japanese Society of Irrigation, Drainage and Reclamation Engineering: 3 papers

The 58th annual meeting of the association for regional agricultural and forestry economics: 3 papers

The 22th annual meeting of the center for environmental information science: 1 paper

2008 annual meeting of the association of Beijing Agricultural Economics: 1 paper

## **A-3. Off-campus activities**

### ***Membership in academic societies***

Hoshino, S.: Association of Rural Planning (board of directors, head of the international exchange committee), Japanese Society of Irrigation, Drainage and Reclamation Engineering (head of the committee for revision of planning criteria)

Kuki, Y.: Japanese Society of Irrigation, Drainage and Reclamation Engineering (regular secretary of rural planning section, member of the committee of consideration of Japanese rural beauty), Association of Rural Planning (councilor, member of the international exchange committee, member of the reading papers committee)

### ***Research grant***

Hoshino, S.: Grant-in-Aid for Scientific Research; Basic Research (B), Development of rural planning measures applying the knowledge management. (Head)

Kuki, Y.: Grant-in-Aid for Scientific Research; Basic Research (B), Development of rural planning measures applying the knowledge management. (Co-researcher), Study on the improvement of measures to decrease agricultural damage by wildlife considering agricultural characteristics and social structures in Wakayama Prefecture (Wakayama Prefecture)

## **A-4. International cooperations and overseas activities**

### ***International meetings (roles)***

Hoshino, S.: International Rural Planning Seminar between Japan and Korea (coordinator)

Kuki, Y.: International Rural Planning Seminar between Japan and Korea (moderator)

### ***International joint researches, overseas research surveys***

Hoshino, S.: Empirical research of the New Village Construction Policy (China)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**



a) Courses given

Undergraduate level: Rural planning (Hoshino), Land consolidation engineering (Hoshino), Surveying (Hoshino), Rural planning and practice (Hoshino and Kuki), Practice in surveying (Hoshino and Kuki)

Graduate level: Rural Landuse planning (Hoshino), Special seminar in rural planning I (Hoshino), Special seminar in rural planning II (Hoshino), Laboratory course in rural planning (Hoshino)

**B-2. Off-campus teaching, etc.**

*Part-time lecturer*

Kuki, Y.: Prefectural University of Hiroshima (Environmental Technology, special lecture)

*Open seminar*

Kuki, Y.: Seminar of agricultural land conservation and countermeasures to agricultural damage by wildlife, Kozagawa Town, Wakayama Prefecture (2009.3.28)

**C. Other Remarks.**

Hoshino, S.: Member of the independent committee for “Policy Measures to Conserve and Improve Land, Water and Environment” (Rural Development Bureau, Ministry of Agriculture, Forestry and Fisheries of Japan), Member of the committee of new policy evaluation method for rural areas development (RDB, MAFF), etc.

Kuki, Y.: Head of the committee of countermeasures to uncultivated farmland (Kobe City), Member of the rural landscape section of the committee of rural land use planning (Kobe City), Member of the committee of evaluation of the activities for land, water and environment conservation in Kobe City (Hyogo Prefectural land reclamation office, Kobe branch)

## Chair of Bioproduction Engineering

### 2.5.12 Laboratory of Agricultural Systems Engineering

*Staff Associate Professor: Nakashima, Hiroshi, D. Agric. Sci.*

*Assistant Professor: Miyasaka, Juro, M. Agric. Sci.*

*Assistant Professor: Ohdoi Katsuaki, D. Agric. Sci.*

*Students and research fellows*

*Master's program : (6)*

*Undergraduate : (5)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Terramechanics

The Discrete Element Method is applied to elucidate the interaction between machine parts and soil. We are now simulating the soil behavior caused by a tire. Some effective methods are under study, such as combining DEM and FEM, or parallel processing of DEM. Experimental researches on tire mobility by using an indoor soil bin and tri-axial contact reaction measurement at tire-soil interface are also conducted. Moreover, numerical analysis of turning behavior of articulate-frame steering vehicle has been studied.

##### b) Development of electric agricultural vehicle using microwave power transmission

A no-emission vehicle is under development in order to contribute the environmental conservation. A test electric vehicle, which has no battery but only electric motors which are driven by electricity transmitted in form of microwave, is designed, made and tested. In order to improve the transmission efficiency a parabola antenna, direction control of antennae and a radio data transmission method are tried.

##### c) Systems engineering study on farm management, mechanization and rural development

The optimum cultivation system is studied to maximize the income of competitive vegetable farmer by means of a simulated annealing method. In order to decrease the cost of agricultural machine, the method to optimize the farm work schedules was developed by genetic algorithm. Moreover, this method was applied to decide the necessary number of staff and facilities when the effluent of anaerobic digestion was applied to farm field as a liquid fertilizer.

##### d) Biomass energy

It is clear that the fossil energy resources will be exhausted and the energy production by way of recycling agricultural wastes will be one of the necessary technologies in future. We are now investigating the efficient production of methane gas.

##### e) Root growth simulation

An approach of model construction by applying dynamic contact interaction has been studied.

#### A-2. Publications and presentations

##### a) Publications

### ***Books***

Patil, S. L., V. M. Salokhe, H. Nakashima: Application of distinct element method to large soil deformation with tool interaction, Modeling of soil-tool interaction in tillage (Edited by S. Karmakar). 149–173, Transworld Research Network, 2008

### ***Original papers***

Nalavade, P. P., V. M. Salokhe, H.P.W. Jayasuriya, H. Nakashima: Development of a wide tractor mounted spray boom for increased efficiency. Journal of Food, Agriculture and Environment, 6(2); 164–169, 2008

Nakashima, H., Y. Takatsu: Analysis of Tire Tractive Performance on Deformable Terrain by Finite Element-Discrete Element Method. Journal of Computational Science and Technology, 2(4); 423–434, 2008

Nakashima, H., Y. Fujita, H. Tanaka, J. Miyasaka: A model of root elongation by dynamic contact interaction. Plant Root 2; 58–66, 2008

Nakashima, H., Y. Shioji, K. Tateyama, S. Aoki, H. Kanamori, T. Yokoyama: Specific cutting resistance of lunar regolith simulant under low gravity conditions. Journal of Space Engineering, 1(1); 58–68, 2008

Itoh, H., K. Matsuo, A. Oida, H. Nakashima, J. Miyasaka, T. Izumi: Aggregate size measurement by machine vision. Journal of Terramechanics, 45(4); 137–145, 2008

Nakashima, H.: A serial domain decomposition method for Discrete Element Method simulation of soil-wheel interactions. Agricultural Engineering International, the CIGR E-journal, Manuscript PM 08 006, Vol. X, November, 2008

Shinone, H., H.Nakashima, Y.Takatsu, T.Kasetani,, H.Matsukawa,: Improvement of an indoor traction measurement system based on a forced slip mechanism, Proc. 16th International Conference of ISTVS, Turin, 138–143, 2008

Takatsu,Y., H. Nakashima, H. Shinone, H. Matsukawa, T. Kasetani: Effect of tread pattern on traction performance of off-road tires analyzed by FE-DEM, Proc. 16th International Conference of ISTVS, Turin, 150–155, 2008

Nakashima,H., H. Takahashi, K. Tateyama, R. Fukagawa, T. Kobayashi, H. Kanamori, S. Aoki, K. Matsui: Concept of a wheel for micro lunar rover. Proc. 16th International Conference of ISTVS, Turin, 156–161, 2008

Ramirez, A. A., A. Oida, H. Nakashima, J. Miyasaka, K. Ohdoi: Mapping indicators of machinery utilization predicted by an artificial neural network. Agricultural Engineering International: the CIGR E-journal, Manuscript IT PM 08 004, Vol. X, December, 2008

Itoh, H., K. Matsuo, A. Oida, H. Nakashima, J. Miyasaka, T. Izumi: Non-contact measurement of soil clod fineness by image analysis. Journal of JSAM, 71(1); 80–86, 2009

Nakashima, H.: Cyclic parallel discrete element method for soil-wheel interaction analysis. Engineering in Agriculture, Environment and Food, 2(1); 38–43, 2009

Nakagawa, S., Y. Yamanaka, K. Ohdoi, J. Miyasaka, K. Hashimoto, N. Shinohara, T. Mitani: Development of an Electric Vehicle by Microwave Power Transmission –Fundamental Experiments for Angle Control of Transmission and Receiving Antenna–. Technical Report of IEICE; SPS2008-12(2009-03)

Nakagawa,S., Y.Yamanaka, K.Ohdoi, J.Miyasaka, H.Nakashima: Development of an Electric Vehicle

by Microwave Power Transmission – Detection of the Vehicle Position and Direction Control of Transmitting Antenna – (in Japanese). Reports of Kansai Branch of JSAM 105; 56-57, 2009

### ***Reports***

Yamanaka, Y., S. Nakagawa, J. Miyasaka, K. Ohdoi, H. Nakashima: Development of an Agricultural Vehicle Applying Microwave Power Transmission Technology – Installation of Rectenna Turntable and Rotary Encoder on the Model Vehicle –. Kansai Branch Report of JSAM 105; 58-59, 2009

Nakagawa, S., Y. Yamanaka, K. Ohdoi, J. Miyasaka, H. Nakashima: Development of an Agricultural Vehicle Applying Microwave Power Transmission Technology – Detection of the Vehicle Position and Direction Control of Transmitting Antenna – (in Japanese). Reports of Kansai Branch of JSAM 105; 56-57, 2009

Nakagawa, S., Y. Yamanaka, K. Ohdoi, J. Miyasaka, H. Nakashima: Development of an Electric Vehicle by Microwave Power Transmission–Detection of the Vehicle Position for Direction Control of Transmitting Antenna by Image Processing – (in Japanese). Reports of Kansai Branch of JSAM 104; 56, 2008

Yamanaka, Y., S. Nakagawa, J. Miyasaka, K. Ohdoi, H. Nakashima: Development of an Electric Vehicle by Microwave Power Transmission – Communication and Control System for a Small Model Vehicle –. Kansai Branch Report of JSAM 104; 55, 2008

Nakashima, H., T. Nakamura: On a turning of articulated frame-steering vehicle (in Japanese). Kansai Branch Report of JSAM 104; 54, 2008

Nakashima, H., Y. Fujita: Simulation of root elongation by DEM (in Japanese). Kansai Branch Report of JSAM 104; 53, 2008

b) Conference and seminar papers presented

16<sup>th</sup> International Conference of ISTVS, Turin, Italy: 3 papers

29<sup>th</sup> Meeting of Japanese Society for Terramechanics: 3 papers

8<sup>th</sup> Meeting of SPS Technical Group: 1 paper

120<sup>th</sup> Meeting of Kansai Branch of JSAM: 7 papers

121<sup>th</sup> Meeting of Kansai Branch of JSAM: 4 papers

Annual Meeting of JSAM: 4 papers

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

Nakashima, H.: JSAM (Councilor, Member of Planning Committee), Kansai Branch of JSAM (Secretary), Japanese Society for Terramechanics (Director, Member of Lunar Mechanics Committee), Japanese Geotechnical Society, Japan Society of Mechanical Engineers, Japan Society for Computational Engineering and Science, Japanese Society of Agricultural, Biological and Environmental Engineers and Scientists, Japanese Society of Agricultural Informatics, Japanese Society for Root Research

Miyasaka, J.: Kansai Branch of JSAM (Member of Planning Committee)  
Society for Science on Form (Financial Secretary)

Japanese Society for Farm Work Research

The Japanese Society for Terramechanics

Society for Phytotechnology

Ohdoi, K.: Japanese Society of Agricultural Machinery, Japanese Society of Farm Work Research

### ***Research grants***

Monbusho Research Grant: Exploratory Research: Expression of root elongation and enlargement based on a dynamic contact interaction with surrounding soil environments (Project Leader: Nakashima)

Co-operation Research Project: “Optimization of transportation and application of liquid fertilizer by mathematical programming” The Japan Association of Rural Resource Recycling Solutions (JARUS) (Ohdoi, Co-researcher)

## **A-4. International cooperation and overseas activities**

### ***International meetings (roles), etc.***

Nakashima, H.: International Conference of ISTVS, Turin, ITALY. (Presentation)

### ***Membership in international academic societies***

Nakashima, H.: ISTVS (Secretariat of Japan), American Society of Mechanical Engineers, Asian Association of Agricultural Engineering

Miyasaka, J.: International Society for Terrain-Vehicle Systems  
Asian Association for Agricultural Engineering

### ***International Journals***

Nakashima, H.: Journal of Terramechanics (Editorial Board Member), Agricultural Engineering Journal of AAAE (Editorial Board Member)

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Applied Mechanics (Nakashima, shared), Strength of Materials (Nakashima), Energy and Prime Movers in Agriculture (Nakashima), Laboratory Course in Agricultural Machinery I (Nakashima, Miyasaka, Ohdoi, shared), Laboratory Course in Agricultural Machinery II (Nakashima, Miyasaka, Ohdoi, shared), Practice in Data Processing (Nakashima and Miyasaka, shared), Seminar in Agricultural Machinery (Nakashima, Miyasaka, Ohdoi, shared), Seminar in Agricultural and Environmental Engineering (Nakashima, Miyasaka, Ohdoi, shared), Practice in Data Processing II (Nakashima, and Ohdoi, shared)

Graduate level: Agricultural Systems Engineering (Nakashima), Special Seminar in Agricultural Systems Engineering I and II (Nakashima), Laboratory Course in Agricultural Systems Engineering (Nakashima)

### **B-3. Overseas teaching**

### ***Lectures and Seminars***

Miyasaka, J.: Asian Institute of Technology, Thailand (Lecture)

### **C. Other remarks**

#### ***Awards***

## 2.5.13 Laboratory of Field Robotics

*Staff      Professor                      : Umeda, Mikio, Dr. Agric. Sci.*  
*Associate Professor: Iida, Michihisa, Dr. Agric. Sci.*  
*Assistant Professor : Suguri, Masahiko, Dr. Agric. Sci.*  
*Assistant Professor : Masuda, Ryouhei, M. Agric. Sci.*

### *Students and research fellows*

*Teaching assistant : (1) (~2008.7, 2 people)*  
*Master's program : (7)*  
*Undergraduate : (7)*  
*Research fellow : (1)*

## **A. Research Activities (2008.4-2009.3)**

### **A-1. Main subjects**

It is afraid that a un-balance of the material cycle due to increase in the food import deteriorates environment in Japan.

This laboratory researches mainly on precision agriculture and field robot based on the thought with “Food should be produce within the country to preserve an environment of the country” and “Agriculture has always adopted the most advanced technology of the age.”

a) Precision agriculture based on the field map and variable rate fertilizer application.

The Precision agriculture is the information-orientated agriculture that the field is separated virtually into small fields, and fertilizer is implicated based on the soil condition, plant growth and grain yield on those small fields, and copes with stabilization of the yield and the quality of the products and protection of the environment.

In order to decide the amount of fertilizer, the nutriment in the soil and the amount of growth must be measured. This laboratory in cooperation with Laboratories of Plant Production Systems and Irrigation, Drainage Hydrological Environmental Engineering starts research on precision agriculture in 2007. In 2008, the field tests were conducted in Yagi.

b) Estimation of nitrogen contents of rice plant using remote sensing.

The ideal amount of topdressing fertilizer is the amount possess subtracts from the necessity. Plant growth sensor is required to estimate the nitrogen possessed by the plant. In 2008, both basal- and top-dressing of methane digested sludge or chemical fertilizer were applied at the prescribed rate in five paddy fields of Yagi town, Nantan city, Kyoto, Japan. After that, the airborne images were taken using hyper-spectral and multi-spectral meter in order to estimate the plant growth.

c) Estimation of nitrogen contents and proper time of harvesting for tea plant using remote sensing.

Tea cultivation requires enormous amounts of nitrogen fertilizer. Therefore, it is important to analyze the relationship between the amount of applied nitrogen and the quality of tea The quality of the tea and the optimum time of plunking were estimated using the portable plant growth measuring device and hyper-spectral camera.

d) Grain yield mapping by using a head-feeding combine with a grain yield monitor.

A head-feeding combine equipped with a grain yield monitor has been developed by collaboration with Mitsubishi Agricultural Machinery Co., Ltd. We measured grain yields in several paddy fields

in Natan city, Kyoto, and then grain yield maps were made by processing the measured data. They showed the spatial variability of grain yield in the field, depending on the applied amount of fertilizer and the application methods.

e) Measurement of turning behavior of the articulated vehicle.

Articulated vehicle like a wheel loader takes advantages of the turning with a small radius and the almost same rut of the front and rear tires. The wheel loader is often used for working in narrow livestock barn in agriculture. It is important to improve the turning performance of the vehicle for working in the narrow workspace. It is so effective to enlarge the articulated angle of the vehicle for steering. However, the articulated angle is limited due to the construction and stability of the vehicle. Therefore, the final goal of this research is to achieve the small radius turn of the articulated vehicle by applying direct yaw-moment control by the braking control. In 2008, turning behavior of the articulated vehicle was measured by using the test vehicle and simulated by using the dynamical model on the computer.

f) Development of liquid fertilizer applicator for methane fermentation digested sludge.

In order to apply methane fermentation digested sludge as liquid fertilizer, liquid fertilizer applicators have been developing. A slurry injector is used for basal dressing. This machine is installed a GPS and electric-hydraulic valve control system in order to adjust the amount of fertilizer according to speed and position. It was used to apply the digested sludge in three paddy fields.

g) Development of a controller with a LCD for field operation support.

In past researches, a note PC was used to control a machine and display data in variable application of fertilizing and seeding. However, it is important to improve easy operation, mobility, and power supply. Therefore, a controller equipped with a LCD and a readable/recordable device was developed to support field operation.

h) Research about mechanical properties and geometric characteristics of parenchyma.

It seems that geometric characteristics of root crop parenchyma cells, e.g. shape of the cells and distribution of the cells, influence upon mechanical properties of parenchyma. To clarify relation between mechanical properties and geometrical properties of parenchyma, it is needed to give a proper description to the geometrical properties of parenchyma cells. We have given consideration to the description of geometrical properties of calotte parenchyma by using images taken with the confocal laser microscope. Gabor filter were used to construct the description of geometrical properties.

i) Threshing of colza with head-feeding type combine harvester

In order to reduce the emission of CO<sub>2</sub>, biodiesel fuel of colza oil is expected as one of alternatives of fossil fuel. Because colza can be cultivated as altercrop of rice. Colza is harvested by conventional combine harvester, but if it could be harvested by head feed type combine, it has advantage in energy efficiency and machine cost. Therefore threshability and power requirement was tested.

## A-2 Publications and presentations

a) Publications

**Books**

Umeda, M., Iida, M. (Participant), (Fujisaki, K., Nishida, R., Sakuma, M., Ed), 2009 (March):  
Entomological Science and its Perspective, Part II, Chapt 6 Hexapod robot working in field,



### ***Original papers***

- Iida, M., Ohdoi, K., Ryu, C., Umeda, M., 2009 : Basal application of methane fermentation digested liquid using a slurry injector, *Journal of JSAM*, 71(2), 81-87.
- Kang, D., Iida, M., Umeda, M., 2009 : The walking control of a hexapod robot for collecting field information, *Journal of JSAM*, 71(1), 63-71.
- Taniwaki, M., Iida, M., Kang, D., Tanaka, M., Izumi, T., Umeda, M., 2008 : Walking behaviour of a hexapod robot using a wind direction detector, *Biosystems Engineering*, 100, 516-523.
- Matsuzaki, Y., Iida, M., Umeda, M., 2008: Measurement of moisture and crude protein content in single kernel of rough rice using NIR transmittance spectroscopy, *Journal of JSAM*, 70(4), 53-60.
- Iida, M., Kimura, A., Yao, Y., Nishikori, M., 2008: Grain return flow control using a flow rate sensor, *Journal of JSAM*, 70(4), 69-75.
- Iida, M., Kang, D., Taniwaki, M., Tanaka, M., Umeda, M., 2008: Localization of CO<sub>2</sub> source by a hexapod robot equipped with an anemoscope and a gas sensor, *Computers and electronics in agriculture*, 63, 73-80.
- Sakai, S., Iida, M., Osuka, K., Umeda, M., 2008: Design and control of a heavy material handling manipulator for agricultural robots (in English), *Autonomous robots*, 25, 189-204.
- C.K., Lee, Y., Choi, H.J., Jun, S.K., Lee, C.S., Ryu, D.M., Kim, Development of a rapeseed reaping equipment attachable to a conventional combine (1), *Journal of Biosystems Engineering*, 33(6), pp.371-378 , December, 2008 (in Korean)
- Osakabe, Mh., Isobe, H., Kasai, A., Masuda, R., Kubota, S., Umeda, M., 2008: Aerodynamic advantages of upside down take-off for aerial dispersal in *Tetranychus* spider mites *Experimental and Applied Acarology*, Vol. 44, pp. 165-183

### ***Reports***

- Suguri, M., Ryu, C., Sasaki, R., Umeda, M., 2008 : Estimation of tea quality by hyper-spectral remote-sensing, *Reports of Kansai Branch of JSAM*, 104, 31.
- Suguri, M., Ryu, C., Jyo, K., Umeda, M., 2008 : Estimation of rice growth by hyper-spectral remote-sensing, *Reports of Kansai Branch of JSAM*, 104, 32.
- Masuda, R., Kurita, H., Umeda, M., 2008 : Analysis of carrot cell image by using Gabor filter, *Reports of Kansai Branch of JSAM*, 104, 33.
- Umeda, M., Suguri, M., Hirogari, K., 2008 : Input amount estimated from torque fluctuation of thresher in head-feeding combine, *Reports of Kansai Branch of JSAM*, 104, 34.
- Iida, M., Umeda, M., Fukuta, M., 2009 : Simulation of turning behavior of articulated vehicle, *Reports of Kansai Branch of JSAM*, 105, 28-31.
- Umeda, M., Suguri, M., Tamaki, H., 2009 : Threshing of colza by head-feeding type combine harvester, *Reports of Kansai Branch of JSAM*, 105, 40-41.
- Soneda, T., Masuda, R., Umeda, M., 2009 : Navigation of a crawler vehicle between inter-rows by Reinforcement learning, *Reports of Kansai Branch of JSAM*, 105, 66-67.
- Kurimoto, T., Suguri, M., Ryu, C., Umeda, M., 2009 : Estimation of tea yield and quality variabilities in a field by remote-sensing, *Reports of Kansai Branch of JSAM*, 105, 80-83.

Umeda, M., 2009 : Effort from Agricultural Engineering to Biological Engineering, Reports of Kansai Branch of JSAM, 105, 84-87.

Masuda, R., 2008: Decision making of multi-robot system with topological map for field surveillance, Proceedings of International advanced workshop on information and communication technologies for sustainable agri-production and environment, Alexandroupolis, Greece, May, pp184-194

### ***International***

AWICTSAE08, Alexandroupolis, Greece, May, 2008: 1 presentation

### ***Domestic***

120th Regular Meeting of Kansai Branch of JSAM: 5 presentation

121st Regular Meeting of Kansai Branch of JSAM: 4 presentations

## **A-3. Off-campus activities**

### ***Membership in academic societies (roles)***

Umeda, M.: JSAM (Japanese Society of Agricultural Machinery, Director, Chairman of Program Committee), JSAI (Japanese Society of Agricultural Informatics, Director)

Iida, M.: JSAM (Councilor), Robotic Society of Japan, Japanese Society of Agricultural Informatics

Suguri, M.: JSAM

Masuda, R.: JSAM

### ***Research grant***

Research Grant of Japanese Science Promotion Society (JSPS): Scientific Research (B)(2) “Development of crop management in consideration of soil, crop growth and grain yield variation.” (Participant: Iida, M., Suguri, M.)

Accepted Research from Ministry of Agriculture, Forestry and Fisheries: “Development of technical bio-resource recycling solutions of methane fermentation digested sludge by application as liquid fertilizer” (Representative: Umeda. M., Participant: Iida, M., Suguri, M., Masuda, R.)

Co-operation Research Project: “Utilization of methane fermentation digested sludge for rice cultivation (Subsidy Project for Creation of Biomass Circle)”, (Representative: Umeda. M. Participant: Iida, M. , Suguri, M.)

Co-operation Research Project: “Investigation of rice taste in Yagi (Subsidy Project for Creation of Biomass Circle)”, (Representative: Umeda. M., Participant: Iida, M., Suguri, M.)

Co-operation Research Project: “Optimaization of transportation of methane digested sludge by mathematical programming”, (Representative: Umeda. M. )

Industry-University Co-operation Research Project: “Turning control for articulated steered vehicle” Caterpillar Japan Co., Ltd. (Representative: Umeda. M., Participant: M. Iida)

## **A-4. International cooperation and overseas activities**

### ***Membership in international academic societies***

Umeda, M.: International Commission of Agricultural Engineering (CIGR) (Chairperson of Section IV), Asian Conference on Precision Agriculture (ACPA) (Director), Asian Association for Agricultural Engineering (AAAE, Country representative of Japan), American Society of

Agricultural and Biological engineering (ASABE)

Iida, M.: American Society of Agricultural and Biological engineering (ASABE)

## **B. Educational Activities (2006.4-2007.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Field Robotics (Umeda), Introduction to Foreign Literature in Agricultural Machinery (Umeda), Design of Machine Elements (Umeda), Practice in Computer Aided Design (Umeda and Masuda), Vibration (Iida), Automatic Control (Iida), Applied Mathematics (Iida and others), Laboratory Course in Agricultural Machinery I (Iida, Suguri, Masuda and others), Laboratory Course in Agricultural Machinery II (Iida, Suguri, Masuda and others), Practice in Data Processing II (Iida, Masuda and others), Seminar in Agricultural Machinery (Umeda, Iida, Suguri, Masuda and others), Science of Life Sphere (Umeda and others), Selected Technologies of Food and Agriculture (Umeda and others), Seminar in Agricultural and Environmental Engineering (Umeda, Iida, Suguri, Masuda and others), Experiments in Physics (Masuda and others), Life/Food/Environment and Physics (Umeda)

Graduate level: Advanced Seminar in Field Robotics I (Umeda and Iida), Advanced Seminar in Field Robotics II (Umeda, Iida, Suguri and Masuda), Laboratory Course of Field Robotics (Umeda, Iida, Suguri and Masuda), Field Robotics (Advanced course) (Umeda) , Field Automation (Iida)

### **B-2. Off-campus teaching and others**

#### ***Part-time lecturer***

Umeda, M.: Kobe University (Technology, Society and Ethics)

### **B-3. Overseas teaching**

#### ***Lectures and seminars***

Umeda, M.: Lecture "Introduction to Precision Agriculture" in JICA Course of low input production system.

#### ***Students and research fellow from abroad***

Doctor's program 1 (China)

## **C. Other Remarks**

Umeda, M.: (On-campus) Department of Agricultural and Environmental Engineering (Chairperson), School Affairs Committee(Member), Assessment Committee (Member), Experimental Farm Council (Member of council), Information System Management committee (Member), Information Security Committee (Member), Research Promotion Committee (Member), Basic Education Committee/Physical Subject Section (Member)  
(Off-campus) Science council of Japan (Extended Member), Japan Organics Recycling Association; Special Committee for Recycling System of Bio-waste-materials of Technical Committee of (Chairperson), Japanese Association of Rural Recycling Resource Solution; Biomass Utilization Information Committee (Member), Methane Formation Test Plant

System for Rural Area Committee (Member), Agriculture Promotion Association; Large Scale Farm Management Committee (Member), Biogas Utilization Council; Biomass Promotion committee (Member)

Iida, M.: (On-campus) Member of Space Collaboration System Committee, Member of Working Group for PFI Construction, Member of Annual Report 2006 Committee, Member of Working Group for Educational Improvement

Suguri M: (On-campus) Member of KAIS Steering Committee

Masuda R: (On-campus) Observer of Experimental Drain from the Facility of Bio-production Engineering

## 2.5.14 Laboratory of Agricultural Process Engineering

*Staff Professor : Kondo, Naoshi, Dr. Agric. Sci.*

*Associate Professor : Shimizu, Hiroshi, Dr. Agric. Sci.*

*Students and research fellows*

*Post-doctoral researcher: (2) Teaching assistant: (1)*

*Foreign research associate: (3) Overseas special research fellow: (3)*

*Doctor's program: (3) Master's program: (5)*

*Research student: (7) Undergraduate : (6)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Blood Vitamin A Level Measurement in Beef Cattle

Vitamin A (V.A) in cattle blood is an important indication of managing the beef quality in Japan. The V.A level should be maintained low level for the beef quality and kept above 30 IU/dl from 16 months to 24 months. Since the V.A deficiency (less than 30 IU/dl) induces serious diseases in cattle, it is essential to monitor the V.A level carefully. The conventional blood test is used for detecting the V.A level, which is time-consuming, expensive, and stressful to the cattle. Pupil color reflection is noninvasively investigated by several sensors for developing an optimum method to measure the blood V.A.

##### b) Measuring of Volume/density of Agricultural Products and Foodstuffs by Acoustic Resonance

A volume/density measuring system has been developed using a Helmholtz resonator. This system enables to measure volume/density of not only solid food or liquid food but also solid-liquid mixture food. Experiments are conducted for applications to determine void fraction of the porous food (bread) and to measure sugar content of kiwi fruits.

##### c) Machine Vision for Fruit Grading System

Algorithms are investigated for inspect round shape fruits such as tomato and citrus using TV cameras. Especially for citrus fruits, fluorescence images are acquired to detect rotten fruits, which is difficult to be find even by human eyes, because their skins contain fluorescent substances which can be reacted by ultraviolet light.

##### d) Comfort and Automation in Operations at Agricultural Facilities

Generally speaking, there are many kinds noise sources in agricultural facilities and operators often work under noisy conditions. Especially in grading systems, they are sometimes in more than 90 dB noise for more than several hours. To communicate with operators one another, a virtual low-noise space around operators' ears under noisy environment in facility has been studied for keeping safety and comfortable working condition. Robotization and automation projects are being conducted in greenhouse or grading facilities. A tomato cluster harvesting robot and an asparagus harvesting robot in greenhouses are being developed.

##### e) Informatization of Agricultural Products

Grading systems are the largest sources to obtain many kinds of information on agricultural products. TV cameras and NIR inspectors can give us information added products by their images and spectral data. A mobile grading robot to which the grading function was installed has been

investigated. In this project, a mobile citrus fruit grading robot was made as a trial. The grading robot can extract fruit grading information as well as tree information while human operators harvest fruit and it immediately grade the harvested fruits. This makes not orchard management but tree management in the orchard and guides precision agriculture in citrus production.

f) Environment Control for Plant Growth

The major experimental technique to search an optimal environment condition for plant growth is trial-and-error method under various environmental conditions. However, it is unknown whether an optimal environment condition is obtained with this kind of methods. We are focusing the amount level of gene expression in the plant which responds to environmental factors. The expression level of the enzyme “Gibberellin” which is hormone specifically manages extension growth has been investigated to find out the environmental condition (that is, optimal environmental condition in which this maximizes extension growth).

## A-2. Publications and presentations

a) Publications

***Books***

Yael Edan, Shufeng Han, Naoshi Kondo, 63. Automation in Agriculture, Springer Handbook of Automation, 33 pages, SPIN: 11510079, MS ID: hb17-063 (2009.2.24)

***Original papers***

Vui Kiong CHONG, Mitsuji MONTA, Kazunori NINOMIYA, Naoshi KONDO, Kazuhiko NAMBA, Eichi

TERASAKI, Takao NISHI and Tanjuro GOTO., Development of Mobile Eggplant Grading Robot for Dynamic In-field Variability Sensing— Manufacture of Robot and Performance Test —, EAEF Vol. 1(2): 68-76(2008)

Tomowo SHIIGI, Naoshi KONDO, Kazunori NINOMIYA, Mitsutaka KURITA, Takao NISHI, Kazuhiko NAMBA, Hiroshi SHIMIZU and Takahisa NISHIZU. Construction of Virtual Low-Noise Space in Noisy Agricultural Facility for Safety and Comfort, EAEF Vol. 1(2): 77-83(2008)

V.K. Chong, N.Kondo, K.Ninomiya, T.Nishi, M.Monta, K.Namba, Q.Zhang: Features Extraction for Eggplant Fruit Grading System Using Machine Vision, Applied Engineering in Agriculture, ASABE, Vol.24 (5):675-684 (2008)

V.K. Chong, T. Nishi, N.Kondo, K.Ninomiya, M.Monta, K.Namba, Q.Zhang, H.Shimizu: SURFACE GLOSS MEASUREMENT ON EGGPLANT FRUIT, Applied Engineering in Agriculture, Vol.24 (6):877-883 (2008)

Hiroshi Shimizu and Tamotsu Hisamatsu, Day temperature strongly influences stem elongation rate in subsequent night in Chrysanthemum morifolium Ramat., Engineering in Agriculture, Environment and Food, 2(2), 49-53(2008)

Hiroshi Shimizu, Zhiyu Ma, VK Chong, Takahisa Nishizu, Naoshi Kondo: Machine Vision System for Plant Morphogenesis Analysis, Environment Control in Biology, 46(4), 221-231(2008)

Hiroshi Shimizu, Megumi Ohta, Wataru Fujinuma: A Growth Model for Leaf Lettuce under Greenhouse Environments, Environment Control in Biology, 46(4), 211-219(2008)

- T.Hisamatsu, K.Sumitomo and H.Shimizu: End-of-day far-red (EOD-FR) treatment enhances responsiveness to gibberellin and promotes stem extension of chrysanthemum, *Journal of Horticultural Science and Biotechnology*, 83(6), 695-700 (2008)
- Shunsuke CHIBA and Hiroshi SHIMIZU: Effect of conditions at germination and nursery stages on fresh weight of plantlet and leaf weight at harvest in *Lactuca sativa* L. *Greenwave, Environment Control in Biology*, 46(2), 115-122 (2008)
- Hiroshi Shimizu, Ai Takano, Effect of day and night temperatures on stem elongation in *Chrysanthemum morifolium* Ramat, *Journal of SHITA*, 20(1), 8-13 (2008)
- Hiroshi Shimizu, Yukari Tsushima, Kanako Komatsu, Analysis of hypocotyl elongation of *Chrysanthemum paludosum*, North Pole, under DIF conditions, *Journal of SHITA*, 20(1), 2-7 (2008)
- Hiroshi Shimizu, Ma Zhiyu, Shinji Tazawa, Blue fluorescent lamp and blue LED showed different influences on stem elongation in *Chrysanthemum morifolium* Ramat. 'Reagan', *Journal of SHITA*, 20(2), 98-101 (2008)
- Hiroshi Shimizu, Yukari Tsushima, Kanako Komatsu, Hypocotyl elongation analysis of *Brassica oleracea* var *Dacephala*., Tsugumi, under DIF conditions, *Journal of SHITA*, 20(1), 21-25 (2008)
- Hiroshi Shimizu, Yukari Tsushima, Kanako Komatsu, Reasons for inefficacy of DIF on French marigold (*Tagetes patula*, 'Bonanza Yellow') -Analysis of hypocotyl elongation in the light and dark periods-, *Journal of SHITA*, 20(1), 26-30 (2008)
- Yinghui Mu, Zhiyu Ma, Masakazu Komatsuzaki, Hiroshi Shimizu, Hiroshi Okamoto, Assessing soil organic carbon relation to land use management using a portable hyper spectral camera in Andisols, *Journal of JSAM*, 70(3), 124-128 (2008)
- Hiroshi Shimizu, Yukari Tsushima C Kanako Komatsu C Tomoo Shiigi, Takahisa Nishizu, Chong Vui Kiong C Naoshi Kondo, Effect of day/night temperature on hypocotyl elongation of in *Zinnia elegans* L., *Journal of SHITA*, 20(4), 253-256 (2008)
- Peter RAJENDRA, Naoshi KONDO, Kazunori NINOMIYA, Junzo KAMATA, Mitsutaka KURITA, Tomowo SHIIGI, Shigehiko HAYASHI, Hirotaka YOSHIDA, Yasushi KOHNO: Machine Vision Algorithm for Robots to Harvest Strawberries in Tabletop Culture Greenhouses, *EAEF* 2(1), 24-30 (2009).
- Naoshi Kondo, 2009, Robotization in Fruit Grading System, Sensing and Instrumentation for Food Quality and Safety, Springer New York, ISSN: 1932-7587 (Print), 1932-9954 (Online), DOI:10.1007/s11694-008-9065-x, Vol.3, No.1: 81-87 (2009)

b) Conference and seminar papers presented

2008 ISMAB International Conference: 1 paper

ASABE Food Processing Automation Conference: 2 papers

2008 ASABE Annual Meeting: 4 papers

Kyoto Forum on Engineering, Structure and Physical Properties of Foods, JSFE: 2 papers

DIA 2009, JSPE: 1 paper

The 121st Annual Meeting of Kansai Branch of JSAM: 7 papers

### A-3. Off-campus activities

#### *Membership in academic societies (roles)*

Kondo, N.: Japanese Society of Agricultural Machinery (Director, Councilor, Editor in Chief, English journal editing committee); Kansai Branch of Japanese Society of Agricultural Machinery (Member of Board); Japanese Society of Mechanical Engineers (Robotics Mechatronics

branch committee member); Japanese Society of Agricultural Biological and Environmental Engineers and Scientists (Science and High Technology in Agriculture Division, Director)

Shimizu, H.: Japanese Society of Agricultural, Biological and Environmental Engineers and Scientists (Director), Japanese Society of Agricultural Machinery (member of English journal editing committee), The society of Instrumentation and Control Engineers (Director of Technical Committee on Instrumentation and Control in Biosystems), Japanese Society of Agricultural Informatics (Councilor)

### ***Research grants***

Kondo, N.: Grant-in-Aid for Scientific Research (B), “Mobile grading robot for citrus production and control of observation satellite” (Head), Grant-in-Aid for JSPS fellow: “Machine vision system for grafting robot of tomato seedling” (Head), Fundamental research for innovation creation, BRAIN, “Development of blood component measurement device and management system by use of pupillary reflex of beef cattle” (Head), National Agriculture and Food Research Organization, “Development of lavorsaving technologies on controlled-environment horticultural production”, Nagasaki Prefecture, “Development of machine vision for asparagus harvesting robot”

Shimizu, H.: Grant-in-Aid for Scientific Research (B), “Development of new strategy for environment control for plant using gene expression” (Head)

## **A-4. International Cooperation and overseas activities**

### ***International meetings (roles)***

Kondo, N.: Food Processing Automation Conference, ASABE, Providence, Rhode Island, USA, (invited Speaker)

### ***Scholar from abroad***

Foreign research associate: 3

Overseas research fellow: 3

## **B. Educational Activities (2007.4-2008.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Instrumentation and Measurement for Biological Objects (Kondo), Agricultural Processing Machinery (Kondo), Electric Engineering and Electronics (Kondo), Introduction to Foreign Literature on Agricultural Machinery (Kondo), Laboratory Course In Agricultural Machinery I and II (Shimizu, shared), Practice in Data Processing II (Shimizu, shared), Seminar in Agricultural Machinery (Kondo, and Shimizu, shared), Seminar in Agriculture and Environmental Engineering (Kondo and Shimizu, shared), Pocket Seminar (Kondo, shared)

Graduate level: Physical Properties of Agricultural Products (Shimizu), Seminar I on Agricultural Process Engineering (Kondo and Shimizu), Seminar II on Agricultural Process Engineering (Kondo and Shimizu), Laboratory Course in Agricultural Process Engineering (Kondo and Shimizu)



## **B-2. Off-Campus teaching**

### ***Guest Professor:***

Kondo, N.: Zhejiang University, China

### ***Part-time lecturer:***

Kondo, N.: Faculty of Engineering, Ehime University (Mechatronics)

Shimizu, H.: Faculty of Agriculture, Ibaraki University (Engineering for instrumentation, Laboratory course in bioproduction machinery), Graduate school of agriculture, Ibaraki University (Instrumentation on bioproduction systems)

## **B-3. Overseas teaching**

### ***Students and research fellow from abroad***

Graduate Student: (China 1)

Research Student: (Malaysia 1, Iran 1, Italy 1)

### ***Part-time lecturer:***

Kondo, N.: Zhejiang University, China (Robotics for bioproduction systems)

## Chair of Nuclear Science and Engineering (Research Reactor Institute)

### 2.5.15 Laboratory of Radiation Safety Control

*Staff      Professor                      : Takahashi, Sentaro, Dr. Agric. Sci.*

*Associate Professor: Takahashi, Tomoyuki, Dr. Eng.,*

*Assistant Professor: Yamasaki, Keizo, M. Eng.,*

*Assistant Professor: Yashima, Hiroshi, Dr. Eng.,*

*Students*

*Doctor's program : (1)*

#### **A. Research Activities (2008.4-2009.3)**

##### **A-1. Main subjects**

- a) Development of efficient and high performance methods for radiation safety control

A variety of research works are carried out in the Research Reactor of Kyoto University (KUR). In this laboratory, efficient and high performance methods for radiation safety control are being developed. This method uses the information related to features of radiation works, knowledge and experience of workers, and their health, medical and psychological conditions. In this year, we analyzed all the accident and trouble data in the radiation works, and found out a few important factors directly related to those events.

- b) Characterizations of radio-aerosol produced by the use of accelerator

The use of accelerator is rapidly increasing these days in many facilities. Although it is known that high energy radiation may produce radioactive aerosols, the detail of the mechanisms and characteristics of the aerosols has not been well known. In this study, the physico-chemical characteristics of accelerator related aerosols were investigated in the air irradiated by high energy neutron generated with a linear accelerator.

- c) Estimation of the residual radioactivity in the nuclear and accelerator facilities

It is an important issue for radiation safety control to investigate the induction of secondary particles (mainly neutron) and induced-radioactivity in the air, water, and equipments, during the use of nuclear facilities and accelerator facilities. In this study, the experiment on the shielding to high energy neutron and the measurement on nuclide-production cross-sections induced by charged particles and neutrons have been carried out to contribute to the safety assessment of nuclear and accelerator facilities.

- d) Behavior and kinetics of radioactive materials in the land ecosystem

In order to assess the effects of radioactive materials originated from nuclear facilities, a development of model to analyze the behavior of radioactive materials in the environment, and the identification of related parameters are essential. In this year, a study on the modeling of a behavior of  $^{14}\text{C}$  in rice paddy fields and its accumulation in polished rice were conducted.

- e) Health effects and risks of radiation and radioactive materials

It is well known that an excess dose of radiation leads to adverse effects on human health.

The health effects of neutrons, and the combined effects of radiation and other environmental toxicants are investigated. In this year, gamma-ray and arsenite were used in culture cells, and genes responding to these were analyzed by using a new gene expression profiling system (HiCEP).

## A-2. Publications and presentations

### a) Publications

#### *Original papers*

- Fujimori A, Yaoi T, Ogi H, Wang B, Suetomi K, Sekine E, Yu D, Kato T, Takahashi S, Okayasu R, Itoh K, Fushiki S.: Ionizing radiation downregulates ASPM, a gene responsible for microcephaly in humans. *Biochem Biophys Res Commun.* 2008 May 9;369(3):953-7. Epub 2008 Mar 10.
- Kuetomi, K., Takahashi, S., Kubota, Y. and Fujimori, A.: Identification of genes responding to low-dose arsenite using HiCEP. *Toxicology Mechanisms and Methods.*, 18: 605-611, 2008.
- Maruyama, K., Kojima, A., Yasuda, T., Suetomi, K., Kubota, Y., Takahashi, S., Ishikawa, Y. and Fujimori, A.: Expression of brain-type fatty acid-binding protein (*fabp7*) in Medaka during development. *J. Exp. Zool.* 310B:577-587, 2008.
- Ishikawa, N., Takahashi, T., Uchida, S. and Tagami, K.: A Statistical Approach to Estimate Soil-Soil Solution Distribution Coefficient of Radiostrontium. *Radioisotopes*, 57: 295-303, 2008
- Kawaguchi, Y., Takahashi, T. and Uchida S.: Investigation on Applicability of Biota Dose Assessment Model to Japanese Environment. *Jpn. J. Health Physics*, 43: 282-289, 2008

#### *Reports*

- Takahashi, T., Yamamoto, K., Tagami, K., Takeda H. and Uchida S.: Development of a Dynamic Compartment Model for prediction of Transfer of Carbon-14 to Rice Grains from the Atmosphere, *Proceeding of the International Symposium on Application of a Closed Experimental System to Modeling for <sup>14</sup>C Transfer in the Environment*, Institute for Environmental Sciences, 15-20, 2008.

### b) Conference and seminar papers presented

- 42<sup>th</sup> annual meeting of Japan Health Physics Society: 3 presentation
- 2008 (autumn) meeting of the Atomic Energy Society of Japan: 2 presentations
- 2008 (spring) meeting of the Atomic Energy Society of Japan: 1 presentation
- 51th annual meeting of Japan Radiation Research Society: 2 presentations
- 11th International Conference on Radiation Shielding (USA.2008.4) : 1 presentation

## A-3. Off-campus activities

#### *Research grants*

- Grant-In-Aid for Young Scientist (B) A study on the measurements of nuclide-production cross-sections of high energy neutrons.

## A-4. International cooperation and overseas activities

#### *Editorial board of the International journal etc.*

- Takahashi, S.: Member of the Technical Committee of Pacific Basin Nuclear Congress, 2008.

## **B. Educational Activities (2007.4-2008.3)**

### **B-1. On-Campus teaching**

a) Course given

Undergraduate level: Behavior of Contaminants in the Environment (Takahashi, S. )

Graduate level: Environmental Radiation Protection (Takahashi, S.), Seminar in Environmental Radiation Control I, II (Takahashi, S.), Applied Environmental Radiation Technology (Takahashi, S.), Experimental Radiation Control in the Environment (Takahashi, S.)

## **C. Other remarks**

### ***Safety Management***

Takahashi, S.: Director of Radiation Control, Member of Nuclear Safety Committee, Member of Health Physics Committee, Member of Radiation Committee for Medical Usage

Takahashi, T.:Administrator of Industrial Health in Kumatori Site.

### ***Off-campus activities***

Takahashi S.: Japan Radiation Research Society (Councilor), Osaka Prefecture (Environmental Radiation Assessment Committee), Kyoto Prefecture (Environmental Radiation Measurement Committee)

Takahashi, T.:Japan Atomic Energy Agency (TRU/Uranium Waste Disposal Committee), Institute for Environmental Sciences (Plant Carbon Transfer Committee), Nuclear Safety Technology Center (Monitoring Text Sub-group Committee)(Network for Emergency Medicine in Osaka Region, Committee)

## 2.6 DIVISION OF NATURAL RESOURCE ECONOMICS

Division of Natural Resource Economics offers research and educational opportunities of socio-economical problems concerned with industrial activities around natural resource as well as harmony between industrial development and nature conservation. This is the only division which studies the field of social science in graduate school of agriculture. Therefore this division is characterized by comprehensive and interdisciplinary studies based on economics, sociology and history and so on.

Division of Natural Resource Economics is composed of 3 chairs and 8 laboratories: Chair of Management & Information of Agricultural Enterprise (Laboratory of Farm Management, Laboratory of Farm Managerial Information and Accounting), Chair of International Agricultural Economics (Laboratory of Regional Environmental Economics, Laboratory of Food and Environmental Policy, Laboratory of Forestry Policy and Economics, Laboratory of International Rural Development). Chair of Comparative Agricultural History & Philosophy of Agricultural Science (Laboratory of Comparative Agricultural History, Laboratory of Philosophy of Agricultural Science).

149 undergraduate students and 81 graduate students (include 37 students in master course and 44 in doctor course) are enrolled in this division on March 20, 2009.

In addition, staffs of this division offer educational service for undergraduate students in the Department of Food and Environmental Economics.

## Chair of management & Information of Agricultural Enterprise

### 2.6.1 Laboratory of Farm Management

*Staff*      *Professor*                      : Niiyama, Yoko, D. Agric. Sci.  
                 *Associate Professor* : Tsujimura, Hideyuki, D. Agric. Sci.  
                 *Instructor*                        : Taguchi, Kozue, M.Agric.Sci.

*Students and research fellows*

*Doctors program:* (8)

*Masters program:* (8)

*Undergraduate* : (6)

#### A. Research activities (2007.4-2008.3)

##### A-1. Main subjects

a) Joint study by staff:

Market and Farm Management:

The world agriculture has been increasingly embracing the free market principle. Can farms survive under such principle? It is now essential not only to create a coordination system, which is based on social values of the agriculture and the farm in each country, but also to redefine the market. Through comparative analysis on problems regarding the farm management among US and the EU which lead in world agriculture, developing countries in Asia and Africa, and needless to add Japan, we will discuss future pictures of farm organizations and management, and conditions that is essential for their survivals.

Diversity of Farms and Agribusinesses:

In every country, farms are abundant in diversity with traditional family farms at one end and huge farms dominated by multinational conglomerate agribusinesses at the other. The disparities in management structure, corporate behavior and social raison d'être of respective farms should be clarified. In addition, social significance and impacts of respective farms on local communities and food supply should be brought to light.

Roles of Regional Agricultural Organizations:

Sustainable development of the farm requires the regional agricultural organization. There are various kinds of regional agricultural organizations including the community-based organizations, collective organizations, agricultural cooperatives and agricultural services. A number of studies on their contributions to the establishment of

regional agricultural system and production center system have been accumulated.

Person and Management:

The Farm organization is created and run by human. Not only the managerial creed, the managerial function and the business management system, which has been created by person in order to run business management more efficiently, but also the impact of management philosophy, thought and ethics on society (including products and regional communities), and culture created through management will be clarified.

Food System and Social System to Ensure Food Safety:

In order to supply high-quality food, farms have now been called for cooperation not only with consumers but also with affiliated industries which form the food system: food manufacturing, wholesaling, retailing and catering industries. In addition, in these days of frequent food incidents including those caused by BSE, food poisoning through pathogenic microbes such as O157:H7, residual pesticides on produce and false labeling of foods, we are urged to create a social system to ensure food safety. The future direction of Japan in this regard will be further discussed by comparing it with EU and US.

b) Individual study:

Niiyama, Y.: 1) Theoretical and Empirical Study on Agribusiness and Food-system; 2) Comparative Studies of Food-safety and Traceability system in Food Chain in Japan- the E.U. Countries; 3) Comparative Studies of Beef Food-system in Japan- the U.S.- the E.U. Countries; 4) Studies on the Regional Organization of Agriculture; 5) Studies on the Type of Enterprise and Business Administration in Agriculture.

Tsujimura, H.: 1) Studies of food-system and agribusiness based on cases concerning agricultural products (especially coffee) produced in developing countries; 2) Studies on roles of cooperatives played in socio-economic development at rural area in Africa ; 3) Studies on problems of poverty and farming household economies at rural area in Tanzania; 4) Studies on roles of the fair trade played in producing areas (developing countries) and its development in consuming areas (developing countries).

Taguchi, K.: 1) Studies on environmentally-sound farm enterprises in mountainous areas in Austria; 2) Studies on rural tourism in Austria; 3) Historical and economic study on mountainous areas of Kyoto.

## **A-2. Publications and presentations**

a) Publications

### ***Original papers***

Niiyama, Y.: The Social Responsibility of Food Business for Sustainable Development of Agriculture; Fresh Food Price Setting Bihavior, *Agriculture and Economy*;

- 74(8), pp.50-62, August 2008 (in Japanese)
- Niiyama, Y.: The Structure of Problems and Measurements of Food Pollution Scandals; Food Safety Management and Emergency Response, *Agriculture and Economy*; 74(11), pp.5-16, September 2008 (in Japanese)
- Niiyama, Y.: The Concept and Framework of Food Safety, Agricultural Information Research;17(4), pp1-10, December 2008 (in Japanese)
- Tsujimura, H.: Ethical Sourcing, Fair trade and CSR in the Coffee Industry, *Agriculture and Economy*, 74(8), July 2008 (in Japanese)

### ***Reviews***

- Niiyama, Y.: The Decline of Dairy Farms by the Low Milk Price; Retailer's Low Price Selling and Consumer's Price Judgments, *at*, No.14, pp.24-35, December 2008 (in Japanese)
- Niiyama, Y.: Food Safety and Forged Labels; The Points of Problems and Measurements, *Public Health*, 72(10), pp774-778, October 2008(in Japanese)
- Tsujimura, H.: Small Farmers in Africa Confronting the Coffee Crisis, *Black Gold*, Uplink, pp.13-15, May 2008 (in Japanese)
- Tsujimura, H. : Analysis Method of Fairness in Food Trade: Roles of "Food System" and "Management of Farming Household Economy" for Fair Trade Studies, *Quarterly AT*, 14, pp.57-69, December 2008 (in Japanese)
- Tsujimura, H.: Skyrocketing Maize Prices and Food Security: Tanzanian Small Farmers' Strategies to Avert Price Volatility Risk, *Agriculture and Economy*, 74(14), pp.87-90, December 2008 (in Japanese)
- Tsujimura, H.: Production Areas of Fair Trade Coffees, *Days Japan*, 6(2), pp.38-39, February 2009 (in Japanese)

### ***Reports***

- Niiyama, Y.: The Report of Grant-in-Aid for Scientific Research (A), Science Based Food Safety Policy; Establishing Risk Analysis, Profession, and Professional Code, Annual Repots of 2007, February 2009 (in Japanese)
- Niiyama, Y.: The Report of the Food Safety Policies, the Organizations of Food Industry and Actions of Food Business in EU- The Report of Grant-in-Aid for Scientific Research (A), Science Based Food Safety Policy; Establishing Risk Analysis, Profession, and Professional Code, February 2009 (in Japanese)
- Taguchi, K., Matsushita, K., and Uno, H.: Old Documents on Forestry and Forest Products in Ohara, Kyoto, Japan (2): Documents related to Kimura Sohemon, Magistrate of



*Gonyubokuyama, The Natural Resource Economics Review*, 14, pp.142-194, March 2009 (in Japanese)

### ***Translations***

Tsujimura, H. (Translation Supervisor), *The Coffee Book: Anatomy of an Industry from Cup to the Last Drop* written by Luttinger, Nina and Dicum, Gregory, Sekaishiso Publisher, August 2008

## **A-3. Off-campus activities**

### ***Membership in academic societies (roles)***

Niiyama, Y.: The Food System Research Association of Japan (vice-president)

The Farm Management Society of Japan (president)

Tsujimura, H.: The Association for Regional Agricultural and Forestry Economics

(director for edit)

: Japan Association for African Studies (member of editorial board)

### ***Research grants***

Niiyama, Y.: Grant-in-Aid for Scientific Research (A), Science Based Food Safety Policy; Establishing Risk Analysis, Profession, and Professional Code, Head investigator, 2007-2009

Niiyama, Y.: Grant-in-Aid for Scientific Research (B), Common Agricultural Policies in North East Asia; New Direction under the Economic Integration, Partaker, 2008-2010

Tsujimura, H.: Grant-in-Aid for Scientific Research (C), Management of Farming Household Economy and Rural Development in Kilimanjaro: Roles of Fair Trade, Head investigator, 2008-2010

: Grant-in-Aid for Scientific Research (A), Science Based Food Safety Policy; Establishing Risk Analysis, Profession, and Professional Code, Partaker, 2007-2009

## **B. Educational Activities (2007.4-2008.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Prejudice, Discrimination, and Human Rights (Niiyama), Foods, Agriculture and Environment in the World 2 (Niiyama), Farm Management (Niiyama), Theory of Agribusiness (Tsujimura), Discussions on Agribusiness (Niiyama, Tsujimura), Food and Agriculture Ethics (Niiyama, Tsujimura), Advanced Discussions on Regional Farming and Farm Management (Niiyama,

Tsujimura), Foreign Food and Environmental Economics 1 (Tsujimura), Seminar in Farm Management 1, 2, 3 (Niiyama, Tsujimura, Taguchi), Food Safety 2 (Niiyama)  
Graduate level: Advanced Farm Management 1, 2 (Niiyama), Advanced Theory of Agribusiness Analysis (Tsujimura), Comparative Farm Management (Niiyama, Tsujimura, Taguchi), Advanced Seminar on Farm Management 1, 2 (Niiyama, Tsujimura, Taguchi)

## **B-2. Off-campus teaching**

### ***Part-time lecturer***

Institute for Liberal Arts Education, Kanazawa University (Tsujimura)

## **B-3. Overseas teaching**

### ***Students and research fellows from abroad***

Fellows Abroad: 1 (China)

## 2.6.2 Laboratory of Farm Managerial Information and Accounting

### *Staff*

*Professor: Shigeaki Oda*

*Recture: Bunyo Kagawa*

### *Students and research fellows*

*Master's program: (5)*

*Undergraduate:(9)*

*Research Stuff:(1)*

*Research student:(2)*

## **A. Research Activities(2008.4 - 2009.3)**

### **A-1. Main Subjects**

#### a) Research on management and accounting for agricultural corporations

There is a tendency of family farms in Japan to change into firms and corporate bodies. Central and local governments and groups have been encouraging it recently. However, in the academic circles, only research in institutions is advanced, while research in management and accounting is quite weak. Therefore, our section has been studying the importance and organization of agricultural corporations theoretically in the fields of business, financial accounting, and management accounting for several years. We also are doing many case studies all around Japan.

#### b) Study of farm services

Every farm business pursues its expansion and rationalization. Depending on farm services is one possible means. It includes various categories such as; consignment of productive operations, sales, purchases, and distribution, diagnosis and analysis of management and technique, bookkeeping, and booking analysis tax declaration, information gathering and its analysis, etc. There is no doubt that the need for farm services is increasing in Japan. Our section is studying the concept of farm services by basing on the theory of farm industrial institution, business theory, cost calculation theory, and theoretical cost-benefit analysis.

c) Research on information systems in farm management

In this highly information-oriented age, it is necessary for farm managers to gather, analyze, and utilize information efficiently. Apart from quantitative information related to accounting, technique, and marketing, managers require qualitative information concerning the business. They require both an internal information system on their businesses and an external information system within their regions. Our section is doing research on decision making, accounting information, information systems, and industrial organizations theoretically. We are collecting and analyzing other researches information and case studies in this field in and out of Japan.

## **A-2. Publications and presentations**

a) Publications

Original Paper:

Yasushi Kobayashi, Haruhiko Iba, Koji Ochiai, Nobuko Ueda, Shigeki Oda“Attributes and Issues of Viticulture and Wine Making Business Primarily Utilizing Wild Grapes”, Journal of The American Society for Enology and Viticulture, Japan Chapter, Vol.19, No.2, 2008.7

Bunyo Kagawa, Shigeaki ODA "Social Responsibility and Accountability of Farming", Journal of Rural Problems Vol.44, No.3, 2008.12

Bunyo Kagawa "The Incentive of Information Disclosure on Farm Management", The Natural Resource Economics Review No.14, 2009.3

A-3. Off-campus activities

Shigeaki Oda:

American Society for Enology and Viticulture Japan(Editor)

Bunyo Kagawa:

The Farm Management Society of Japan(director)

A-4. International cooperation and overseas activities

## **B. Educational Activities(2006.4-2007.3)**

### **B-1. On-campus teaching**

a) Courses given

#### Undergraduate level

Outline of Farm Managerial Information and Accounting Survey(Oda), Survey Method for Farm Management(Oda, Kagawa), Accounting for Farm Finance(Kagawa), Practice of Agricultural and Forestry Statistics(Kagawa), Monograph for Agricultural and Forestry Economy I (Oda), Monograph for Agricultural and Forestry Economy II (Kagawa) , Seminar in Farm Managerial Information and Accounting I (Oda, Kagawa), Seminar in Farm Managerial Information and Accounting II (Oda, Kagawa), Seminar in Farm Managerial Information and Accounting III(Oda, Kagawa) , Fundamental Practice for Farm Accounting(Oda, Kagawa) , Training of Research Method I (Oda, Kagawa) , Training of Research Method II (Oda, Kagawa)

#### Graduate level

Farm Managerial Information and Accounting I・II (Oda), Methodology of Farm Accounting(Kagawa), Advanced Seminar on Farm Managerial Information and Accounting I・II(Oda, Kagawa)

#### b) Thesis titles and supervisors

##### Research stuff

“Group Farming”(Oda, Kagawa)

#### B-2. Off-campus teaching etc.

##### a)Off-campus teachings

##### Shigeaki Oda:

Osaka Economic University(Outline of Information Processing Methods)

##### Bunyo Kagawa

Nara Women’s University(Theory of Consumer Action and Behavior)

Nara Women's University(Practice of Social Statistics)

##### b)Public lectures, etc

##### Shigeaki Oda

The 72th Farm Accounting and Management Lectures at Kyoto University (1st class)

Class topic: Double entry bookkeeping for the growth and rationalization of firm management; theory and practical affairs

Bunyo Kagawa

The 72th Farm Accounting and Management Lectures at Kyoto University (1st class)

Class topic: Double entry bookkeeping for the growth and rationalization of firm management; theory and practical affairs

## **C. Others**

### **C-2 Offcampus committee member**

Shigeaki Oda:

The Council of Price Stabilization Policy in Kyoto Prefecture

## Chair of International Agricultural Economics

### 2.6.3 Laboratory of Regional Environmental Economics

*Staff      Professor: Kagatsume, Masaru, Dr. Agr. Sci.*

*Lecturer : Shen, Jinhu, Dr. Agr. Sci.*

*Students and research fellows*

*Doctor's Program : (8)              Visiting Research fellow : (1)*

*Master's Program : (5)              Trainee: (1)*

*Undergraduate : (6)*

#### **A. Research Activities (2008.4-2009.3)**

##### **A-1. Main subjects**

- a) Systematization of research & education field of regional environmental economics

Research on the interrelation between environmental resources conservation and agro-forest activities in various areas in the world, such as interactions between sustainable rural development & environmental resources constraints in global level. These research areas contain both theoretical and empirical approaches for fields of national resources accounts, social account matrix and regional input-output analysis as well as international trade of food & resources etc.

- b) Regional Planning and the Policy Evaluation in Less Favored Areas

We investigated on regional characteristics of Agriculture in Awaji island, South of Hyogo prefecture, which has been suffered from lack of rainfall and water for irrigation, then surveyed the feasibility of regional revitalization schemes based on securing source of irrigation water.

- c) Model Building on Land Use & Land Cover Change in East Asia

We have been trying to build basic model for forecasting the land-use & land cover change in East Asia such as Japan, China, Indonesia and Thailand, which is conducted in collaboration with IIASA and NIES by incorporating the Regional Input-Output Analysis based on Environmental Resources Accounts and Social Account Matrix (SAM).

- d) Economic Analysis, Assessment, Planning and Management of Regional Agriculture, Resources & Environment in Urbanizing Areas - Theoretical and Positive Approaches -

The competition between agricultural use and non-agricultural use of regional environmental resources has become more and more serious recently in urbanizing areas.

As a type of regional agriculture, farming in urbanizing areas, where changes in use of resources are drastic and these uses are in a state of disorder, is especially of interest. Case studies have been conducted in both developed countries (U.S.A., U.K., Germany, Australia & New Zealand, Japan) and developing countries (Thailand, Philippines, Malaysia, Indonesia and China).

e) Effects of Economic Integration in Asia-Pacific regions on Agricultural Trade of EU and APEC Countries

We made a positive analysis on effects of economic integration, such as trade and investment liberalization in APEC countries on the international trade market of agricultural commodities and regional environments.

f) Agricultural Restructuring and Environmental Issues after the introduction of market mechanism in CEEC

Having experienced transition from the central planned economic system to the market economic system since late 1980s, some central and east European countries begin to prepared joining into the EU now. However, in this process, agricultural structures have dynamically changed and serious environmental issues have occurred. A joint research has been conducted on the current situation and these problems.

g) Study on Agricultural Promotion in ESA and Direct Payment in Japan

Following to the WTO asgreement, the market distorting policy such as price policies has been replaced by the direct payment schemes like the environmental direct payment system in the EU and the fixed payment system in USA. In Japan, the “direct payment policy for mountainous areas” and “cross commodity direct payment for management stabilization” have been adopted. This research focusses on the international comparative study of several direct payment schemes.

h) Estimationg the Waste Input Output Table for promoting the resource recycling sustainable rural industries.

In the traditional Input-Output tables, the rows of the waste emission as the byproducts and the columns of the waste desposition (i.e. the “vein” sectors ) are added to the endogenous parts of the interactive relations among the sectors (i.e. the “artery” sectors ). This table is called “waste input-output” table (WIO). By this WIO table, the economic and environmental effects of promoting the resource recycling sustainable rural industries are investigated in this study.

## **A-2. Publications and presentations**

a) Publications



## ***Books***

### ***Original Papers***

Kagatsume M.: "Effects of the Serious Droughts and Grains Market Situation in Australia", "Agriculture", May, 2008, No.1507, pp60-66, Dainihonnoukai (Japan Agriculture Association)

Kagatsume M.: "Development of Food & Agricultural Policy and Trend of Grain Markets after unprecedented Serious Drought in Australia", *The Natural Resource Economics Review*, Vol 13, pp.69-88, Mar. 2008

Kagatsume M.: "Food Demand & Supply in Australia and Its Effects to the International Market", *Agriculture and Economy*, Vol.74, No.4, submitted in Feb 2008, pp94-102.

Shen J. H., "Institutional Reforms, Economic Growth and Environmental and Economic Problems in the steppe areas of Northwestern China", *The Natural Resource Economics Review*, No.14, p.1-42, March 2009.

### ***Reports***

Kagatsume M.: "Food Issues and Biofuel", the column of private and public logics, Kyoto Newspaper, Sep 26, 2008

Kagatsume M.: "Mutual Discussion---explore the yardstick in the hard world---, Thinking of Foods in Japan", "YAKU: flights of fancy", Kansai Electric Power Company bulletine, pp3-18, No.3, (winter issue) 2009 (published in Dec 19, 2008)

#### b) Conference and seminar papers presented

Kagatsume M.: "Prospects of Biofuel Projects for Sustainable Regional Development in Japan", Special symposium at Lijiang campus of Yunnan University, "Construction of the Nature Friendly Society in Asia", Sep 16, 2008

Kagatsume M.: "Cross-products management stabilization scheme and farmland conservation policy in Japan---Target and Evaluation of Japan style Direct payment system, in special workshop in Beijing Agricultural College, Sep 18, 2008

Paula ROSSI and Masaru KAGATSUME, "Environmental Impact of Beef Restrictions in Argentina", Society of Environmental Economics and Policy, Osaka University, Sep 28 (Sun),

Shen J. H., "Individual Farmer System, Economic Growth and Desertification of Steppe: a

study on the causes and measures of the Desertification in the steppe areas of Northwestern China", The Academic Seminar on the Sustainable Development of Chinese Agriculture in Shanghai Research Center of Kyoto University. 16 Feb. 2009

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Kagatsume, M.: The Agricultural Economics Society of Japan, The Association for Regional Agricultural and Forestry Economics; The Oceanian Economics Society (President); Society of Australian Studies (Director), Research Coordination Council for Academic Conferences, PanPacific Input Output Analysis Society, Society of Environmental Economics and Policy, The Agricultural Management Society of Japan, Agricultural Information Society, International Development Association, Japan Behavioral Medical Association

Shen J. H.,: The Association for Regional Agricultural and Forestry Economics(Regular Director)

#### **Research Federation for Japan Academic Council**

Kagatsume, M.: Committee Member for Research on Land Use & Cover Change, Research Coordination Committee for Global Environment Research, Japan Academic Council Section 6

#### ***Research grants***

Grants-in-aid for Scientific Research (KAKENHI)

Kagatsume, M.: (Basic Research B2, Grant No1930127) "Agricultural Restructuring under the Development of Free Trade Agreement and International Comparison of Environmental Direct Payment System", <Project Leader: Masaru Kagatsume>

Kagatsume, M.: (Set-up Research): "An Econometric Study on the Effects of Ecological Emigration Against Grassland Desertification in China", <Project Leader: Masaru Kagatsume>

### **A-4. International cooperations and overseas activities**

#### ***International meetings(roles)***

Kagatsume, M. "Food & Resource Trade and Environmental Issues under the Australia-Japan FTA and Asia Pacific Community Concept", International Research Workshop, University of New South Wales, Australia, 18 to 20 February 2009

***International joint researches, overseas research surveys***

Kagatsume M.: Sweden & Germany, "Agricultural Restructuring under the Development of Free Trade Agreement and International Comparison of Environmental Direct Payment System", Basic Research B, June 11-15, 2008

Kagatsume M.: Austria & Ukraine, "Agricultural Restructuring under the Development of Free Trade Agreement and International Comparison of Environmental Direct Payment System", Basic Research B, August 3-12, 2008

Kagatsume M.: China, "Impacts prediction of and Adaptation Strategy for Climate Fluctuation by the Asia Agriculture Model", (Basic Research B, Research head: Nakagawa M.), Sep 13-18, 2008

Kagatsume M.: Russia, "Agricultural Restructuring under the Development of Free Trade Agreement and International Comparison of Environmental Direct Payment System", Basic Research B, Sep 19-26, 2008

Kagatsume M.: China, "Agricultural Restructuring under the Development of Free Trade Agreement and International Comparison of Environmental Direct Payment System", Basic Research B, Oct 26-Nov 3, 2008

Kagatsume M.: China, "Foods and Agriculture under the population decreasing stage", (Basic Research B, Research head: Yamaguchi M.), Jan 4-9, 2009

Kagatsume M.: USA, "Research on the Non-Tariff Measures in the International Trade", Regional Environmental Economics Laboratory Scholarship, March 14-18

Kagatsume M.: Australia, "Food & Resource Trade and Environmental Issues under the Australia-Japan FTA and Asia Pacific Community Concept", International Research Workshop, University of New South Wales, February 18-20, 2009.

(granted as Research Fellow in University of New South Wales for 3 years from 2008).

<subsidy: UNSW (staying cost) and Kyoto University (travel cost) >

***JSPS Post Doctoral Fellowship***

***1.(granted by Japan Bank for International Cooperation, JBIC)***

Guo Shanmin, Associate Professor, Henan Agricultural University, (Nov 1, 2007 to April 30, 2008)

**2. *(granted by Australia-Japan Foundation***

***for the Special Open Lectures Series for Post Graduate Course in Kyoto University)***

- 1) Dr Barry Brook (Univ. of Adelaide), May 24, 2008  
"Climate Change Impacts and Adaptation for the Rural Environment"
  - 2) Dr John Ward (Chief Researcher, CSIRO, Adelaide), June 28, 2008  
"Water resources and environmental economy"
  - 3) Dr Michele John (Curtin University), July 26, 2008  
"The use of Life Cycle Assessment in the Australian agricultural industry"
  - 4) Dr Ben WHITE (Western Australia University) August 23, 2008  
"Biodiversity Conservation on Western Australia's Farmland"
  - 5) Dr Anna STRUTT, September 27, 2008  
(Associate Professor, Faculty of Economics & Commerce, University of Waikato)  
"Preferential Trade deals in Asia-Pacific Region (including Australia and New Zealand) and the Economic & Environmental Effects"
- (Cf. Report on the AJF funded Special Open Lectures Series for Post Graduate Course in Kyoto University, and homepage: <http://home.hariko.com/> )

**3. *The Special Lecture by Australian Prime Minister, Kevin RUDD,* June 9, 2008,**

Assisted by Australia Japan Foundation and Japanese Minister of Foreign Affairs  
"Environmental Policy in Australia and International Cooperation & Safety Security Issues"  
At Inamori hall, Shiran Kaikan, Kyoto University

**4. *The Special Seminar,* May 8, 2008**

Dr Yong S Wui, (Assistant Professor, School of Business and Management, University of Arkansas at Pine Bluff, USA)  
"Economic Efficiency of Alternative Bycatch-Reduction Policies and Bycatch Reduction Devices"

**5. *The Special Seminar,* July 16, 2008**

Dr. Tamara V. Litvinenko  
(Senior researcher, Dept. of Social and Economic Geography, Institute of Geography, Russian Academy of Sciences, Moscow, Russian Federation.

(Visiting professor, Dept. of Economics, Doshisha University, Oct 1, 2007- Sep 30, 2008)  
“Spatial Transformation of Natural Resources Utilization and  
Associated Social and Ecological Problems in Eastern Russia”

## **B. Educational Activities (2007.4-2008.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Resource & Environmental Economics (Kagatsume), Agricultural & Forestry Statistics (Kagatsume), Resource and Environmental Analytics (Shen), Basic Information Processing Method (Shen), Basic Sociology & Economics for Agriculture (Shen and Adachi), Seminar in Resource & Environmental Economics I, II, III (Kagatsume, Shen), Outline of Natural Resource Economics (Kagatsume, 2 other professors)

Graduate level: Regional Environmental Economics I, II, III (Kagatsume), Advanced Seminar in Regional Environmental Economics I, II, III (Kagatsume, Shen), Rural Resources Economics (Shen)

### **B-2. Off-campus teaching, etc.**

#### ***Part-time lecturer***

Kagatsume, M.: Junior College, Toyama Prefectural University, Environmental Economics

Kagatsume, M.: Dept of Economics, etc. Outemon Gakuin University,

(Food Economics 1,2 and Rural Industry Policy in Australia)

Kagatsume, M.: Collaborated Education Activities between Highschool and University, SSH Seminar System, Zeze Highschool

### **B-3. Overseas teaching**

#### ***Students and research fellows from abroad***

(Master and Doctor course) China 4, Nigeria 1, Mali 1, Argentina 1

(Research Student) China 1

## **C. Other remarks**

Kagatsume, M.: Committee Member of International Food Market Research Committee, Japan Association for International Collaboration of Agriculture and Forestry (JAICAF),

Kagatsume, M.: Director Board Member of Kansai New Zealand Center

Kagatsume, M.: Councilor, Center for Agricultural Development and Training

Kagatsume, M.: Reviewing Committee member for Research Subjects for Rural Industry  
Research Enhancement Projects by the Cutting Edge Technologies

Kagatsume, M.: Reviewing Committee member for Research Subjects for Practical  
Technology Development Projects for Promoting New Rural Industry Policies.

## 2.6.4 Laboratory of Food and Environmental Policy

*Staff      Professor : Takebe, Takashi, D. Agric. Sci.*

*Students and research fellows*

*Undergraduate    : (5)*

### **A. Research Activities (2008.4-2009.3)**

#### **A-1. Main subjects**

##### a) Food, Agricultural and Environmental Policies

In consideration of the global environment as the basis for human life, we examine and identify the agricultural and environmental problems from the viewpoint of the theory in economics and policy. Our topics include sustainable food production in the world, environmental governance, normative analyses of local resource use, international cooperation for global environmental protection, and collaboration between private and public sectors in regional communities. We consider these issues with an eye towards the formation of a recycling society.

##### b) Environmental Governance

Environmental governance is to build institutions or socioeconomic systems to attain a sustainable society. We conduct theoretical analyses of the mutual relation between economic activities and the global environment in order to clarify conditions for sustainable food production and investigate the regional imbalance of food production and its distribution. We also consider the methods for environmental valuation.

##### c) Economic Evaluation of Resource Use

We examine and evaluate the current states of utilization, conservation and management of all sorts of local resources, especially farm land. For this purpose we use and employ the principles of resource, environmental, and managerial economics and utilize the techniques of the geographic information system.

##### d) Clarifying Activities of NPO and NGO

Associations aimed at public benefit and/or group benefit will become socioeconomic organizations in charge of our society in the near future. Non-profit organizations in Japan exist as public-oriented and/or group-oriented organizations. We study various activities of these NPO and NGO

#### **A-2. Publications and presentations**

##### a) Publications

### ***Books***

### ***Original papers***

### ***Reports***

Takebe, T. : Reformation of public-service corporations and Japan's agriculture. Grant-in-Aid for Scientific Research (C) (Takebe, T.: Research Leader), About Influences on Agriculture and Rural District by Activities of Non-profit Organizations ; 6-16, 2009 (in Japanese)

Takebe, T. : Analysis of rent project for specific corporations. Grant-in-Aid for Scientific Research (C) (Takebe, T.: Research Leader), About Influences on Agriculture and Rural District by Activities of Non-profit Organizations ; 17-27, 2009 (in Japanese)

b) Conference and seminar papers presented

## **A-3. Off-campus activities**

### ***Membership in academic societies***

### ***Research grant***

Yoshino, A., Takebe T.: Grant-in-Aid for Scientific Research (C) (Yoshino, A.: Research Leader), Extracting and Proving Principles of Risk Communications on Food Security ; Takebe is a Research Member, 2006-2008

Takebe T., Yoshino, A. : Grant-in-Aid for Scientific Research (C) (Takebe T.: Research Leader), About Influences on Agriculture and Rural District by Activities of Non-profit Organizations ; Yoshino is a Research Member, 2007-2008

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Introduction of Food and Environmental Economics I (Takebe; partial charge), Special Lecture I II (Takebe, Yoshino), Agricultural and Environmental Policy (Takebe), Seminar in Agricultural and Environmental Policy I II III (Takebe, Yoshino)

Graduate level: Advanced Agricultural and Environmental Policy I II (Takebe), Seminar in Advanced Agricultural and Environmental Policy I II (Takebe)

### **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***



## 2.6.5 Laboratory of Forest Policy and Economics

*Staff Associate Professor: Kawamura, Makoto, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's Program : (1)*

*Master's Program : (3)*

*Undergraduate : (3)*

### **A. Research Activities (2008.4-2009.3)**

#### **A-1. Main subjects**

a) Analysis of Japan's forestry

The structure of Japan's forestry drastically progressed after the World War II. Today, about 80% of our demand is satisfied by imported timber, and domestic forestry is less competitive even though we have enough forest resources in our own land. The section of forest policy is studying this historic process and its causes, and searching the way to re-establish domestic forestry.

b) Research for externalities of green environment such as forest resources

Non-timber products or public benefits of forest etc. became familiar with the people these days. Many of them used to be realized as externalities cannot be measured in market system well. Considering that, we are trying to analyze them theoretically and practically as a problem of resource allocation.

c) Research for wood industry system and distribution system

Woods are demanded by a variety of users and allied industries. Pulp and paper industry needs a heavily equipped factories, but timber industry often depends on small mills. Distribution of raw materials and products differs as well. We are researching wood industry system and the market structure of forestry related industry by using econometric models, and analyzing effects of the external conditions and the mechanism of pricing.

d) Input-output analysis of forestry and timber industry

Forestry and timber industry have the characteristics of providing intermediate goods to produce the goods of other industries. We are trying to analyze statistically the status-quo and interrelation of the forestry, timber industry and other industries by using the regional input-output tables, in order to clarify how are the products of the forestry and timber industry demanded and through what industry, and these interdependent relations between sectors and transactions between the industries and the final demand sectors.

e) Comparative study of forestry

It is important for Japan to understand the forestry in North America and Southeast Asia, which are two main sources of imported timber. Our goals of comparative study of these regions and Japan are to find possible ways of sustainable forestry, especially in tropical Asia, and to define the role and responsibility of Japan.

f) Future perspectives of National Forest

Japan has 7.6 million hectares of National Forest, which is about one fifth of total land area. However, it is endangered by financial problems, and restructuring of National Forest managing system is undergoing. As forestry researchers, we believe that the most important point is to ask the public what the National Forest should be in the future and to learn together about it. With studying foreign system of state and national forest or trend of privatization of public forests, we are trying to draw some future perspectives of Japanese National Forest.

g) An econometric analysis on demand, production and import of fruits

Our purpose is to examine how demand, production and import etc. for the fruits changed after the trade liberalization by estimating each function using several kinds of econometric methods and statistics.

## A-2. Publications and presentations (2008.4-2009.3)

a) Publications

***Original papers***

Kawamura, M.: Changing Timber Trade and Forest Products Resources, *Agriculture and Economy*, 74(4), 2008 (in Japanese)

SAKAMOTO .T and M.SHIBA and M. KAWAMURA, Current States and Challenges in Adopting the Hiyoshi-style Integrated Forest Management, *JOURNAL OF THE JAPAN FOREST ENGINEERING ASSOCIATION* 23(1) 2008 (in Japanese)

Kawamura, M.: Housing of Regional System in Rural Areas, *Agriculture and Economy*, 74(13), 2008 (in Japanese)

b) Conference and seminar papers presented

Kawamura, M. and K.Shimoda and N.Sakanoue: The New Vendor System of the Timber Distribution in Japan, The Kansai Branch of Japanese Forest Society 59th, 2008

Shimoda.K\_ and M.Kawamura and N.Sakanoue: The Market trade of the Medium-scaled Logs in Japan, The Kansai Branch of Japanese Forest Society 59th, 2008

Kawamura, M. and N.Sakanoue and T. Hasegawa: The New Forestry Innovation in Japan, The Autumn Meeting of Japanese Forest Economic Society 2008 in Iwate, 2008

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Kawamura M.: The Japanese Forest Economic Society, The Japanese Forest Society (Councilor), Japan Society for Impact Assessment, Japanese Institute of Landscape Architecture, The Japan Society for the Comparative Study of Civilization

### **A-4. International cooperation and overseas activities**

#### ***International meetings (roles)***

Kawamura M.: Mongolian Academy of Sciences and MFF: Conference of Mongolian Forests Regeneration, Mongolia (invitation lecture)

#### ***International joint researches and overseas research surveys***

Kawamura M.: The Research of Land Law in Mongolia ( Nagoya University and University of Mongolia )

## **B. Educational Activities (2007.4-2008.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Forestry economics (Kawamura), Seminar in forestry policy I・II・III (Kawamura)

Graduate level: Forest resources economics (Kawamura), Advanced seminar in forestry policy I・II (Kawamura)

## **C. Other remarks**

Kawamura M.: Committee member of the Mongolia Forest Regeneration Projects (in Hyogo Prefecture), Committee member of the Promotion for Nishiharima Forest Plan Area, Committee member of the Ichikawa & Yumesakigawa River basin, Committee Member of Common Forest Society of Middle Japan , Member of the management board of Takatsuki Municipal Corporation for Urban Greening and Forest Management

## 2.6.6 Laboratory of International Rural Development

*Staff*      *Professor: Seiichi Fukui, Dr.(Agriculture)*  
*Associate Professor: Asami Atsuyuki, Dr.(Agriculture)*  
*Instructor*                      *: Nakada Yoshiaki, Ms. of Sc.*

*Students and Research Fellows*

*Doctor's Program*                      *: (8)*  
*Master's Program*                      *: (5)*  
*Undergraduate (4th year): (4)*

### **A. Research Activities (2008.1.-2008.12)**

#### **A-1. Main subjects**

a) Research and survey on international rural and agricultural development problems

The problems related to poverty, hunger, agricultural technology, rural credit and investment, agricultural marketing, organization, food balance, trade and policy, population explosion, deterioration of natural resources such as pasture, water and forest, environment problems, changing traditional customs in developing countries, and international agricultural cooperation including ODA and NGO are studied with special attention to farm economy, village economy and agricultural sector. The methods in the fields of the neoclassical economics and its applied economics such as agricultural economics, farm management, agricultural policy, agricultural development, economic development, international economics, environmental economics, and econometrics as well as field and village survey method are used for analyzing those problems, and the ways to solve those problems are sought.

b) Research and survey of rural institutional problems

The rural institutional problems such as social interactions in village, rural market and organization, social rules, conventions, formal laws, incentive systems, including the viewpoints of society, culture, history, policy and jurisprudence are studied through new institutional neoclassical as well as neoclassical economics methods. The field surveys of rural China, South East Asia, Middle East Asia, Sub-sahara Africa are conducted and the first hand micro data that are collected by these surveys are utilized to solve the rural institutional problems.

#### **A-2. Publications and presentations**

a) Publications

### ***P a p e r***

M i w a、K a n a a n d F u k u i、S e i i c h i,”Impact of Risk and Kinship Relations on Tenancy Contract Form: A Case Study in Rural Java”, Journal of Rural Problem, 2008, Vol.44,No.2,364-369.

### ***Book***

Takahashi,Motoki and Fukui,Seiichi, eds. Development Economics, April 2008,Keiso-shobo.

### ***Reports***

Asami, Atsuyuki, The Study of Economic Efficiency and Traditional Custom of Chinese Farm Households' Behavior based on the New Institutional Economics Methods : How should they deal with WTO system? Grant-in-Aid for Scientific Research (C)(2),2004~2007, 2008, pp.1~79.

### ***Newspaper Book Reviews***

Asami, Atsuyuki, “ Takahashi Goro: Structural Change and Agriculture of Chinese Economy: The Future of food and Environment, Nihon Keizai Hyoronsha”, Nogyo to Keizai, Vol.74No.9,2008, p.126

## **A-3. Off-campus activities**

### ***Research Grants***

Fukui, Seiichi: Monbusho Research Grant; Basic Research(C): “A Comparative Study of Agrarian Institutions to Cope with Risk in Rural Area of Poor Countries”

Asami,Atsuyuki: Monbusho Research Grant; Basic Research(C): “TheTransformation of Rural China's Institutions from Informal to Formal System : from the viewpoints of Economics and Law”

Asami,Atsuyuki: Monbusho Research Grant; Basic Research(A): “The Farm Household Economy during a Period between world war I and II: Empirical Analysis of Micro Dataf”

## **A-4. International cooperation and overseas activities**

### ***International joint researches and overseas research surveys***

Asami, Atsuyuki: A study on Reforms of Rural Institutions (China Baining).

Asami, Atsuyuki: A study on Agricultural Land Market (China Hunan, Shandong).

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

Undergraduate level: International Rural Development (Fukui), Seminar in International Rural Development Economics (Fukui/Asami/Nakada), Graduation Thesis (Fukui/Asami/Nakada), Agricultural Development (Asami), Reading of English Literature of Agricultural and Forestry Economics (Asami),

Graduate level: International Rural Development I,II (Fukui), Advanced Seminar on International Development Economics I,II (Fukui/Asami/Nakada), International Cooperation in Agricultural and Forestry (Asami)

### **B-2. Off-campus teaching, etc.**

Fukui, Seiichi: Konan University, Faculty of Economics

Asami, Atsuyuki: Tsukuba University, Graduate School of Agriculture

### **B-3. Overseas teaching**

*Students and research fellows from abroad*

Students: three graduate school students (China),

## Chair of Comparative Agricultural History & Philosophy of agricultural Science

### 2.6.7 Laboratory of Comparative Agricultural History

#### **Staff**

*Professor: Noda, Kimio, D. Agric. Sci.*

*Associate Professor: Adachi, Yoshihiro, D. Agri. Sci.*

*Assistant Professor: Ito, Atsushi*

*Students and research fellows*

*Doctor's program: (8)*

*Research Staff: (1)*

*Master's program: (1)*

*Undergraduate Senior: (5)*

*Undergraduate Junior: (5)*

#### **A. Research Activities (2008.4-2009.3)**

##### **A-1. Main subjects**

###### **a) Research on farm management history**

A farm management is the fundamental unit of agriculture. There are various types in farm management, from which are formed some social classes of farmers and the regional agricultural structure. Finally it leads to national agriculture bound to the international relationships. The purpose of our study is to make clear the social dynamic process of the farm management leading the agricultural development, especially by focusing on the technical and economic aspects.

###### **b) Comparative study on the land reform in the 20th century.**

Based on a mass of studies on both prewar and contemporary Japanese agriculture, we rethink on the historical significance of postwar land reform and "jisaku-nou-taisei", the owner-farmers-system, as a result of land reform in 1946-1950, especially from the viewpoint of the farm management history shown in a).

In addition we are engaged in comparative study on some land reforms in the world and agricultural problems as the results of them, which was performed simultaneously after WW2.. The objects of comparison are land reforms in East-Asian (i.e. Japan, China and

Korea) and Europe (i.e. East Germany). Structuring a comparative land reform theory could make clear the significance of the Japanese land reform in the modern world agricultural history.

c) Comparative study on the development of Japanese agriculture.

It is a important subject in current social sciences to rethink the paradigm of modernization, which has been regarded as a universal trend effectual even in another non-European countries. Reviewing the results of historical studies on Japanese agriculture and peasant society, furthermore comparing it with another Asian countries, we are now engaged in clearing a characteristic of Japanese agriculture in world agriculture types. Our new framework is based on a comprehensive historical knowledge, different from a once presented hypothesis from a viewpoint of agricultural technology.

d) Study on the agriculture and peasant problems in the war-time-system

It has been often emphasized that further historical study is required on the real conditions of agriculture and rural society in the war-time-system 1937-1945. As is shown in the following subjects, "technology, production, and farm management in the war-time-system", "the real situations of rural society under the economic control of the government", "life and farm of Japanese immigrants in Manchuria", we research firstly on the influence of the extreme selective economic policy upon the domestic agriculture, secondly on the influence of both the inflation and the economic control of the government upon the rural society, finally on the political and economical position of domestic agriculture and rural society in the "Japanese empire". Further comparison with German agriculture is well covered in this study, because both Japan and German agriculture in war time is considered to have been in relative common aspects in several points.

e) Research on the German agricultural history in modern-age

In the traditional research on the German agricultural history we cannot find the sufficient explanation of farm labors, hired-men, and foreign seasonal workers, because there is the dominant idea that farmers and landlords had played the important role in the German modern village. From this viewpoint we study now, 1. on the ethnic problems in the rural village which was represented in the polish seasonal labors in the Wilhemine Era, 2. on the farm labor and Nazism in the rural life, and 3. on the relations between the refugees problem and land reform in East and West Germany after the WW□.

## **A-2. Publications and presentations**

a) Publications

***Books***

NODA, Kimio: History of HATASHYO-CHO vol.3, ed. by "Editing Committee of History of



HATASHYO-CHO”, 2008, pp.242-269、 pp.336-356、 pp.466-471

NODA, Kimio: History of HATASHYO-CHO vol.4, ed. by “Editing Committee of History of HATASHYO-CHO”, 2009, pp.299-303.318-323

NODA, Kimio: The “aporia” of the Japanese small farming theory. How do you evaluate the demand of the small farmer for landownership in JAPAN?, IMANISHI, H. (ed.). A world system and East Asia, 2008, pp.45-71

NODA, Kimio: Importance and possibility of the National Accord about the ideal method of Japanese agriculture, FUJITANI, C. (ed.), The new direction of the Japanese agriculture and agricultural administration, 2008, pp.246-256

### ***Original Papers***

NODA, Kimio: “The traditional landholding” as the alternative to “the structure policy” in Japan, GENNDAI-NOGYO (Modern agriculture in Japan) ,2008.2, pp.194-201

ADACHI, Yoshihiro: Refugee and socialism in rural East Germany. Land reform and collectivization as agricultural settlement 1945-1960, The Journal of Agricultural History, No.43, March 2009, pp.28-39

ADACHI, Yoshihiro: The machine and tractor station of Bad Doberan County in 1952-1961, Agricultural mechanization and the making of new rural cadres. The Natural Resource Economics Review, No.13, March 2009, pp.65-122.

ITO Atsushi: Trends in history and economic history. Annual Bulletin of Rural Studies 43; 250-262, 2008

ITO Atsushi: Articles on Matsushita Sugao (Watanabe Takeo). Ritsumeikan Studies in Language and Culture 20(2); 221-223, 2008

### ***Book reviews***

ADACHI, Yoshihiro: Okuda H. (ed.), History of Russian peasantry in 20 century, Russian–Eurasian Economy, No.909, Apr. 2008, pp.40-46.

ADACHI, Yoshihiro: Hirai, S., Rural society and lower class in modern Germany, Journal of Rural Studies, No. 29, Oct. 2008, pp.49-50.

### **b) Conference and seminar papers presented**

ITO Atsushi: Emigration policy in postwar Japan: An aspect of agricultural policy and historical context of Japanese Brazilian immigration. The 8th Conference of the East-Asian Agricultural History, 2008

## **A-3. Off-campus activities**

### **Membership in academic societies (roles)**

NODA, K.: The Regional Agricultural and Forestry Economics Association (President of committee), The Agricultural History Society of Japan (President of committee),  
ADACHI, Y.: The Regional Agricultural and Forestry Economics Association (a member of committee), The Agricultural History Society of Japan (a member of committee),

### **Research Grant**

Grant-in-Aid for Research (B) from the Japan Society for the Promotion of Science (NODA)  
(Comparative Historical Study on the Agricultural and Forest Resources Development from Pre- to Post -World War II.)

Grant-in-Aid for Research (C) from the Japan Society for the Promotion of Science (ADACHI), Continuity of German Agricultural History from NSDAP to DDR

Grant-in-Aid for Young Scientists (B) from the Japan Society for the Promotion of Science (ITO), Migration Flow of Rural Japan: Manchuria colonization, postwar reclamation, and postwar emigration

### **A-4. International co-operations and overseas activities**

ADACHI, Yoshihiro: Research Trip for the Study of “the Agricultural Resources Development in modern Germany”, March 2009

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### **Courses given**

Undergraduate level: Agricultural and Rural History (NODA), Introduction to Food & Environmental Economics (NODA, et al.), Science of Biosphere-Life, Food, and Environment (NODA, et al.), Agriculture, Food and Environment in the World (NODA, et al.), Social Economic History (ADACHI), Basic Sociology & Economics for Agriculture (ADACHI, et al.), Foreign Food & Environmental Economics II (ADACHI), Seminar in Agricultural History I, II, III(NODA, ADACHI, ITO).

Graduate level: Comparative Study of Agricultural History I, II (NODA), Comparative Study of Economic History (ADACHI), Advanced Seminar in Comparative Study of Agricultural History (NODA, ADACHI, ITO)

### **B-2. Off-campus teaching**

#### **Open Lecture**

NODA, Kimio : An Special Lecture in the 72 Farm Accounting and Management Lectures at

Kyoto University(1st class)

## 2.6.8 Laboratory of Philosophy of Agricultural Science

*Staff      Professor                      : Suehara, Tatsuro, D. Agric. Sci. (Kyoto University)*

*Associate Professor : Akitsu, Motoki, D. Agric. Sci. (Kyoto University)*

*Assistant Professor : Oishi, Kazuo, M. Agric.Sci. (Kyoto University)*

*Student and Research fellows*

*Doctor's program: (9)*

*Master's program: (9)*

*Undergraduate : (6)*

*Research fellow : (3)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

a) Philosophical Studies on the Agricultural Sciences

Philosophical, Ethical and Methodological studies on Agriculture and the Agricultural Sciences. We also study on the relationship between agriculture and society.

b) Comparative Study on Modern and Traditional Rural Societies

Comparative studies on socio-economic structure of rural societies from a global perspective, especially transformations under the expansion of economic globalization.

c) Cultural, Historical and Anthropological Studies of Food, Food Production and Food Consumption

Cultural, historical and anthropological studies on food, food production, food distribution and consumption in the community and national levels from a global perspective.

Studies on food-systems including the relationships agricultural products, marine products, forest products, wholesale systems, retail systems and the consumers.

Studies on the life and value systems of farmers, fishermen and foresters.

#### A-2. Publications and presentations

a) Publications

***Books***

Suehara, T.: Encyclopedia of Cultural Anthropology, Maruzen, 194-197, 2009

### ***Original papers***

Suehara, T.: “L’agriculture de la culture et l’agriculture de l’économie, L’agriculture participative: Pourquoi, comment jusqu’où?”, *PRIVDBJ*, 4-2, 1-13, 2008

Suehara, T.: Food Production and Japanese Civilization. *Nogyo to Keizai (Agriculture and Economy)* 74(5), 20-30, 2008

Suehara, T.: Varieties of Food Plant and Principle of Economics, *SER* 84, 467-482, 2009

Akitsu M.: Reconstructon of Rural Life and the Role of Small Business. *Nogyo to Keizai (Agriculture and Economy)* 74(13), Showado, Kyoto, 5-14, 2008

Akitsu M.: A Sociological Approach to the Sustainable and/or Revitalization of Japan’s Rural Society: A Path from the Present Situation. National Agricultural Research Center Rural Economic Research 58, National Agricultural Research Center, Tsukuba, 3-9, 2008

Akitsu, M.: A Japanese tradition of study on agricultural ethics: a critical review of the academic history of ‘Philosophy of Agricultural Science’. The paper of XII World Congress of Rural Sociology, Goyang, Korea, 2008 (<http://www.irsaworld.org/XII/papers/14-1.pdf>)

Oishi, K.: Shinto Priest’s Families and Peasant Families of Kamigamo Village in Early Meiji Era (Part 2), *Kamobunka (Journal of Kamo Culture)*, 5, 73-83, 2008

Oishi, K.: Establishing a trust relationship between non-chemical rice vinegar and rice-producing region. *Nogyo to Keizai (Agriculture and Economy)* 75(1), 88-91, 2009

### ***Reports and Reviews***

Suehara, T.: Book Review, Introduction to African Studies Today (Shoko Yamada), *Journal of African Studies* 74, 75, 2009

Suehara, T.: A Japanese Model of Urban Agriculture, *Nogyo to Keizai (Agriculture and Economy)* 75(5), 1, 2009

Akitsu M.: Overall Comment as an Organizer. *Journal of Rural Problems* 173, 41, 2009

b) Conference and seminar papers presented

XII World Congress of Rural Sociology : 1

The Annual Conference of the Agricultural Economics Society of Japan, 2009 : 1

## **A-3. Off-campus activities**

### ***Memberships in academic societies (roles)***

Suehara, T.: The Agricultural Economics Society of Japan (director); The International Association for Kyoto Studies (director); Japan Association for African Studies

(councilor, director, editor in chief)

Akitsu, M.: The Japanese Association for Rural Studies (Chair of Program Committee); The Association for Regional Agriculture and Forest Economics (director)

Oishi, K.: The Association for Regional Agriculture and Forest Economics (director)

### ***Research grants***

Suehara, T.: Monbukagaku-shou Research Grant (B) (1): Agricultural and Cultural Studies on Rural Communities and their Biological Resources (Head Investigator: Suehara)

Suehara, T.: Monbukagaku-shou Research Grant: (A) (1): Multidisciplinary Study on Bush Meat in Equatorial Africa (Co-researcher: Suehara)

Akitsu, M.: Monbukagaku-shou Research Grant (B) (1): Methodological and Practical Studies on Agricultural Sciences as a Field Science and Studies on Agriculture from a Cultural Perspective (Co-researcher: Akitsu)

Akitsu, M.: Monbukagaku-shou Research Grant (A): The Ecological and Environmental History of Hanoi-Yangon Transect (Co-researcher: Akitsu)

Akitsu, M.: Monbukagaku-shou subsidy of "Open Research Center" for Private Universities: Open Research Center for the Study of SATOYAMA and Community Life (Co-researcher: Akitsu)

Akitsu, M.: Monbukagaku-shou Research Grant (A): Science Based Food Safety Policy; Establishing Risk Analysis, Profession, and Professional Code (Co-researcher: Akitsu)

Akitsu, M.: Global Center of Excellence for Reconstruction of the Intimate and Public Spheres in 21<sup>st</sup> Century Asia (Program Member: Akitsu)

## **A-4. International cooperations and overseas activities**

### ***International meetings (roles)***

Suehara, T.: International Congress, "L'agriculture participative: Pourquoi, comment jusqu'ou?", *PRIVDBJ*, Rennes, France, 6-7. Nov, 2008 (Invited speaker, Chair person)

### ***International Joint researches overseas research surveys***

Suehara, T.: A Comparative Study on Reservation of Agricultural Diversity in France

Suehara, T.: A Comparative Study on Reservation of Agricultural Diversity in North America

Suehara, T.: Study on Cacao Production and Forest Reservation in Cameroon

Akitsu, M.: The Resource Management and Environmental History in Northern Thailand

Akitsu, M.: The Relationship between Farmers and Consumers in Thailand and USA

### ***Scholars from abroad***

1 Invited Scholar from Northwest A&F University of China

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On Campus teaching**

a) Courses given

*Undergraduate Level:* Outline of Agricultural Science (Suehara), Philosophy of Agricultural Science (Suehara), Food, Environment and Agriculture in the World (Suehara, Niiyama and Yoshida), Food and Agriculture Ethics (Suehara and Akitsu and others), Training of Research Method 1, 2 (Suehara, Akitsu and Oishi), Seminar in Philosophy of Agricultural Science 1, 2 & 3 (Suehara, Akitsu and Oishi), History of Economic Thought (Akitsu), Rural Sociology / Special Lecture on Sociology (Akitsu), Occupational Training: Agriculture (Akitsu), Prejudice, Discrimination and Human Rights (Akitsu and others), Proseminar on Environmental Science (Oishi and others)

*Graduate Level:* Advanced Lecture on Philosophy of Agricultural Science 1, 2 (Suehara), Advanced Seminar on Philosophy of Agricultural Science 1, 2 (Suehara, Akitsu and Oishi), Advanced Lecture on International Rural Development (Suehara, Kagatsume), Advanced Lecture on Comparative Study of Rural Sociology / Special Lecture on Sociology (Akitsu)

### **B-2. Off-campus teaching**

*Part-time lecturer*

Akitsu, M.: Kinki University, Kagawa University

*Public lectures, etc*

Akitsu, M.: The 71th Farm Accounting and Management Lectures at Kyoto University (2nd class)

### **B-3. Overseas teaching**

*Lectures*

Akitsu, M.: Special Lecture at Chulalongkorn University, Thailand, and Undergraduate Lecture at Kentucky University, USA

*Students and research fellows from abroad*

1 Doctoral Course Student from USA

## **C. Other remarks**

Suehara, T.: Vice President of Kyoto University Press.

Suehara, T.: Visiting Researcher, National Museum of Ethnology

Akitsu, M.: Scientific Adviser of Kyoto Prefectural Chamber of Agriculture, Member of  
Committee for Promoting 'Consuming Local Food' Policy in Kyoto Prefecture,  
Member of Committee on Strategy for the Environmentally Friendly Agriculture

## 2.7 DIVISION OF FOOD SCIENCE AND BIOTECHNOLOGY

Division of Food Science and Biotechnology established on April 2001 comprises three basic chairs; Food Life Sciences, Food and Health Science, and Food Production Technology. Food is the vital alimentary material for human to sustain life and to promote wellness, therefore, must be highly acceptable for human consumption. The challenges of this century are to overcome worldwide problems of food production and prevailed life style-related diseases.

To establish fundamental concept of foods for improving quality of life from various points of view, we take a multidisciplinary approach including sciences related to natural resources, environment, culture, social, life sciences, and information technology. We have the education and research programs of studying food materials at chemical, biological and physiological level using the updated information and technology about rapidly-advancing bioscience. We are developing a new methodology for food production using bioengineering and gene technology.

Division of Food Science and Biotechnology includes 8 laboratories, in which located at three basic chair, Enzyme Chemistry, Food and Environmental Sciences, Organic Chemistry in Life Science, Nutrition Chemistry, Molecular Function of Food, Physiological Function of Food, Bioengineering, and Basic and Applied Molecular Biotechnology. Currently, for the graduate program, 72 first year students are working towards master's degree, and 18 students toward Ph.D. including 6 international students. In undergraduate program, 38 freshmen, 37 sophomores, 34 juniors, and 37 seniors are enrolled.



## Chair of Food Life Sciences

### 2.7.1 Laboratory of Enzyme Chemistry

*Staff      Professor                      : Inouye, Kuniyo, Dr. Agric. Sci. (Kyoto Univ.)*  
*Associate Professor: Yasukawa, Kiyoshi, Dr. Med. Sci. (Osaka Univ.)*  
*Assistant Professor: Takita, Teisuke, Dr. Agric. Sci. (Kyoto Univ.)*  
*Assistant Professor: Kojima, Kenji, M. Agric. Sci. (Kyoto Univ.) (From 2009. 2)*

*Students and research fellows*

*Doctor's program : (2)*  
*Master's program: (8)                      Research student: (3)*  
*Undergraduate    : (4)*

#### A. Research Activities (2008.4-2009.3)

##### A-1. Main subjects

###### a) Studies on proteolytic enzymes.

(i) Molecular mechanism of the activity of thermolysin. We found that the activity of thermolysin, a typical thermophilic proteinase, is greatly enhanced up to over 20 times in the presence of high concentration (2-5 M) of neutral salts. Thermal stability of the enzyme is also enhanced in the presence of the salts. We expect that the molecular mechanism of the activity of thermolysin can be revealed by understanding the halophilicity of this enzyme. Involvement of tyrosyl residues at the active site and charged groups on the surface of the enzyme in the enhancement of the enzyme activity has been suggested. Site-directed mutagenesis and chemical modification have been applied to reveal the roles of tyrosyl, tryptophyl, lysyl, aspartic, and glutamyl residues in the halophilicity of thermolysin.

(ii) Enzymatic properties of MMP-7. The metalloproteinase MMP-7, which contains a zinc ion essential for enzyme activity, plays an important role in tumor invasion and metastasis with proteolysis of extracellular matrix proteins. We have compared enzymatic properties of MMP-7 with those of thermolysin. In addition, we have studied on naturally occurring MMP-7 inhibitors which could be useful for cancer therapy.

###### b) Studies on aminoacyl-tRNA synthetases.

(i) Reaction mechanism of lysyl-tRNA synthetase (LysRS) of mesothermophilic bacteria. Aminoacyl-tRNA synthetases guarantee the fidelity of translation of the genetic information into the structure of a protein by their substrate recognition mechanisms. We purified

LysRS to homogeneity from *Bacillus stearothermophilus*. Interactions of the substrates (L-lysine and ATP) and their analogues with LysRS were studied by a combination of several enzyme-activity assays, fluorescence titration, equilibrium dialysis, stopped-flow method etc. The order of binding of the substrates to LysRS and some features of substrate recognition by the enzyme were revealed. We cloned the LysRS gene of *Bacillus stearothermophilus*, deduced total amino acid sequence, and established the overexpression system by using *E. coli*. For further details of the recognition mechanism of LysRS, we have applied site-directed mutagenesis to the LysRS gene and tried to evaluate the 3D-structure by X-ray crystallographic analysis. In addition, we have cloned aminoacyl-tRNA synthetase cDNA from hyperthermophilic archaeon *Aeropyrum pernix* K1 and tried its expression in *E. coli*.

c) Studies on carbohydrate hydroxylases and their inhibitors.

Stabilization of bacterial amylases against thermal denaturation has been examined by mutagenesis and improvement of the reaction conditions. The thermal stability was much improved by introducing negatively-charged residues into the calcium-ion binding sites. In the cases of *Bacillus* amylases, enhancement in the stabilization has been desired for glucose-production industry, whereas attenuation in the stability for the baking industry. The results obtained might be useful for these purposes. On the other hand, we have purified a protein amylase inhibitor named 0.19AI from the albumin fraction of wheat proteins, and examined the inhibition against porcine pancreas alpha-amylase (PPA). It was revealed that a single electrostatic interaction is essential for the interaction between 0.19AI and PPA. Currently, we are in progress for identifying the residues involved in the electrostatic interaction by chemical modification. The fruits of this study might be useful for prevention and therapy of obesity and diabetes.

e) Studies on application of monoclonal antibodies.

(i) The application to immunoassays. Monoclonal antibodies have been used widely in diagnoses and analysis of bioactive substances. There are some points to be improved in enhancement of the sensitivity and simplification in the operation. We would solve these points by the use of active fragments, and bispecific antibodies in place of the native monoclonal antibodies. Liposome assay and fluorometric assay might be examined for development of homogeneous enzyme immunoassays. In order to increase a sensitivity of the enzyme immunoassays, we have developed an assay system using synchronization of multiple enzymes containing an alkaline phosphatase conjugated with a second antibody. We have also studied an enzyme immunoassay for histamine, which is important in food analysis and a test for allergy.

(ii) Catalytic antibodies. Monoclonal antibodies which catalyze the hydrolysis of ester derivatives of chloramphenicol are examined from the view of enzyme kinetics and

spectrophotometric analysis.

f) Studies on the application of soy proteins and whey proteins.

Soy proteins especially defatted ones are not utilized well. In this project, a potentiality of the soy proteins as food stuffs are examined. We have developed a method of deodorization of soybean proteins by physicochemical processing with hydrophobic resins. In addition, we have developed a new method to make a bean curd with proteinases. We are studying the aggregation process of soy proteins induced by various proteinases with physicochemical methods. On the other hand, whey protein especially gluten is also an important food protein but it has unique amino acid composition so that its proteolytic digestion *in vitro* and *in vivo* proceeds hardly. Presently, we are in process to develop an effective method for whey protein degradation to amino acids.

g) Studies on reverse transcriptase

Reverse transcriptase (RT) is an enzyme which is indispensable as a tool for research in molecular biology and diagnosis of RNA virus. Although RTs from avian myeloblastosis virus (AMV) and Moloney murine leukaemia virus (MMLV) have been the most extensively used due to their high catalytic activity, thermal stability, and fidelity, those with higher activity and stability have been desired. We have compared their enzymatic properties and attempted to improve their activity and stability by site-directed mutagenesis.

## A-2. Publications and presentations

a) Publications

**Books**

- Inoue, K. (Co-author): Enzyme Handbook, 3rd Edition (Yagi, Fukui, Ichishima, Kagamiyama, and Traya, eds.) 1008 pages, Asakura Shoten, Tokyo, 2008 (Japanese)
- Inouye, K.: Protease-catalyzed digestion of soy-proteins and modification of their protein chemical characterization. Technology and Market of Enzymes 2009 (CMC Publishers Editorial Office. ed.) p. 36-44 , 2009 (Japanese)
- Inouye, K.: Application of bacterial amylases to starch industry, and its problems and future perspectives. Technology and Market of Enzymes 2009 (CMC Publishers Editorial Office. ed.) p. 19-27 , 2009 (Japanese)
- Inouye, K. (Editor): Applied technology and the latest trend of industrial enzymes (Supervised Editor: Inouye, K.), p. 1-345, CMC, Tokyo, 2009 (Japanese)
- Inouye, K.: General review: Past, present, and future of research on industrial enzymes (Editor: Inouye, K.), p. 1-14, CMC, Tokyo, 2009 (Japanese)
- Inouye, K., Hashida, Y., Kusano, M., and Yasukawa, K.: Application and improvement of thermolysin (Editor: Inouye, K.), p. 58-68, CMC, Tokyo, 2009 (Japanese)

Yasukawa, K.: Method for nucleic acid amplification (Editor: Inouye, K.), p. 194-202, CMC, Tokyo, 2009 (Japanese)

Inouye, K., Lee, S., Oneda, H., Mouri, Y., Minoda, M., and Tanaka, A. Protein engineering and molecular recognition of the activity and stability of *Bacillus*  $\alpha$ -amylases for their application to food science and biotechnology. Proceedings of the International Seminar on Chemistry 2008 (Ed. by University of Padjadjaran), (ISBN 978-979-18962-0-7) p. 37-44, 2008

### ***Original papers***

Yasukawa, K., Nemoto, D., and Inouye, K. Comparison of the thermal stabilities of reverse transcriptases from avian myeloblastosis virus and Moloney murine leukaemia virus. J. Biochem., 143; 261-268, 2008

Kojima, K., Tsuzuki, S., Fushiki, T., and Inouye, K. Roles of functional and structural domains of hepatocyte growth factor inhibitor type 1 in the inhibition of matriptase. J. Biol. Chem., 283; 2478-2487, 2008

Takita, T., Aono, T., Sakurama, H., Itoh, T., Wada, T., Minoda, M., Yasukawa, K., and Inouye, K. Effects of introducing negative charges into the molecular surface of thermolysin by site-directed mutagenesis on its activity and stability. Biochim. Biophys. Acta, 1784; 481-488, 2008

Saruwatari, Y., Wada, T., Takita, T., and Inouye, K. Substrate-induced conformational changes of the truncated catalytic domain of *Geobacillus stearothermophilus* lysyl-tRNA synthetase as examined by fluorescence. Biochim. Biophys. Acta, 1784; 1633-1640, 2008

Ueda, M., Asano, T., Nakazawa, M., Miyatake, K., and Inouye, K. Purification and characterization of novel raw-starch-digesting and cold-adapted alpha-amylases from *Eisenia foetida*. Comp. Biochem. Physiol. B Biochem. Mol. Biol. 150; 125-130, 2008

Ueda, M., Noda, K., Nakazawa, M., Miyatake, K., Ohki, S., Sakaguchi, M., and Inouye, K. A novel anti-plant viral protein from coelomic fluid of the earthworm *Eisenia foetida*: purification, characterization and its identification as a serine protease. Comp. Biochem. Physiol. B Biochem. Mol. Biol. 151; 381-385, 2008

Kusano, M., Yasukawa, K., and Inouye, K. Insights into the catalytic roles of the polypeptide regions in the active site of thermolysin and generation of the thermolysin variants with high activity and stability. J. Biochem., 145; 103-113, 2009

Yasukawa, K., Mizuno, M., and Inouye, K. Characterization of Moloney murine leukaemia virus/avian myeloblastosis virus chimeric reverse transcriptases. J. Biochem 145; 315-324, 2009

Sakurama, H., Takita, T., Mikami, B., Itoh, T., Yasukawa, K., and Inouye, K. Two crystal structures of lysyl-tRNA synthetase from *Bacillus stearothermophilus* in complex with lysyladenylate-like compounds: insights into the irreversible formation of the enzyme-bound adenylate of L-lysine hydroxamate. J. Biochem., 145; 555-563, 2009

Inouye, K., Nakano, K., Asaoka, K., and Yasukawa, K. Effects of thermal treatment on the coagulation of

- soy proteins induced by *subtilisin Carlsberg*. J. Agric. Food Chem., 57; 717-723, 2009
- Kojima, K., Tsuzuki, S., Fushiki, T., and Inouye, K. The activity of a type II transmembrane serine protease, matriptase, is dependent solely on the catalytic domain. Biosci. Biotechnol. Biochem., 73; 454-456, 2009
- Asaoka, K., Yasukawa, K., and Inouye, K. Coagulation of soy proteins induced by thermolysin and comparison of the coagulation reaction with that induced by subtilisin Carlsberg. Enz. Microbial. Technol., 44; 229-234, 2009
- Kosonh, X., Tsukiyama, T., Inouye, K., Okumoto, Y., Nakazaki, T., and Tanisaka, T. Gene cloning, expression, purification and characterization of rice (*Oryza sativa* L.) class II chitinase CHT11. Enz. Microbial. Technol. 43; 19-24, 2008
- Inouye, K. Food diagnosis by enzyme immunoassay: Improvement in its sensitivity and rapidity by enzyme chemistry and protein engineering. J. Biotechnol. 1365; S711, 2008.
- Kojima, K., Tsuzuki, S., Fushiki, T., and Inouye, K. Role of the stem domain of matriptase in the interaction with its physiological inhibitor, hepatocyte growth factor activator inhibitor type I. J. Biochem., in press
- Murai, N., Miyake, Y., Tsuzuki, S., Inouye, K., and Fushiki, T. Identification of the basolateral sorting signal of a type II transmembrane serine protease matriptase. Cytotechnology, in press
- Mochida, S., Tsuzuki, S., Yasumoto, M., Inouye, K., and Fushiki, T. Secreted expression of pseudozymogen forms of recombinant matriptase in *Pichia pastoris*. Enz. Microbial. Technol., in press
- Miyake, Y., Yasumoto, M., Tsuzuki, S., Fushiki, T., and Inouye, K. Activation of a membrane-bound serine protease matriptase on the cell surface. J. Biochem., in press

### ***Reviews and others***

- Inouye, K., Okumura, S., and Mizuki, E. : Parasporin-4, a novel cancer cell-killing protein produced by *Bacillus thuringiensis* (Minireview). Food Sci. Biotechnol., 17; 219-227, 2008
- Okumura, S., Saitoh, H., Ishikawa, T., Mizuki, E., and Inouye, K. Identification and characterization of a novel cytotoxic protein, parasporin-4, produced by *Bacillus thuringiensis* A1470 strain. Biotechnol. Annu. Rev., 14; 225-252, 2008
- Okumura, S., Saitoh, H., Katayama, H., Kusaka, Y., Inouye, K., and Mizuki, E. Reaction mechanism of a bacterial cytotoxic protein, parasporin-4. Annual Reports of the Industrial Technology Center of Fukuoka Prefecture, 18; 24-26, 2008
- Kohno, H., Shimizu, S., and Inouye, K. Separation, identification and activity of useful bacterial strains from the environments in the purpose of hydrogen production. Annual Reports of the Nippon University Bioengineering Research Center, H-20; 7-14, 2008

### **b) Conference and seminar papers presented**

Annual Meeting of the Japan Society (2008) for Bioscience, Biotechnology, and Agrochemistry: 17

papers

Annual Meeting of Kansai Branch of the Japan Society for Bioscience, Biotechnology, and Agrochemistry: 8 papers

55th Annual Meeting of Kinki Branch of the Japanese Biochemical Society: 4 papers

8th Annual Meeting of the Food Enzyme Chemistry Forum: 2 papers

31th Annual Meeting of the Molecular Biology Society of Japan and 80th Annual Meeting of Japanese Biochemical (BMB 2008): 4 papers

The Joint Meeting of the 8th Insect Pathology Symposium and the 14th BT Forum: 1 paper

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Inouye, K.: The Japanese Biochemical Society (Councilor, Councilor of the Kinki Branch), Japan Society for Bioscience, Biotechnology, and Agrochemistry (Councilor, Councilor of the Kansai Branch), The Japanese Society for Food and Technology (Councilor of the Kansai Branch), Japanese Association of Animal Cell Technology (Councilor), 8th Academic Meeting of the Food Enzyme Chemistry Forum (Chair), Japanese Association of Food Analysis (Councilor), The Japanese Society for Proteases in Pathophysiology (Councilor).

#### ***Research grants***

JSPS Research Grant, Research (B): “Protein engineering and reaction control engineering of thermolysin aiming at expansion of use of thermolysin in food industry” (Inouye, representative)

JSPS Grant, Research (C): “Establishment of the expression system of recombinant AMV reverse transcriptase and improvement of its productivity, activity, and thermal stability” (Yasukawa, representative)

### **A-4. International cooperations and overseas activities**

#### ***International meetings (roles)***

Inouye, K.: The 33rd International Symposium on High Performance Liquid Phase Separations and Techniques, Kyoto University (Dec., 2008) (Co-author)

Inouye, K.: International Seminar on Chemistry 2008, University of Padjadjaran, Indonesia (Oct., 2008) (Invited Speaker)

Inouye, K.: 13th International Biotechnology Symposium, Dalian Expo Center (Oct., 2008) (Invited Speaker, Symposium Chair)

Inouye, K.: 22nd International Conference on Coffee Science, Campinas, Brazil (Sept., 2008) (Co-author)

Inouye, K.: The Environmental Research Seminar at the Austrian Research Centers, Seibersdorf, Austria (July, 2008) (Co-author)

Inouye, K.: KIR Special Seminar on Proteases, London, UK (April, 2008) (Invited Speaker)

***International joint researches, overseas research surveys***

Inouye, K.: Japan-Korea Core Universities Joint Research on the Energy Science between Kyoto University and Seoul National University (Korea); Proteases on bacterial infection, diagnosis, and therapy (University of Michigan, USA), Characterization of soy and wheat proteins (University of Wageningen, the Netherlands); Role of MMPs in digestive diseases (University of Leiden and University of Groningen, the Netherlands); Reaction mechanism of MMPs (Imperial College, London, UK); Biotechnology of enzymes and antibodies (University of Tromsø, Norway); Research on structure-function relationship of thermophilic enzyme (Seoul National University, Yonsei University and Gwanju Institute of Technology, Korea); Enzyme reaction mechanism (Warwick and Exceter, UK); Research on reaction mechanism of amylase and proteinase and their application to food science and technology (Seoul, Korea); Application of amylases and proteinases (University of Guelph, Canada); Collaborative study on the stabilization of proteins (Graz Technical University, BOKU, and Austrian Research Center for Science and Technology, Austria)

***Editorial work for international journals (roles)***

Inouye, K.: Biotechnology Annual Review (Elsevier) Vols. 1-15 (Editor)

Inouye, K.: New Biotechnology (Elsevier) (Review Editor)

Inouye, K.: Enzyme and Microbial Technology (Elsevier) (Editor)

Inouye, K.: Food Science and Biotechnology (International Editorial Board Member)

**B. Educational Activities (2008.4-2009.3)**

**B-1. On-campus teaching**

a) Courses given

Undergraduate level: Food Biochemistry II (Inouye, Yasukawa), Enzymes: Function and Application (Inouye, Yasukawa), Enzyme Chemistry (Inouye, Yasukawa), Introduction to Research I (Inouye, Yasukawa), Laboratory Course in Enzyme Chemistry and Biochemistry (Yasukawa, Takita).

Graduate level: Advanced Course of Life Sciences in Food (Inouye, Yasukawa), Enzyme Chemistry Seminar (Inouye, Yasukawa, Takita), Experimental Course of Enzyme Chemistry (Inouye, Yasukawa, Takita).

b) Meetings (roles)

Inouye, K.: FD workshop of the Faculty of Agriculture/Graduate School (Speaker)

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Inouye, K.: Okinawa Engineering College (Bases of Enzyme Chemistry) (Nov., 2008)

Inouye, K.: University of Ryukyus, Faculty of Agriculture (Application of Bacillus amylases to Saccharification) (Nov., 2008)

Inouye, K.: Osaka Prefectural Kodzu Senior High School (Introduction of Kyoto Univ. Agricultural School) (July, 2008)

Inouye, K.: Iwate University, Faculty of Agriculture (Introduction to Enzyme Chemistry) (July, 2008)

Inouye, K.: University of Ryukyus, Faculty of Agriculture (Mechanism of metalloproteases) (June, 2008)

Inouye, K.: Okayama Science College Graduate School (Enzyme reaction mechanism) (June, 2008)

## **B-3. Overseas teaching**

### ***Part-time lecturer***

Inouye, K.: The Austrian Research Centers, Seibersdorf, Austria (Enzyme Chemistry) (July, 2008)

Inouye, K.: Imperial College, London, UK (Enzyme Chemistry) (April, 2008)

### ***Students and research fellows from abroad***

Kenya (1 research student)

## **C. Other remarks**

### ***Committees***

Inouye, K.: Deputy Director-General of the University Office of Society-Academia Collaboration for Innovation (SACI); Member of the Committee for the Operation of the Office of SACI; Member of the Committee for the Operation of the Innovative Collaboration Center; Member of the Committee for the Promotion of International Relationships; Member of the Committee for Planning of Open-seminar in Kyoto University; Member of the Committee for the Building of the Graduate School of Agriculture; Member of the Committee for Undergraduate Education of the Graduate School of Agriculture; Member of Judging Committee for Industrialization by Minor Enterprises; Member of the Judging Committee for Member of the Ministry of Economy, Trades, and Industry; Kyoto Municipal



Bio-industrial Business Promotion Forum; Cooperative-researcher of the Research Institute of Humanosphere, Kyoto University; Member of the Institute of Science and Technology Policy of the Ministry of Education, Culture, Sports, Science and Technology; Member of the Science Committee of the Iijima Foundation; Visiting Professor of Toyo University; Visiting Researcher of the Nippon University Biotechnology Research Center.

Yasukawa, K.: Member of the Committee for the Edition of Annual Report of the Graduate School of Agriculture

## 2.7.2 Laboratory of Food and Environmental Sciences

*Staff      Professor                      : Kitabatake, Naofumi, D. Agric. Sci.*

*Associate Professor                      : Tani, Fumito, D. Agric. Sci.*

*Assistant Professor: Masuda, Tetsuya, M. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (2)*

*Master's program : (8)*

*Undergraduate      : (3)*

*Research fellow      : (0)*

### **A. Research Activities (2008.4-2009.3)**

#### **A-1. Main subjects**

a) Functional properties of food proteins:

The functional properties of wheat gluten and its molecular mechanism are investigated. Wheat flour is used as a food ingredient for various food products, such as noodles, breads, pastas, confectionaries, and others. The characteristic features of these products are derived from the specific properties of its major protein component of wheat; gluten. And some enzymes in wheat flour are also affecting the properties of wheat products. We are studying such minor wheat protein as well as gluten.

Heating is necessary in the food processing of wheat flour, and proteins and starch are denatured and gelatinized by heating, respectively, which strongly influence the properties of final products. We are investigating the change in the protein molecule and starch by heating.

b) Taste properties of food proteins:

The role of protein in foods is not only to make the structure of the food products and to give the physical properties of the food products, such as gelling, foaming, viscosity, texturization, and others, but also to grant some specific functions, involving enzyme activity and taste activity. We are focusing the sweet-tasting activity of some proteins. Until now we have investigated molecular characteristics of sweet-tasting protein; egg white lysozyme and thaumatin using chemical modification techniques and site-directed mutagenesis techniques. In this year we extended the study to the interaction of sweet-tasting protein molecule with sweet receptor.

c) Studies on the response of innate immunity to changing environments and its regulation by foodstuff:

Dendritic cells (DCs) and macrophages are the essential sentinels to sense danger signals by invaders in the gastrointestinal mucosal immunity. In order to elucidate the physiological functions of gut-associated lymphoid tissues (GALT), we are studying the immunological role on those sentinels of stress proteins such as heat shock protein 70 (hsp70) that are the major intracellular components in all kinds of living cells and functions as immunoregulatory molecules. We found stress proteins in gastrointestinal luminal contents which are derived from indigenous microflora and from exogenous foodstuff ingested. Also, using hsp70 derived from four different organisms, we revealed that the mechanism for recognition of hsp70 differently works among various types of antigen-presenting cells (APCs), depending on the sequence diversity at the C-terminal region of hsp70.

d) Digestion and physiological properties of food polysaccharides:

Degradation and digestibility of starch have been analyzed in vitro and in vivo experiments using mice and humans.

## A-2. Publications and presentations

a) Publications

***Original papers***

- 1) Tani F., Ohno M., Furukawa Y., Sakamoto M., Masuda S., and Kitabatake N.: Surface expression of a C-terminal  $\alpha$ -helix region in heat shock protein 72 on murine LL/2 lung carcinoma can be recognized by innate immune sentinels. *Mol. Immunol.* **46**: 1326-1339 (2009)
- 2) Ohta K, Masuda T, Ide N, Kitabatake N. Critical molecular regions for elicitation of the sweetness of the sweet-tasting protein, thaumatin I. *FEBS J.* **275**: 3644-3652 (2008).

***Reports***

- 1) Ohue R., Tani F., and Kitabatake N.: Effects of CpG-oligodeoxynucleotides on dendritic cell development. *Nucleic Acids Symposium Series No.52* (Oxford University Press); 647-648 (2008)

b) Conference and seminar papers presented

- 1) The 55th annual meeting of the Japanese Society for Food Science and Technology: 11 papers
- 2) The annual meeting of the Japan Society for Bioscience, Biotechnology and Agrochemistry 2009: 4 paper
- 3) The joint meeting of the 81th annual meeting of the Japanese Biochemical Society and the 31th annual meeting of the Molecular Biology Society of Japan: 2 papers
- 4) Joint Symposium of the 18th International Roundtable on Nucleosides, Nucleotides and

Nucleic Acids and the 35<sup>th</sup> International Symposium on Nucleic Acids Chemistry: 1 paper

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

Kitabatake, N:

Japan Society for Bioscience, Biotechnology, and Agrochemistry (Board),

The Japanese Society for Food Science and Technology (Board)

International Food Science and Technology Research (Editorial Board)

Tani, F:

Japan Society for Bioscience, Biotechnology, and Agrochemistry (Board in Kansai Branch)

#### ***Research grants***

Kitabatake;

Grant-in-Aid for Scientific Research (S) (partial charge)

Grant from The Iijima Memorial Foundation For The Promotion of Food Science and Technology

Grant from The Cereal Science Consortium by the Graduate School of Agriculture, Kyoto University and Nisshin Seifun Group Inc.

Tani;

Grant-in-Aid for Scientific Research (C)

Grant from The Itho Memorial Foundation

Grant from The Towa Food Research Foundation

Masuda;

Grant-in-Aid for Scientific Research (Young Scientist)

### **A-4. International cooperations and overseas activities**

a) International meeting

Joint Symposium of the 18th International Roundtable on Nucleosides, Nucleotides and Nucleic Acids and the 35<sup>th</sup> International Symposium on Nucleic Acids Chemistry: 1 paper

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

a) Courses given

Undergraduate level:

Food Safety I (Kitabatake)

Food Chemistry (Kitabatake)

Introduction and Practice in the Department of Food Science and Biotechnology I  
(Kitabatake)

Introduction to the Molecular Cell Biology II (Tani)

Basic Laboratory Course in Food Science and Biotechnology (Tani)

Laboratory Course in Chemical Engineering (Tani)

Graduate level:

Advanced Course of Food and Environmental Studies (Kitabatake, Tani)

Advanced Course of Life Sciences (Kitabatake)

Food and Environmental Sciences Seminar (Kitabatake, Tani),

Experimental Course in Food and Environmental Sciences (Kitabatake, Tani)

## **B-2. Off-campus teaching, etc.**

### ***Part-time lecturer***

Nagasaki University

Kyoto Women's University

## **B-3. Overseas teaching**

### ***Students and research fellows from abroad***

## **C. Other remarks**

### 2.7.3 Laboratory of Organic Chemistry in Life Science

*Staff      Professor                      : Irie, Kazuhiro, Dr. Agric. Sci.*  
*Assistant professor : Murakami, Akira, Dr. Agric. Sci.*  
*Technician                      : Yamaguchi, Kanoko*  
*Postdoctoral fellow : Nakagawa, Yu, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's Program : (6)*  
*Master's Program: (8)*  
*Undergraduate    : (2)*

*Collaborative Laboratory (comparative agricultural science):*  
*Professor: Hirai, Nobuhiro, Dr. Agr. Sci.*

#### A. Research Activities (2008.4-2009.3)

##### A-1. Main subjects

a) Toward the development of new anti-cancer agents like bryostatins

Bryostatins, macrocyclic lactones isolated from marine bryozoa, are promising compounds for the treatment of various types of cancer. Their cellular targets are protein kinase C (PKC) isozymes, but their activation mechanism is quite different from that of tumor promoters like phorbol esters. Since bryostatins are isolated in extremely low yield from natural sources, and since their total synthesis requires over 70 steps, their surrogate compounds are urgently needed to clarify their molecular mechanism of action and to develop new anticancer drugs with better synthetic accessibility. We focused on aplysiatoxin, a potent tumor promoter with a similar partial structure of bryostatins, and synthesized its new simplified analogue with less hydrophobicity in only 22 steps via standard reactions. The compound named Aplog-1 displayed significant anticancer activities comparable to those of bryostatin 1 in several cancer cell lines. Aplog-1 as well as bryo-1 showed significant binding of PKC $\delta$  and induced its translocation to the nuclear membrane in CHO-K1 cells. This study provides a synthetically accessible PKC activator with bryostatin-like activities, which could be another therapeutic lead for cancer.

b) Chemistry of amyloid  $\beta$  peptides

Aggregation of the 42-residue  $\beta$ -amyloid (A $\beta$ 42) plays a crucial role in the pathogenesis of Alzheimer's disease (AD). Our proline scanning and solid-state NMR studies suggested the existence of two conformers in the central region: a major conformer with a turn at positions

25 and 26, and a minor conformer with a turn at positions 22 and 23. The latter was proved to be a toxic conformer, and to have a tendency to form toxic oligomers (3 and 4-mer), the ultimate toxic species of A $\beta$ 42. These oligomers extracted from the SDS-PAGE were subjected to MALDI-TOF-MS measurements. However, only the monomer A $\beta$ 42 was detected, suggesting that A $\beta$ 42 interacts noncovalently to form oligomers.

c) Studies on the mechanisms underlying obesity-related colon carcinogenesis

Adipocytokines are a group of adipocyte-secreted proteins that have significant effects on the metabolism of lipids and carbohydrates. A number of recent studies have indicated that some adipocytokines may significantly influence the proliferation of malignant cells in vitro, whereas it remains unclear whether they have similar roles in vivo. We determined serum levels of adipocytokines in mice with colon carcinogenesis. Nobiletin, a citrus flavonoid, was given in the diet (100 ppm) for 17 weeks. The serum leptin level in carcinogenic mice was six times higher than that in untreated mice, whereas there were no significant differences in the levels of triglycerides, adiponectin and interleukin-6. Feeding with nobiletin abolished colonic malignancy and notably decreased the serum leptin level by 75%. Further, nobiletin suppressed the leptin-dependent, but not independent, proliferation of HT-29 colon cancer cells and decreased leptin secretion through inactivation of mitogen-activated protein kinase/extracellular signaling-regulated protein kinase, but not that of adiponectin in differentiated 3T3-L1 mouse adipocytes in a dose-dependent manner. Thus, higher levels of leptin in serum may promote colon carcinogenesis in mice, whereas nobiletin has chemopreventive effects against colon carcinogenesis, partly through regulation of leptin levels.

d) Chemical ecology of plants

Some ectomycorrhiza form a fairy ring which shows the circular formation of fruit body. The inside of the fairy ring of *Tricholoma* is a whitish mycelium-soil aggregated zone, and called “shiro”. The density of bacteria and fungi in the shiro is significantly lower than that of the outside of the shiro. The researchers of our University demonstrated in 1967 that the shiro had antimicrobial activity against bacteria. However, the antimicrobial compound(s) has been remained unclear. We identified an antimicrobial compound from the extract of *Pinus densiflora* roots forming ectomycorrhiza as a diterpene, totarol, and found localization of totarol in the root. Further analysis of the extract gave six diterpenes including a new one. The new diterpene was identified as (+)-(1*R*)-hydroxytotarol by the X-ray analysis of its *p*-bromobenzoyl derivative. The analysis of other *Pinus* group has shown occurrence of abietic acid and other diterpenes in *P. thunbergi*, *P. strous*, *P. bungeana*, and *P. parviflora*, but totarol was not found in these species, suggesting that totarol was a specific constituent in the root of *P. densiflora*.

e) Molecular technology of a plant hormone, abscisic acid

Abscisic acid (ABA) is an important plant hormone that induces adaptative responses in plants upon water stress and low temperature. However, the effect of ABA does not last since ABA is quickly inactivated by the degradation enzyme, ABA 8'-hydroxylase. The inhibitor of the hydroxylase may delay the inactivation of ABA to increase resistance of plants to environmental stress. We developed a hydroxylase inhibitor AHI 1 as an ABA analog with the researchers at Shizuoka University. Twenty-six analogs of uniconazole-P, a known inhibitor of the enzyme, were designed and synthesized. Several analogs showed the inhibitory activity on the hydroxylase and water stress tolerance of apple trees. The analog modified at C-4 of the benzene ring does not inhibit the P-450 enzymes involved in biosynthesis of gibberellins, suggesting that it is a highly selective inhibitor for the hydroxylase. We have started phylogenetic analysis and purification of the hydroxylase for identification of the hydroxylase gene.

## A-2. Publications and presentations

a) Publications

### *Books*

Masuda, Y., Uemura, S., Ohashi, R., Nakanishi, A., Takegoshi, K. and Irie, K.: Identification of toxic conformation in A $\beta$ 42 aggregates using solid-state NMR. Peptide Science 2008, Nomizu, M. (Ed.), The Japanese Peptide Society, pp.25-28, 2009

Murakami, A., Ikeda, Y. and Ohigashi, H.: Modulation of MAPK pathways by food phytochemicals: risks and benefits. In: Dietary Modulation of Cell Signaling Pathways, Surh, Y.-J., Dong, Z., Cadenas, E. and Packer, L. (Eds.), pp.75-90, Taylor and Francis Group, LLC, New York, 2009

### *Original papers*

Masuda, Y., Uemura, S., Nakanishi, A., Ohashi, R., Takegoshi, K., Shimizu, T., Shirasawa, T. and Irie, K.: Verification of the C-terminal intramolecular  $\beta$ -sheet in A $\beta$ 42 aggregates using solid-state NMR: implications for potent neurotoxicity through the formation of radicals. Bioorg. Med. Chem. Lett., 18(11); 3206-3210, 2008

Masuda, Y., Nakanishi, A., Ohashi, R., Takegoshi, K., Shimizu, T., Shirasawa, T. and Irie, K.: Verification of the intermolecular parallel  $\beta$ -sheet in E22K-A $\beta$ 42 aggregates by solid-state NMR using rotational resonance: implications for the supramolecular arrangement of the toxic conformer of A $\beta$ 42. Biosci. Biotechnol. Biochem., 72(8); 2170-2175, 2008

Masuda, Y., Uemura, S., Ohashi, R., Nakanishi, A., Takegoshi, K., Shimizu, T., Shirasawa, T.



- and Irie, K.: Identification of physiological and toxic conformations in A $\beta$ 42 aggregates. *ChemBioChem*, 10(2); 287-295, 2009
- Kim, M., Miyamoto, S., Sugie, S., Yasui, Y., Ishigamori-Suzuki, R., Murakami, A., Nakagama, H. and Tanaka, T.: A tobacco-specific carcinogen, NNK, enhances AOM/DSS-induced colon carcinogenesis in male A/J mice. *In Vivo*, 22(5); 557-563, 2008
- Ikeda, Y., Murakami, A. and Ohigashi, H.: Strain differences regarding susceptibility to uracil acid-induced interleukin-1 $\beta$  release in murine macrophages. *Life Sci.*, 83(1-2); 43-49, 2008
- Miyamoto, S., Yasui, Y., Tanaka, T., Ohigashi, H. and Murakami, A.: Suppressive effects of nobiletin on hyperleptinemia and colitis-related colon carcinogenesis in male ICR mice. *Carcinogenesis*, 29(5); 1057-1063, 2008
- Sekiguchi, H., Washida, K. and Murakami, A.: Suppressive effects of selected food phytochemicals on CD74 expression in NCI-N87 gastric carcinoma cells. *J. Clin. Biochem. Nutr.*, 43(2); 109-117, 2008
- Kaneko, K., Akuta, T., Sawa, T., Kim, H.W., Fujii, S., Okamoto, T., Nakayama, H., Ohigashi, H., Murakami, A. and Akaike, T.: Mutagenicity of 8-nitroguanosine, a product of nitrative nucleoside modification by reactive nitrogen oxides, in mammalian cells. *Cancer Lett.* 262(2); 239-247, 2008
- Sung, B., Murakami, A., Oyajobi, B. and Aggarwal, B.: Zerumbone abolishes RANKL-induced NF- $\kappa$ B activation, inhibits osteoclastogenesis and suppresses human breast cancer-induced bone loss in athymic nude mice. *Cancer Res.*, 69(4); 1477-1484, 2009
- Kim, M., Miyamoto, S., Yasui, Y., Oyama, T., Murakami, A. and Tanaka, T.: Zerumbone, a tropical ginger sesquiterpene, inhibits colon and lung carcinogenesis in mice. *Int. J. Cancer*, 124(2); 64-271, 2009
- Kajikawa, M., Hirai, N. and Hashimoto, T.: A PIP-family reductase is required for biosynthesis of tobacco alkaloids. *Plant Mol. Biol.*, DOI 10.1007/s11103-008-9424-3, 2008
- Todoroki, Y., Kobayashi, K., Yoneyama, H., Hiramatsu, S., Jin, M.-H., Watanabe, B., Mizutani, M. and N. Hirai: Structure-activity relationship of uniconazole, a potent inhibitor of ABA 8'-hydroxylase, with a focus on hydrophilic functional groups and conformation. *Bioorg. Med. Chem.*, 16; 3141-3152, 2008

## **Reviews**

- Irie, K. and Masuda, Y.: Toxic conformation of amyloid  $\beta$ . *Kagaku to Seibutsu*, 46(2); 431-434, 2008 (in Japanese)

- Murakami, K., Shimizu, T., Shirasawa, T. and Irie, K.: Proposal of the toxic conformation of amyloid  $\beta$  (A $\beta$ 42). *Biomedical Gerontology*, 32(3); 25-29, 2008 (in Japanese)
- Murakami, A., Ashida, H. and Terao, J.: Multitargeted cancer prevention by quercetin. *Cancer Lett.*, 269(2); 315-325, 2008
- Miyamoto, S. and Murakami, A.: Leptin: A factor which links obesity to colon carcinogenesis. *Food Research*, 642; 34-38, 2008 (in Japanese)
- Murakami, A.: The lecture: Giving and being given. *FOOD Style 21*, 13(3); 90-91, 2009 (in Japanese)
- Murakami, A.: The seminar battle. *FOOD Style 21*, 13(2); 64-65, 2009 (in Japanese)
- Murakami, A.: Researches of my concerns, Part 1. *FOOD Style 21*, 13(1); 99-101, 2009 (in Japanese)
- Murakami, A.: Experiences with foreign students. *FOOD Style 21*, 12(12); 76-77, 2008 (in Japanese)
- Murakami, A.: What metabolic syndrome brings about. *FOOD Style 21*, 12(11); 72-73, 2008 (in Japanese)
- Murakami, A.: Discussion at laboratory. *FOOD Style 21*, 12(10); 76-77, 2008 (in Japanese)
- Murakami, A.: How to proceed with research. *FOOD Style 21*, 12(9); 116-117, 2008 (in Japanese)
- Murakami, A.: Reviewing a paper. *FOOD Style 21*, 12(8); 84-85, 2008 (in Japanese)
- Murakami, A.: English as a hard nut to crack. *FOOD Style 21*, 12(7); 76-77, 2008 (in Japanese)
- Murakami, A.: Gazing at failure. *FOOD Style 21*, 12(6); 81-83, 2008 (in Japanese)
- Murakami, A.: Animal experiments: Right or wrong and indispensable or unnecessary? *FOOD Style 21*, 12(5); 99-101, 2008 (in Japanese)
- Murakami, A.: Brushing up Bachelor's thesis. *FOOD Style 21*, 12(4); 94-95, 2008 (in Japanese)

### ***Reports***

- Irie, K.: Development of antibodies and aggregation inhibitors for amyloid  $\beta$  peptides based on the new aggregation model. Report (2008) for Monbu-kagakusho Research Grant [Scientific Research (A)]
- Irie, K.: Analysis of the reaction mechanism of the enzyme that catalyzes the introduction of a nitrogen atom on the 4 position of indole. Report (2008) for Monbu-kagakusho Research Grant [Germination]
- Murakami, A.: Molecular mechanisms underlying inflammation-associated carcinogenesis and its prevention. Report (2008) for funds from the Ministry of Health, Labor, and Welfare

Murakami, A.: Role of adipocytokines in colon carcinogenesis and identification of preventive food factors. Report (2008) for Monbu-kagakusho Research Grant [Scientific Research (C)]

Hirai, N.: Development of drugs protecting plants from environmental stress in semi-arid land. Report (2008) for Monbu-kagakusho Research Grant [Scientific Research (B)]

b) Conference and seminar papers presented

The 2008 Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry (Fukuoka): 12 general papers and 1 invited presentation

The 31st Annual Meeting of Japan Society for Biomedical Gerontology (Matsumoto): 1 general paper

The 43rd Summer School on Natural Products Chemistry (Osaka): 1 general paper and 1 invited presentation

The 60th Annual Meeting of The Society for Biotechnology, Japan (Sendai): 1 general paper

The 50th Symposium on The Chemistry of Natural Products (Fukuoka): 1 general paper

The 27th Annual Meeting of Japan Society for Dementia Research (Maebashi): 2 general papers

The 45th Japanese Peptide Symposium (Tokyo): 1 general paper

The Symposium on Toxins (Tokyo): 1 invited presentation

Riken Symposium “The 9th Frontier of Analytical Technique and Chemistry” (Wako): 1 invited presentation

The 54th Shirasagi Seminar (Sakai): 1 invited presentation

The 455th Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry in Kansai branch (Osaka): 1 invited presentation

The 3rd Meeting of Research Society for Wild Ginger (Osaka): 1 invited presentation

The 15th Conference of Japanese Society for Cancer Prevention (Fukuoka): 1 general paper

The 67th Annual Meeting of Japanese Cancer Association (Nagoya): 1 general paper

The 13th Annual Meeting of Japanese Society for Food Factors (Tokyo): 5 general papers

The 13th Annual Meeting of Society for the Study of Anti-oxidant Biofactors (Tokyo): 1 general paper

The 19th Annual Meeting of the Redox Life Science (170 Committee) (Gotenba): 1 invited presentation

The 2008 Annual Meeting of The Japanese Society for Horticultural Science (Tokyo): 1 general paper

The 43rd Annual Meeting of The Japanese Society for Chemical Regulation of Plants (Tsukuba): 3 general papers

The 52nd Annual Meeting on Chemistry of Terepene, Essential oils, and Aromatics

(Itakura): 1 general paper

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Irie, K.: Japan Society for Bioscience, Biotechnology, and Agrochemistry in Kansai Branch (councilor), Organizing committee of Symposium on The Chemistry of Natural Products (member), Organizing committee of Summer School on Natural Products Chemistry (member), The Japanese Association for the Pursuit of New Bioactive Resources (councilor)

Murakami, A.: Japanese Society for Food Factors (director), Japanese Society for Oxidative Stress Research (councilor), The Society for Antioxidant Unit (councilor), Food Science Forum (councilor)

#### ***Research grants***

##### Monbu-Kagakusho Research Grant

Scientific Research (A): Development of antibodies and aggregation inhibitors for amyloid  $\beta$  peptides based on the new aggregation model (Irie, K., Head)

Germination: Analysis of the reaction mechanism of the enzyme that catalyzes the introduction of a nitrogen atom on the 4 position of indole (Irie, K., Head)

Scientific Research (C): Role of adipocytokines in colon carcinogenesis and identification of preventive food factors (Murakami, A., Head)

Scientific Research (B): Development of drugs protecting plants from environmental stress in semi-arid land (Hirai, N., Head)

##### Grant-in-Aid from Japan Science and Technology Agency

The Prefecture Collaboration of Regional Entities for the Advancement of Technological Excellence, Evaluation of anti-inflammatory activity of Yamatomana and its applications for new cultivars and foods (Murakami, A., Cooperator)

##### Grant-in-Aid from the Ministry of Health, Labor, and Welfare

Molecular mechanisms underlying inflammation-associated carcinogenesis and its prevention (Murakami, A., Head)

##### Foundations

The Foundation for the Promotion of Fruits Research: Anti-*Helicobacter pylori* effects of citrus fruits and elucidation of underlying action mechanisms (Murakami, A., Head)

### **A-4. International cooperations and overseas activities**

#### ***International meetings (roles)***

Irie, K.: The 38th Annual Meeting of Society for Neuroscience (Washington DC, USA, 3 general papers)

Irie, K.: Keystone Symposia on Neurodegenerative Diseases: New Molecular Mechanisms (Cololado, USA, 1 general paper)

Murakami, A.: The 66th Annual Meeting of the American Association for Cancer Research (San Diego, 1 general paper)

Murakami, A.: The Joint Symposium Between Japan and Italy on Natural Products and Functional Foods (Salerno, Italy, 1 invited presentation)

Hirai, N.: 236th ACS National Meeting (Philaderphia, USA, 1 general paper)

***Editorial work for International journals***

Murakami, A.: Journal of Clinical Biochemistry and Nutrition (editor)

***Membership in international academic societies***

Irie, K.: American Chemical Society (member), The Society for Neuroscience (member)

Murakami, A.: American Association for Cancer Research (member)

**B. Educational Activities (2008.4-2009.3)**

**B-1. On-campus teaching**

a) Courses given

Undergraduate level: Organic Chemistry in Food Science I (Irie, K.), Organic Chemistry in Food Science II (Irie, K.), Organic Chemistry in Food Science III (Irie, K.), Organic Chemistry in Life Science (Irie, K.), Laboratory Course in Organic Chemistry (Irie, K., Murakami, A. and Hirai, N.), Introduction and Practice in the Department of Food Science and Biotechnology (Irie, K., Murakami, A. and Hirai, N., a partial charge), Outline of Agricultural Science (Irie, K., a partial charge)

Graduate level: Organic Chemistry in Life Science (Irie, K.), Advanced Course of Life Sciences in Food (Irie, K., a partial charge), Seminar of Organic Chemistry in Life Science (Irie, K., Murakami, A. and Hirai, N.), Experimental Course of Organic Chemistry in Life Science (Irie, K., Murakami, A. and Hirai, N.)

**B-2. Off-campus teaching, etc.**

***Open seminars***

Irie, K.: Saito Bio Hills Club, Proteomics Symposium (presentation)

Murakami, A.: Ochanomizu University (closely-packed series of lectures)

**B-3. Overseas teaching**

***Students and research fellows from abroad***

Research Student: 1 (Thailand)

### **C. Other remarks**

Irie, K.: [In Kyoto University] Head of Departement of Food Science and Biotechnology, Safeguard Committee of Faculty of Agriculture for Radioisotopes and Radiation (member), Committee of general curriculum in chemistry in Kyoto University (member), Program Officer of the Task Force for Research Strategy at Kyoto University, Presidential Assistant of Kyoto University, [Outside Kyoto University] Committee of Collaboration among Medicine, Technology, and Life Science in Kyoto City, [Award] Award for Excellence to Authors Publishing in Bioscience, Biotechnology, and Biochemistry in 2008 (Japan Society for Bioscience, Biotechnology, and Agrochemistry)

Murakami, A.: Animal Research Committee, Graduate School of Agrticulture, Kyoto University (member), Hygiene Administrator of Graduate School of Agrticulture

## Chair of Food Bioscience

### 2.7.4 Laboratory of Nutrition Chemistry

*Staff      Professor                      : Fushiki, Tohru, Dr. Agric. Sci.*

*Associate Professor: Inoue, Kazuo, Dr. Agric. Sci.*

*Assistant Professor: Tsuzuki, Satoshi, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program: (0)                      Master's program    : (14)*

*Undergraduate    : (3)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Palatability of foods; Nutrition, Physiology and Brain science

It is important conception in the field of research of food science that new food resources are palatable and acceptable in human. To get this final goal, new foods are required to have a good sensitive nature, a good nutritional property, safety and many other good properties. We want to eat delicious foods. It can not be coped with a close food crisis that the development of food resources are accepted only by starving people. In this point of view, we studied what properties of food resources have high acceptability in human. Especially, we study on fat taste and the traditional "umami" taste by the analyses of interaction mechanisms on tongue of experimental animals.

##### b) Control of gastrointestinal epithelial turnover and the regulation by food components, and regulatory mechanism of gastrointestinal hormone secretion

The mucosal surface of the intestine comprises epithelial monolayer cells that are critical for the absorption of nutrients and defense. Aging epithelial cells must be rapidly replaced by younger cells for the maintenance of these functions. However, details of the underlying mechanism governing the rapid turnover of intestinal epithelial cells have remained unknown. We found a novel enzyme, designated membrane-type serine protease 1 (MT-SP1), and suggested that this enzyme is involved in the control of intestinal epithelial turnover under physiological conditions. Furthermore, we found that the activities of MT-SP1 and granzyme A (GrA), which is likely to induce apoptosis of abnormal intestinal epithelial cells, are regulated by food components. Our studies have revealed that some food components can regulate the turnover of the intestinal epithelium.

c) Development of special foods to increase endurance capacity.

Long-distance runners have broken many world records in recent years. Because they apparently ingested special foods to increase their endurance capacity, these exogenous substances and their effects on endurance capacity have been brought into the light. We devised an adjustable-current swimming pool for the evaluation of endurance capacity of mice. Our apparatus provides for the reliable and reproducible evaluation of the endurance capacity of mice. By using our apparatus, we studied the detecting and mechanism of the effects of dietary differences and drug pretreatment on the endurance capacity. In addition, we investigate the relation to central fatigue induced by brain TGF- $\beta$  with endurance capacity in order to clarify whether food stuff that has effects on endurance capacity also modifies the manifestation of tiredness.

d) Mechanisms of manifestation of central fatigue and TGF- $\beta$  in brain

Intracerebroventricular administration of cerebrospinal fluid (CSF) from exercise-fatigued rats elicited the decrease in spontaneous motor activity of sedentary mice, as though they were exhausted. There was no such effect in the CSF from sedentary rats. Those mice administered the CSF from fatigued-rats seemed to occur the feeling of fatigue and lose their willingness to move.

We thought that the substance which involved in this phenomena was the factor that cause the feeling of fatigue. With various experiments we clarified that transforming growth factor- $\beta$  (TGF- $\beta$ ) was the responsible substance, because 1) the concentration of active TGF- $\beta$  in CSF from fatigued-rats increased, 2) treatment of CSF from fatigued-rats with anti-TGF- $\beta$  antibody eliminated the effect of decreasing spontaneous motor activity of mice, 3) elevating exercise load on rats increased both the concentration of active TGF- $\beta$  in CSF and the inhibitory effect on spontaneous motor activity on mice, and 4) purified TGF- $\beta$  dose-dependently depressed the spontaneous motor activity of mice. These results strongly suggested that active TGF- $\beta$  in the brain elicited the manifestation of central fatigue and depression in willingness to move.

In addition, we showed the administration of TGF- $\beta$  into the brain could augment the ratio of utilization of fatty acid in whole body and the preference for sweet taste. These indicated that active TGF- $\beta$  in the brain not only caused feeling of fatigue, but affected to peripheral tissues (via autonomic nervous system) and involved in the mechanisms which changed metabolic state to the one during/after exercise.

## **A-2. Publications and presentations**

a) Publications

*Books*



Fushiki, T: Consideration of a global environment through a dining table “Acceptability of foods for human” pp1-23, Showado Shuppan (Kyoto), 2007

Inoue K and Fushiki T. Exercise Fatigue. In: *Fatigue Science for Human Health*, edited by Watanabe Y, Evengard B, Natelson BH, Jason LA and Kuratsune H. Tokyo: Springer, 2008, p. 187-202.

### ***Original papers***

Yoneda T, Saitou K, Asano H, Mizushige T, Matsumura S, Eguchi A, Manabe Y, Tsuzuki S, Inoue K, and Fushiki T. Assessing palatability of long-chain fatty acids from the licking behavior of BALB/c mice. *Physiol Behav* 96: 735-741, 2009.

Saitou K, Yoneda T, Mizushige T, Asano H, Okamura M, Matsumura S, Eguchi A, Manabe Y, Tsuzuki S, Inoue K, and Fushiki T. Contribution of gustation to the palatability of linoleic acid. *Physiol Behav* 96: 142-148, 2009.

Murai N, Miyake Y, Tsuzuki S, Inouye K, and Fushiki T. Involvement of the cytoplasmic juxtamembrane region of matriptase in its exclusive localization to the basolateral membrane domain of Madin-Darby canine kidney epithelial cells. *Cytotechnology*, 2009.

Mizushige T, Saitoh K, Manabe Y, Nishizuka T, Taka Y, Eguchi A, Yoneda T, Matsumura S, Tsuzuki S, Inoue K, and Fushiki T. Preference for dietary fat induced by release of beta-endorphin in rats. *Life Sci* 84: 760-765, 2009.

Miyake Y, Yasumoto M, Tsuzuki S, Fushiki T, and Inouye K. Activation of a Membrane-bound Serine Protease Matriptase on the Cell Surface. *J Biochem*, 2009.

Matsumura S, Eguchi A, Mizushige T, Kitabayashi N, Tsuzuki S, Inoue K, and Fushiki T. Colocalization of GPR120 with phospholipase-Cbeta2 and alpha-gustducin in the taste bud cells in mice. *Neurosci Lett* 450: 186-190, 2009.

Masamoto Y, Kawabata F, and Fushiki T. Intragastric administration of TRPV1, TRPV3, TRPM8, and TRPA1 agonists modulates autonomic thermoregulation in different manners in mice. *Biosci Biotechnol Biochem* 73: 1021-1027, 2009.

Kojima K, Tsuzuki S, Fushiki T, and Inouye K. The activity of a type II transmembrane serine protease, matriptase, is dependent solely on the catalytic domain. *Biosci Biotechnol Biochem* 73: 454-456, 2009.

Kojima K, Tsuzuki S, Fushiki T, and Inouye K. Role of the stem domain of matriptase in the interaction with its physiological inhibitor, hepatocyte growth factor activator inhibitor type I. *J Biochem* 145: 783-790, 2009.

Fukatsu Y, Noguchi T, Hosooka T, Ogura T, Kotani K, Abe T, Shibakusa T, Inoue K, Sakai M, Tobimatsu K, Inagaki K, Yoshioka T, Matsuo M, Nakae J, Matsuki Y,

- Hiramatsu R, Kaku K, Okamura H, Fushiki T, and Kasuga M. Muscle-specific overexpression of heparin-binding epidermal growth factor-like growth factor increases peripheral glucose disposal and insulin sensitivity. *Endocrinology* 150: 2683-2691, 2009.
- Yoshikawa Y, Hirayasu H, Tsuzuki S, and Fushiki T. Granzyme A causes detachment of alveolar epithelial A549 cells accompanied by promotion of interleukin-8 release. *Biosci Biotechnol Biochem* 72: 2481-2484, 2008.
- Yoshikawa Y, Hirayasu H, Tsuzuki S, and Fushiki T. Carrageenan inhibits granzyme A-induced detachment of and interleukin-8 release from alveolar epithelial A549 cells. *Cytotechnology* 58: 63-67, 2008.
- Nishino N, Tamori Y, Tateya S, Kawaguchi T, Shibakusa T, Mizunoya W, Inoue K, Kitazawa R, Kitazawa S, Matsuki Y, Hiramatsu R, Masubuchi S, Omachi A, Kimura K, Saito M, Amo T, Ohta S, Yamaguchi T, Osumi T, Cheng J, Fujimoto T, Nakao H, Nakao K, Aiba A, Okamura H, Fushiki T, and Kasuga M. FSP27 contributes to efficient energy storage in murine white adipocytes by promoting the formation of unilocular lipid droplets. *J Clin Invest* 118: 2808-2821, 2008.
- Naitoh R, Miyawaki K, Harada N, Mizunoya W, Toyoda K, Fushiki T, Yamada Y, Seino Y, and Inagaki N. Inhibition of GIP signaling modulates adiponectin levels under high-fat diet in mice. *Biochem Biophys Res Commun* 376: 21-25, 2008.
- Matsumura S, Shibakusa T, Fujikawa T, Yamada H, Matsumura K, Inoue K, and Fushiki T. Intracisternal administration of transforming growth factor-beta evokes fever through the induction of cyclooxygenase-2 in brain endothelial cells. *Am J Physiol Regul Integr Comp Physiol* 294: R266-275, 2008.
- Matsumura S, Saitou K, Miyaki T, Yoneda T, Mizushige T, Eguchi A, Shibakusa T, Manabe Y, Tsuzuki S, Inoue K, and Fushiki T. Mercaptoacetate inhibition of fatty acid beta-oxidation attenuates the oral acceptance of fat in BALB/c mice. *Am J Physiol Regul Integr Comp Physiol* 295: R82-91, 2008.
- Kojima K, Tsuzuki S, Fushiki T, and Inouye K. Roles of functional and structural domains of hepatocyte growth factor activator inhibitor type 1 in the inhibition of matriptase. *J Biol Chem* 283: 2478-2487, 2008.
- Kawasaki H, Yamada A, Fuse R, and Fushiki T. Preference for dried bonito broth in olfactory-blocked or taste nerve-sectioned mice in the two-bottle choice test. *Biosci Biotechnol Biochem* 72: 2840-2846, 2008.
- Inagaki H, Tsuzuki S, Iino T, Inoue K, and Fushiki T. Development of an in vitro system for screening the ligands of a membrane glycoprotein CD36. *Cytotechnology* 57: 145-150, 2008.

Inada H, Kawabata F, Ishimaru Y, Fushiki T, Matsunami H, and Tominaga M. Off-response property of an acid-activated cation channel complex PKD1L3-PKD2L1. *EMBO Rep* 9: 690-697, 2008.

Hirayasu H, Yoshikawa Y, Tsuzuki S, and Fushiki T. A lymphocyte serine protease granzyme A causes detachment of a small-intestinal epithelial cell line (IEC-6). *Biosci Biotechnol Biochem* 72: 2294-2302, 2008.

b) Conference and seminar papers presented

Annual meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry (8 papers)

Annual meeting of Japanese Society of Nutrition and Food Science (5 papers)

Annual meeting of the Japanese Association for the Study of Taste and Smell (5 papers)

Annual meeting of Japan Society for Spice Research (2 papers)

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Fushiki, T.: Japanese Society of Nutrition and Food Science (Councilor), Japan Society for Bioscience, Biotechnology, and Agrochemistry (Councilor of Kansai branch), Japanese Society of Biochemistry (Councilor), Japan Society of Spice Study (President), Japanese Association for the Study of Taste and Smell (Councilor)

#### ***Research grant***

Fushiki, T: Grant from Bio-Oriented Technology research Program for Promotion of Basic research Activities for Innovative Biosciences (Fushiki, representative).

Inoue, K: Monbusho Research Grant: Scientific Research (B) “Establishment of the evaluation system for central fatigue and the development of preparative basis for food which aims the control of fatigue”. (Inoue, representative)

Tsuzuki, S: Scientific Grant (C) “Elucidation of the role for granzyme A, a binding molecule of monitor peptide, in the peptide-mediated CCK release

### **A-4. International cooperation and overseas activities**

#### ***International meetings (roles)***

Kazuo Inoue : 2008 Main Meeting of the Physiological Society: (Cambridge, UK, 1 general paper)

#### ***Editorial work for international journals***

Fushiki, T.: Journal of Nutritional Science and Vitaminology (Chairman), American Journal of Physiology (nominated as a part time reviewer), registered reviewer, for the Elsevier Editorial System

## **B. Educational Activities (2008.4-2009.3)**

### **B-1. On-campus teaching**

#### a) Courses given

Undergraduate level: Nutrition Chemistry (Fushiki), Taste and Preference (Fushiki)  
Laboratory course in food and nutrition chemistry (Inoue, Tsuzuki), Introduction to foreign literature in food science and biotechnology II (Inoue, Masuda)

Graduate level: Nutrition Chemistry (Advanced course) (Fushiki), Laboratory Course in Nutrition Chemistry (Fushiki, Inoue)

### **B-2. Off-campus teaching etc.**

#### ***Part-time lecture***

Fushiki: Faculty of Life Sciences, Kyoto Women's University,

#### ***Enlightenment lecture***

Fushiki, T: Lecture in Annual meeting in Kyoto wholesale market "Mechanisms on the preference of food" (Kyoto), Educational lecture in Annual Meeting for Japan Society for Chemical senses "Food preference and human health" (Toyama), Forum of Techno-School, "Structure of human food preference" (Osaka), Lecture for Hokuriku Experiment Station of Fermentation "Mechanisms on the preference of food and Japanese Sake" (Kanazawa), Lecture for Japan Association of Oil Chemistry "Mechanisms on the preference of fat" (Takamatsu)

Lecture for high school student in High school-University Cooperation Project "Taste and preference of food" Lecture for Japanese culture of Foods "Strategy of health and foods" (Osaka), Lecture for nutritionists in Osaka "Japanese health and traditional foods" (Osaka, Takatsuki)

Inoue K: "Central regulation of fat metabolism during endurance exercise". London, UK (University College London, Dept. of Psychology)

"Why is fat so tasty? Preference for fat and the reward system." In: *DA forum*. London, UK (Imperial College London - Hammersmith Hospital Campus)

"Central regulation of fat metabolism during endurance exercise". Kariya, 2008 Chubu regional meeting of Japanese Society of Nutrition and Food Science, Symposium on Function of the brain and nutrition.

"Central fatigue and lactate". Tokyo, 2009 Fifth meeting of lactate research association

"Central regulation of fat metabolism during endurance exercise". Nagoya, 2009 13<sup>th</sup> Tokai regional meeting of Japanese Society of Physical Fitness and Sports

Medicine

### **C. Other remarks**

Fushiki: Nutrition and food science committee responsible for Science Council of Japan (member), Advisory Board for the Committee of Kyoto wholesale market, Active strategy for establishment of base for food culture. Advisory Board for Kyoto University Radioisotope Research Center (member), The Board of Directors for Japanese Culinary Academy (Director). Writing column series: in "Wine and Taste" in Winart, Art publishing Co, Writing column series in the evening paper of Sankei newspaper "The way of eating of Japanese" A member of Association of sake spread

Inoue: Advisory Board for the Committee of Animal Experiment in Kyoto University Radioisotope Research Center (member), Advisory Board for the Committee of Animal Experiment in Graduate School of Agriculture, Kyoto University (member), Advisory Board for the Committee of Agricultural Library of Kyoto University (member)

## 2.7.5 Laboratory of Molecular Function of Food

*Staff Professor : Kawada, Teruo, Dr. Agric. Sci.*

*Associate Professor: Urade, Reiko, Dr. Agric. Sci.*

*Assistant Professor: Takahashi, Nobuyuki, Dr. Med. Sci*

*Postdoctoral fellow: Hirai, Shizuka, Dr. Agric. Sci.*

*Tsuyoshi Goto, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's Program : (6)*

*Master's Program : (13)                      Research student : (2)*

*Undergraduate : (3)*

### **A. Research Activities (2008.4-2009.3)**

#### **A-1. Main subjects**

##### **a) Genomic regulatory science on lipid metabolism and obesity**

Overweight is superfluous formation of the fat, which constitutes an adipose tissue. It has been pointed out that the factor secreted from a fat cell as a key factor of a lifestyle-related diseases of recent years. Multiplication of a fat cell, specialization, and secretion of the various factor further related to development of symptoms are strongly influenced by the food ingredient to daily take. As a result of analyzing the transcriptional regulation mechanism over the target gene of PPARs (peroxisome proliferator-activated receptors), which are the master regulator of specialization of a fat cell differentiation. And then we found out that CREB-binding protein (CBP) was the indispensable factor of fat cell specialization. Furthermore, the activation factor of PPARs which promotes carbohydrate metabolism and lipid metabolism using this system was found out to natural occurring materials, especially a medicinal herb, or plants.

##### **b) Basic and applied studies on energy and lipid metabolism aimed at prevention of the life-style related disease and metabolic syndrome**

Initiation and progression of the life-style related disease are involved in the lipid metabolism in the various organs including gastrointestinal tract, liver and adipose tissue. For understanding and prevention of these diseases, we are performing the basic studies about lipid metabolism and adipocyte function, and applied studies about food factors regulating lipid metabolism properly. Our current research topics are 1) the screening of natural products for normalizing lipid metabolism, 2) basic and applied studies about lipoproteins in liver and small intestine, and 3) analysis of molecular mechanisms that

monitor hypertrophy of adipocytes.

c) Molecular food function on the regulation of obesity-related inflammatory pathologies

Arteriosclerosis and the allergy are the familiar living body inflammations caused by food and the genetic background. The importance of the cytokines and chemokines such as tumor necrosis factor (TNF)- $\alpha$ , adiponectin, and monocyte chemoattractant protein-1 (MCP-1) in the lifestyle disease is clarified inside and outside the country in recent years. The chemokine is a super-family of the cytokine of cell migration (chemoattractant), and it is known as inflammatory mediator. In addition, the function has been found receiving the modification by various nutrients and the food factors. This research theme clarifies the realities of a chemical factor that it develops metabolic syndrome from the aspect of the cytokine and chemokine.

d) Studies on signaling network of lipid metabolism among organs/tissues.

Communication among organs/tissues is indispensable for the homeostasis. For example, nutrients derived from foods are recognized on the gastrointestinal epithelial cells so that gastrointestinal hormones are released from specific endocrine cells. The gastrointestinal hormones regulate metabolism and/or functions in other organs and tissues like the liver and adipose tissues. Disruption in such network may induce various diseases of metabolism. We are elucidating mechanism of the network composed by the liver, intestine, and adipose tissues, which are significant for systemic regulation of lipid metabolism. Our final purpose is to clarify relationship between regulation of the network and development of lipid metabolism abnormalities.

e) Studies on folding and quality control of protein in endoplasmic reticulum.

The endoplasmic reticulum (ER) is the site of synthesis and posttranslational modifications of secretory and membrane proteins. The ER also plays an important role in folding and quality control of nascent polypeptides. The nascent polypeptides translocated into the ER are folded with assistance of molecular chaperones and many enzymes, which are localized in the ER. The unfolded and misfolded proteins are removed from the transport pathway to the Golgi and then degraded by ER-associated degradation systems. Our primary research goal of this project is to clarify the interactions between nascent polypeptide, molecular chaperones and enzymes during folding of proteins and its regulatory mechanism. We are also studying the roles of ER chaperones and enzymes on the regulation of VLDL secretion from liver, which is an important factor affecting serum triacylglycerol level. In addition, we are interested in the folding mechanism of soybean storage proteins. We are actively studying the characteristics and expression profiles of soybean ER-resident chaperons and their interactions with storage proteins during maturing of cotyledon.

f) Basic and applied studies on dietary lipids and health.

Intensive studies using bacteria, plant and animal culture cells, rat heart and platelets have been performed focusing how dietary lipids consisting of various fatty acids influence on the structure and function of biological membrane. Previously, the toxic effects of saturated fatty acids, erucic acid and trans-fatty acids on animal cells have been revealed. We also have demonstrated that linoleic acid is an essential component for respiratory enzyme, cytochrome c oxidase in heart mitochondria. Moreover, arachidonoyl molecular species of phosphatidylinositol was shown to play a primary role on the signal transduction for activation of platelets by using methods for phospholipid molecular species analysis, which was progressed by our laboratory. Based on those studies on the physiological roles of dietary lipids at the molecular levels, a reasonable way to intake fatty acids for health is being designed.

## **A-2. Publications and presentations**

### **a) Publications**

#### ***Books***

Kawada T, Goto T, Hirai S, Yu R, Takahashi N. Chapter 4: Obesity and Nuclear Receptors: Effective Genomic Strategies in Functional Foods in Book "Nutrigenomic and Proteomics in Health and Diseases-Impact of food factors-gene interactions". 47-58, 2008.

#### ***Original Papers***

Taketa K, Matumura T, Yano M, Ishii N, Senokuchi T, Motoshima H, Murata Y, Kim-Mitsuyama S, Kawada T, Itabe H, Takeya M, Nishikawa T, Tsuruzoe K, Araki E. Ox-LDL activates PPARalpha and PPARgamma through MAPK-dependent COX-2 expression in macrophages. *J Biol Chem.* 283: 9852-9862, 2008.

Takahashi N, Kang M-S, Kuroyanagi K, Goto T, Hirai S, Ohyama K, Lee J-Y, Yu R, Yano M, Sasaki T, Murakami S, Kawada T. Auraptene, a citrus fruit compound, regulates gene expression as a PPARalpha agonist in HepG2 hepatocytes. *BioFactors.* 33: 25-32, 2008.

Oi-Kano Y, Kawada T, Watanabe T, Koyama F, Watanabe K, Senbongi R, Iwai K. Oleuropein, a phenolic compound in extra virgin olive oil, increases uncoupling protein 1 content in brown adipose tissue and enhances noradrenaline and adrenaline secretions in rats. *J Nutr Sci Vitaminol (Tokyo).* 54: 363-307, 2008.

Isa Y, Miyakawa Y, Yanagisawa M, Goto T, Kang MS, Kawada T, Morimitsu Y, Kubota K, Tsuda T. 6-Shogaol and 6-gingerol, the pungent of ginger, inhibit TNF-alpha mediated downregulation of adiponectin expression via different mechanism in



- 3T3-L1 adipocytes. *Biochem Biophys Res Commun.* 373: 429-434, 2008.
- Takayanagi Y, Kasahara Y, Onaka T, Takahashi N, Kawada T, Nishimori K. Oxytocin receptor-deficient mice developed late onset obesity. *Neuro Report.*19: 951-955, 2008.
- Kang MS, Hirai S, Goto T, Kuroyanagi K, Lee JY, Uemura T, Ezaki Y, Takahashi N, Kawada T. Dehydroabietic acid, a phytochemical, acts as ligand for PPARs in Macrophages and adipocytes to regulate inflammation. *Biochem Biophys Res Commun.* 369: 333-338, 2008 .
- Kamauchi, S., Wadahama, H., Iwasaki,K., Nakamoto, Y., Nishizawa, K., Ishimoto, M., Kawada, T. and Urade, R. Molecular cloning and characterization of two soybean protein disulfide isomerases as molecular chaperones for seed storage proteins. *FEBS J.* 275: 2644-2658, 2008.
- Mochizuki, Y., Maebuchi, M., Kohno, M., Hirotsuka, M., Wadahama, H., Moriyama, T., Kawada, T. and Urade, R. Changes in lipid metabolism by soy  $\beta$ -conglycinin-derived peptides in HepG2 cells. *J Agric Food Chem.* 57: 1473-1480, 2009.
- b) Conference and seminar paper presented
- The 2009 Annual Meeting of Japan Society for Bioscience, Biotechnology and Biochemistry (4)
- The 62th Annual Meeting of Japan Society for Nutrition and Food Science (3)
- The 2008 Annual Meeting of Japan Society for the Study of Obesity (5)
- The 2008 Annual Meeting of Biochemistry and Molecular Biology (3)
- The 60th Annual Meeting of The Society for Biotechnology (1)
- 33rd FEBS Congress & 11th IUBMB Conference (1)
- 16th EASO Annual Conference (3)

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

- Kawada, T.: Japan Society for the Study of Obesity (General affairs & publicity committee), Japan Society for Bioscience, Biotechnology, and Agrochemistry (Kansai Branch general affairs), The Japan Endocrine Society (General affairs), Study Group on Adiposcience (General affairs)
- Takahashi, N.: Japan Society for the Study of Obesity (Councilor), The Physiological Society of Japan (Councilor)

#### ***Research grants***

- Monbusho Research Grant: Scientific Research on Priority Areas “Adipomics: Analysis of

molecular mechanism that hypertrophy of adipocytes” (Kawada, representative), Scientific Research (B) “The signal transduction of Dietary fat and energy metabolism via nuclear receptors” (Kawada, representative), Scientific Research (B) “Gene targeting analysis of a folding enzyme ER-60 localized in the endoplasmic reticulum” (Urade, representative), Scientific Research (C) “Molecular analysis of the activation mechanism of volume-sensitive chloride channel” (Takahashi, representative).

Research and Development Program for New Bio-industry Initiatives “Development of functional food for the prevention of hay fever and life-style related disease” (Kawada, representative).

The Salt Science Research Foundation: Research Grant “Functions of salt on the formation of gliadin aggregate in wheat dough” (Urade, representative).

#### **A-4. International cooperation and overseas activities**

##### ***International joint researches, overseas research surveys***

Kawada: Studies on cytokine and chemokine from adipose tissue and obesity related diseases (South Korea, University of Ulsan)

Urade: Studies on the roles of ER-60 on regulatory degradation of ApoB-100 (Toronto University, Canada)

##### ***Editorial work for international journals***

Kawada, T.: J. Medicinal Food (editorial board), J. Nutritional Science and Vitaminology (expert editor), Obesity (referee), B.B.A. (referee), Life Science (referee), Lipid (referee), J. Agric. Food Chem. (referee), B.B.B. (referee)

Urade, R.: Journal of Biological Chemistry (referee), Journal of Food Science (referee)

#### **B. Educational activities (2008.4-2009.3)**

##### **B-1. On-campus teaching**

###### **a) Courses given**

Undergraduate level: Molecular Function of Food (Kawada and Urade), Introduction and practice in the department of food science and biotechnology I (Kawada and Urade), Food biochemistry II (Kawada), Food biochemistry I (Urade), Food Safety II (Kawada), Laboratory Course in Enzyme Chemistry and Biochemistry (Urade and Takahashi)

Graduate level: Advanced Course in Food and Health Science (Kawada), Seminar on Molecular Function of Food Constituents (Kawada, Urade, and Takahashi), Experimental Course in Molecular Function of Food Constituents (Kawada, Urade,

and Takahashi)

## **B-2. Off-campus activities**

### ***Part-time lecturer***

Kawada, T.: Dosisha women's University (Enzyme Science), Saga University (Bioresource chemistry)

## **B-3. Overseas teaching**

### ***Students and research fellows from abroad***

Doctor's Program: (1)                      Research fellow : (2)

Research student : (1)

## 2.7.6 Laboratory of Physiological Function of Food

*Staff Associate Professor: Ohinata, Kousaku, D. Agric. Sci.*

*Assistant Professor: Yamada, Yuko, M. Agric. Sci.*

*Students and research fellows*

*Postdoctoral Fellow: (1)*

*Master's Program : (6)*

*Undergraduate : (2)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main Subjects

a) Potent anxiolytic activity of dipeptide and its mechanism

We previously reported that bioactive peptides isolated from enzymatic digests of various food proteins act on the cardiovascular, immune and endocrine systems; however, we have revealed that they also has actions on the central nervous system (CNS) including anxiolytic-like, food intake-regulating and memory-enhancing activities. Recently, we found that simple dipeptide composed of two common amino acids has potent anxiolytic-like activity in elevated plus maze, comparable to diazepam, a general anxiolytic. We previously reported that bioactive peptides derived from food proteins show anxiolytic activity via acting as opioid receptor agonists or via activating prostaglandin (PG) release; however, the anxiolytic effect of this dipeptide was not blocked by opioid receptor antagonists and a cyclooxygenase (COX) inhibitor, suggesting that the dipeptide shows anxiolytic-like activity via a novel anxiolytic pathway independent of the opioid and PG systems.

b) Anxiolytic-like activity of lactomedin 1 derived from human lactoferrin and its mechanism

Lactomedin 1 (Phe-Lys-Asp-Cys-His-Leu-Ala-Arg) is an ileum-contracting peptide isolated from trypsin digest of human lactoferrin, a major protein in human milk. We found that lactomedin 1 has anxiolytic-like activity after oral administration in the elevated plus-maze test in mice. The anxiolytic-like activity of lactomedin 1 after i.c.v. administration was blocked by pretreatment of antisense ODN for complement C5a receptor but not for C5L2 receptor, among two receptor subtypes for C5a, suggesting that lactomedin 1 has anxiolytic-like activity as an agonist for C5a receptor. We also found that C5a alone has anxiolytic-like activity after i.c.v. administration. Furthermore, the lactomedin 1-induced anxiolytic-like activity was blocked by a COX inhibitor and an antagonist for the DP<sub>1</sub> receptor for PGD<sub>2</sub>, indicating that the anxiolytic-like activity was mediated through PGD<sub>2</sub>

release. We recently found that PGD<sub>2</sub>, a natural sleep inducer, has anxiolytic-like and orexigenic activities. It is interesting that lactomedin 1 couples to PGD<sub>2</sub> having a variety of physiological functions.

c) Food intake suppression of  $\beta$ -lactotensin derived from bovine  $\beta$ -lactoglobulin

$\beta$ -Lactotensin (His-Ile-Arg-Leu) is a multifunctional peptide derived from bovine milk protein showing cholesterol-lowering, bile acid secretion-stimulating and memory-enhancing activities. In this study, we found that  $\beta$ -lactotensin suppressed food intake after oral administration in fasted mice.  $\beta$ -Lactotensin has homology with neurotensin, a brain-gut peptide having anorexigenic activity, and acts as neurotensin agonist peptide; however, the anorexigenic activity of  $\beta$ -lactotensin was not blocked by antagonists for neurotensin receptors. On the other hand, the food intake suppression of  $\beta$ -lactotensin was blocked by antagonists for corticotropin-releasing factor (CRF) and calcitonin gene-related peptide (CGRP).  $\beta$ -Lactotensin did not show affinities for receptors for CRF and CGRP. Taken together,  $\beta$ -lactotensin may suppress food intake via activating the CRF and CGRP systems.

d) Anti-opioid activities of RIY and enterostatin

RIY (Arg-Ile-Tyr) is an anorexigenic and vasorelaxing peptide derived from rapeseed protein. Recently we found that RIY inhibits analgesic effect induced by morphine after i.c.v. administration in mice. The anti-opioid activity of RIY was blocked by a cholecystokinin (CCK)<sub>2</sub> receptor antagonist, LY225910 but not by a CCK<sub>1</sub> receptor antagonist, lorglumide. RIY does not have affinity for the CCK<sub>2</sub> receptor, suggesting that the anti-opioid activity of RIY is mediated by CCK release and the CCK<sub>2</sub> receptor. The food intake suppression and vasorelaxing activities of RIY are mediated by the CCK<sub>1</sub> receptor. It is interesting that these activities of RIY commonly involves in CCK; however, its receptor subtypes were different each other.

We have also found that the endogenous anorexigenic peptide enterostatin (APGPR) also has anti-opioid activity. The anti-opioid activity of enterostatin was blocked by the antagonists of CCK<sub>1</sub> and CCK<sub>2</sub> receptors, lorglumide and LY225910, respectively. These results indicate that the anti-opioid activity of endogenous peptide enterostatin is also mediated by CCK. Enterostatin does not have affinity for the CCK receptors, suggesting that the anti-opioid activity of enterostatin is mediated by the release of CCK.

e) Action of angiotensin II on artery and novel vasorelaxing mechanism mediated by the AT<sub>2</sub> receptor

Angiotensin (Ang II) is a key regulator of blood pressure. We found that Ang II shows vasorelaxing activity after a transient contractile activity in mesenteric artery isolated from spontaneously hypertensive rats (SHRs). There are two major isoforms for Ang II receptors,

AT<sub>1</sub> and AT<sub>2</sub>. We found that the contractile activity of Ang II was mediated by the AT<sub>1</sub> receptor and the vasorelaxing activity was mediated by the AT<sub>2</sub> receptor, by using selective antagonists. Novokinin is an AT<sub>2</sub> agonist peptide which shows anti-hypertensive activity. It showed vasorelaxing activity in mesenteric artery of SHRs without showing vasocontractile activity. The vasorelaxing and anti-hypertensive activities were mediated by PGI<sub>2</sub> and the IP receptor downstream of the AT<sub>2</sub> receptor. The mechanism that the IP receptor is coupled the AT<sub>2</sub> receptor is a novel pathway we found for the first time as the mechanism for the vasorelaxing and anti-hypertensive activities of novokinin. The vasorelaxing activity of Ang II was also blocked by IP receptor antagonist, CAY10441, suggesting that it is mediated by the IP receptor downstream of the AT<sub>2</sub> receptor. A selective AT<sub>2</sub> agonist [*p*-NH<sub>2</sub>Phe<sup>6</sup>]-Ang II also showed relaxing activity after a transient contractile activity, and the vasorelaxing activity was also blocked by the AT<sub>2</sub> and IP receptor antagonists. These results demonstrated that the AT<sub>2</sub> agonists show vasorelaxing activity via IP receptor downstream of the AT<sub>2</sub> receptor.

## A-2. Publications and Presentations

### a) Publications

#### *Books*

- Yoshida, M., K. Ohinata, and M. Yoshikawa: Tyr-Pro-Ile-Glu-His-Gly (YPIEHG) Derived from Actin Exhibits Anxiolytic-Like Effect in Mice. Peptide Science 2008, The Japanese Peptide Society; 345-348, 2009
- Muraki, A., Y. Fujiwara, K. Ohinata, and M. Yoshikawa: Antidiabetic Activity of Novokinin (RPLKPW) after Oral Administration in KK-Ay Mice. Peptide Science 2008, The Japanese Peptide Society; 349-352, 2009
- Hou, IC., K. Ohinata, and M. Yoshikawa:  $\beta$ -Lactotensin (His-Ile-Arg-Leu) Derived from Bovine  $\beta$ -Lactoglobulin Suppresses Food Intake after Oral Administration in Mice. Peptide Science 2008, The Japanese Peptide Society; 367-370, 2009

#### *Original papers*

- Zhao, H., K. Ohinata, and M. Yoshikawa: Rubimetide (Met-Arg-Trp) derived from Rubisco exhibits anxiolytic-like activity via the DP<sub>1</sub> receptor in male ddY mice. Peptides 29(4); 629-632, 2008
- Watanabe-Kamiyama, M., S. Kamiyama, K. Horiuchi, K. Ohinata, H. Shirakawa, Y. Furukawa, and M. Komai: Antihypertensive effect of biotin in stroke-prone spontaneously hypertensive rats. Br J Nutr 99(4); 756-763, 2008
- Takenaka, Y., T. Shimano, Y. Yamada, M. Yoshida, K. Ohinata, and M. Yoshikawa: Enterostatin (APGPR) suppresses the analgesic activity of morphine by a

CCK-dependent mechanism. *Peptides* 29(4); 559-563, 2008

Takenaka, Y., T. Shimano, T. Mori, IC. Hou, K. Ohinata, and M. Yoshikawa: Enterostatin reduces serum cholesterol levels by way of a CCK<sub>1</sub> receptor-dependent mechanism. *Peptides* 29(12); 2175-2178, 2008

Nishizawa, K., A. Kita, C. Doi, Y. Yamada, K. Ohinata, M. Yoshikawa, and M. Ishimoto: Accumulation of the bioactive peptides, novokinin, LPYPR and rubiscolin, in seeds of genetically modified soybean. *Biosci Biotechnol Biochem* 72(12); 3301-3305, 2008

Ohinata, K., M. Takemoto, M. Kawanago, S. Fushimi, H. Shirakawa, T. Goto, A. Asakawa, and M. Komai: Orally administered zinc increases food intake via vagal stimulation in rats. *J Nutr* 139(3); 611-616, 2009

### ***Patents***

Patent pending/applied for Patent application no. 2009-21958 "Pharmaceutical and food containing peptides", inventors: Ohinata K, Kanegawa N, applicant: Kyoto university, application date: Feb. 2, 2008

### ***Reviews***

Ohinata, K., and M. Yoshikawa: Central prostaglandins in food intake regulation. *Nutrition* 24(9); 798-801, 2008

Ohinata, K., and M. Yoshikawa: Food intake regulation by central complement system. *Adv Exp Med Biol* 632; 35-46, 2008

Komai, M., M. Kamiyama-Watanebe, S. Kamiyama, K. Ohinata, K. Horiuchi, Y. Furukawa, and H. Shirakawa: Mechanism for anti-hypertensive effect of biotin at a pharmacological dose *Folia Pharmacol Jpn (Japanese)* 131; 248-251, 2008

Yamada, Y., K. Ohinata, and M. Yoshikawa: Novel anti-hypertensive peptide acting through angiotensin AT<sub>2</sub> receptor. *Molecular Cardiovascular Medicine* 9(5); 77-82, 2008

Yamada, Y., K. Ohinata, and M. Yoshikawa: Design, mechanism and production in genetically modified soybean of novel anti-hypertensive peptide novokinin. *Journal of the Japanese Society of Food Engineering* 28(4); 1-7, 2008

b) Conference and seminar papers presented

Annual Meeting of Japan Society for Bioscience, Biotechnology and Agrochemistry: 7 papers

The 55th Annual Meeting of the Japanese Society for Food Science and Technology: 1 paper

The 3rd Annual Meeting of the Japanese Society for Food Science and Technology for the Young Investigator Award: 2 paper

Biochemistry and Molecular Biology BMB2008: 1 paper

45th Japanese Peptide Symposium: 3 papers

The 3rd Lactoferrin Forum: 1 paper

The 20th Short Course for Development of Peptide-based Functional Foods: 1 paper

### **A-3. Off-campus activities**

#### ***Research grants***

Grant-in-Aid for Young Scientists (B): Novel function of angiotensin system and the control by food-derived components (Yamada, representative).

Grant from Core Research for Evolutional Science and Technology (CREST): Biocommunication between mother and child supporting brain development. (Ohinata, representative)

Japan Dairy Association: Studies on anorexigenic peptides derived from milk protein (Ohinata, representative)

Nestle Nutrition Council, Japan: Studies on roles of dietary zinc in food intake regulation (Ohinata, representative)

### **A-4. International cooperation and overseas activities**

#### ***International meeting***

Yamada: 237th American Chemical Society National Meeting & Exposition March 22-26, 2009 Salt Lake City, UT (Invited lecture)

## **B. Educational Activities (2007.4-2008.3)**

### **B-1. On-campus teaching**

#### **a) Courses given**

Undergraduate level: Principles of Biochemistry in Food Science I (Ohinata), Physiological functions of foods (Ohinata), Seminar in Food Science and Biotechnology (Ohinata), Introduction to experimental food bioscience (Ohinata), Laboratory course in food and nutrition chemistry (Ohinata, Yamada)

Graduate level: Seminar in physiological function of foods (Ohinata), Experimental course in physiological function of foods (Ohinata), Advanced course in health science of foods (Ohinata), Advanced course in physiological function of foods (Ohinata)

### **C. Other Remarks**

Ohinata: Safeguard Committee of Faculty of Agriculture for Radioisotopes and Radiation (member), Advisory Board for the Committee of Animal Experiment in Graduate School of Agriculture, Kyoto University (member).



## Chair of Food Production Technology

### 2.7.7 Laboratory of Bioengineering

*staff      Professor                      : Adachi, Shuji, Dr. Agric. Sci.*

*Associate Professor: Kimura, Yukitaka, Dr. Agric. Sci. (– Sep. 30, 2008)*

*Assistant Professor: Shima, Motohiro, Dr. Agric. Sci.*

*Assistant Professor: Kobayashi, Takashi, Dr. Agric. Sci*

*Part-time Secretary: Kamiya, Rumiko*

*Students and research fellows*

*Doctor's program                      : (1)*

*Master's program                      : (8)*

*Undergraduate                        : (2)*

*Foreign research student           : (1)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

a) Development of novel food processing technology by subcritical water treatment:

Water is present in subcritical condition when being compressed to remain in the liquid state at temperatures above 100°C. Subcritical water has a dielectric constant close to that of organic solvents, which decreases with increasing temperature. Hence, it is better capable of dissolving hydrophobic substances. In addition, high ion product is also characteristic of subcritical water. Setting off with the aim of developing novel food processing technology by leveraging these unique features of subcritical water, we have been devoting our efforts to carrying out both basic and applied researches in subcritical water treatment, in regards to the conversion of little-used biomaterials to useful materials and the degradation (hydrolysis) kinetics of saccharides, amino acids, etc., respectively, from the reaction engineering point of view.

b) Characterization and application of nano- and microdispersed food ingredients:

Nanoemulsions with oil droplet diameter of a few tens nanometer are expected of exhibiting some unique properties and functionalities, which are not found in the existing microemulsions. Nonetheless, the scientific knowledge pertaining to nanoemulsions is still insufficient at present. Taking into consideration the mass transfer phenomenon at the oil-water interface, we performed a systematic study on the effects of the decrease in oil

droplet size of the disperse phase upon the oxidation of unsaturated fatty acids in the phase, wherein the oxidation reaction was found to have been impeded despite the high specific surface area of the nanoemulsions. We also suggested a model that explained the phenomena.

c) Bioreaction engineering research for construction of bioreactors:

Study is carried out on the construction of bioreactor systems for efficient substance production based on the knowledge on the characteristics of biocatalysts such as enzymes. We aspire to establish a reasonable method for designing bioreactor systems for synthesis reactions, in particular the condensation reactions by hydrolytic enzymes for syntheses of functional food ingredients inclusive of surface-active substances, by elucidating the influence of various physico-chemical factors on the efficiency of the reactions.

d) Analyses and development in food processing:

Processes such as cation-exchange resin-mediated separation of saccharides, powderization of lipid with food polymers which retards lipid oxidation, dehydration of pasta which produces rehydratable noodle are examples of existing food processes. However, the phenomena that occur during the processes are not yet to be fully understood. By applying both the existing and new approaches and new models to these processes, we endeavor to gain insight into the phenomena that happen through the processes and thereby contribute toward establishing a reasonable design method for substance production.

## A-2. Publications and presentations

### a) Publications

#### *Reviews*

J. Wiboonsirikul and S. Adachi: Extraction of functional substances from agricultural products or by-products by subcritical water treatment. *Food Sci. Technol. Res.*, 14(4), 319-328 (2008).

S. Adacji: Properties and application to food processing of subcritical water (in Japanese). *Shukuhin Kakou Gijutsu*, 28(2), 45-51 (2008).

#### *Original papers*

N. Iwamoto, M. Shima, and S. Adachi: Synthesis of xylitoyl fatty acid monoesters by immobilized lipase in subcritical acetone. *Biochem. Eng. J.*, 38, 16-21 (2008).

C. Usuki, Y. Kimura, and S. Adachi: Degradation of pentaoses and hexauronic acids in subcritical water. *Chem. Eng. Technol.*, 31(1), 133-137 (2008).

J. Wiboonsirikul, Y. Kimura, Y. Kanaya, T. Tsuno, and S. Adachi: Production and characterization of functional substances from a by-product of rice bran oil and protein production by a compressed hot water treatment. *Biosci. Biotechnol. Biochem.*, 72,

384-392 (2008).

- Y. Watanabe, Y. Sawahara, S. Asai, and S. Adachi: Decomposition kinetics of 6-*O*-monoacyl ascorbate in air. *Food Sci. Technol. Res.*, 14(2), 139-143 (2008).
- J. Wiboonsirikul, Y. Sakai, A. Hosoda, H. Morita, Y. Kimura, H. Taniguchi, T. Tsuno, and S. Adachi: Mutagenicity of the extract from defatted rice bran by subcritical water treatment. *Japan J. Food Eng.*, 9(1), 75-78 (2008).
- R. Nakazawa, M. Shima, and S. Adachi: Effect of oil-droplet size on the oxidation of microencapsulated methyl linoleate. *J. Oleo Sci.*, 57(4), 225-232 (2008).
- S. Kikuchi, T. Kobayashi, and S. Adachi: Dependences of the distribution coefficients of hydrophobic solutes on porous methyl methacrylate resin on the temperature and methanol content of the eluent. *Food Sci. Technol. Res.*, 14(2), 144-147 (2008).
- S. Hata, J. Wiboonsirikul, A. Maeda, Y. Kimura, and S. Adachi: Extraction of defatted rice bran by subcritical water treatment. *Biochem. Eng. J.*, 40(1), 44-53 (2008).
- P. Khuwijitjaru, K. Chaloodong, and S. Adachi: Phenolic content and radical scavenging capacity of kaffir lime fruit peel extracts obtained by pressurized hot water extraction. *Food Sci. Technol. Res.*, 14(1), 1-4 (2008).
- Y. Watanabe, Y. Sawahara, H. Nosaka, K. Yamanaka, and S. Adachi: Enzymatic synthesis of conjugated linoleoyl ascorbate in acetone. *Biochem. Eng. J.*, 40, 368-372 (2008).
- T. Matsuo, T. Kobayashi, Y. Kimura, A. Hosoda, H. Taniguchi, and S. Adachi: Continuous synthesis of glyceryl ferulate using immobilized *Candida antarctica* lipase. *J. Oleo Sci.*, 57(7), 375-380 (2008).
- J. Ohshima, S. Haghighat Khajavi, Y. Kimura, and S. Adachi: Effects of sodium chloride on the degradation of hexoses and the hydrolysis of sucrose in subcritical water. *Eur. Food Res. Technol.*, 227(3), 799-803 (2008).
- Y. Horagai, L. Hung, Y. Kimura, and S. Adachi: Decomposition and discoloration kinetics of L-ascorbic acid powders in superheated steam. *LWT-Food Sci. Technol.*, 41, 2113-2117 (2008).
- H. Imai, T. Maeda, M. Shima, and S. Adachi: Oxidation of methyl linoleate in O/W micro- and nanoemulsion systems. *J. Am. Oil Chem. Soc.*, 85(9), 809-815 (2008).
- S. Kikuchi, T. Kobayashi, and S. Adachi: Temperature dependences of the distribution coefficients of hydrophobic solutes onto porous styrene divinylbenzene resin for the eluent with a low methanol content. *J. Biosci. Bioeng.*, 106(2), 208-210 (2008).
- J. Wiboonsirikul, R. Nakazawa, T. Kobayashi, H. Morita, T. Tsuno, and S. Adachi: Suppression of the oxidation of methyl linoleate encapsulated with the extract from defatted rice bran by a compressed hot water treatment. *Eur. Food Res. Technol.*, 228, 109-114 (2008).

- L. Hung, Y. Kimura, and S. Adachi: Kinetics of disappearance and discoloration of L-ascorbic acid 2-glucoside powders with different water contents. Japan J. Food Eng., 9(3), 135-140 (2008).
- T. Matsuo, T. Kobayashi, Y. Kimura, M. Tsuchiyama, T. Oh, T. Sakamoto, and S. Adachi: Synthesis of glyceryl ferulate by immobilized ferulic acid esterase. Biotechnol. Lett., 30, 2151-2156 (2008).
- T. Kobayashi, T. Matsuo, Yukitaka Kimura, and Shuji Adachi: Thermal stability of immobilized lipase from *Candida antarctica* in glycerols with various water contents at elevated temperatures. J. Am. Oil Chem. Soc. J. Am. Oil Chem. Soc. 85, 1041-1044 (2008).

b) Conference and seminar papers presented

The 6th meeting of Lipid Engineering Division of The Society for Biotechnology, Japan (2 papers)

Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry, 2008 (1 paper)

Annual Meeting of Japan Society for Food Engineering, 2008 (4 papers)

The 55th Annual Meeting of the Japanese Society for Food Science and Technology (4 papers)

Kansai Branch Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry, 2008 (1 paper)

13th International Biotechnology Symposium and Exhibition (3 papers)

Himeji Meeting of the Society of Chemical Engineers, Japan (1 paper)

The 2nd International Symposium on "Rice and Disease Prevention" (6 papers)

The 10th Korea-China-Japan Joint Symposium on Enzyme Engineering (1 paper)

The 30-years Anniversary Meeting of the Japan Society of Enzyme Engineering (1 paper)

Autum Meeting of the Japan Society of Food Engineering (3 papers)

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

Adachi, S.: The Japan Society for Food Engineering (director), The Japanese Society on Enzyme Engineering (vice president), Japan Oil Chemists' Society (secretary of Kansai branch), The Society of Chemical Engineers, Japan (Section-chief of Food and Food Processing Subcommittee).

#### ***Research Grant***

Adachi, S.: Nanotechnology project, the Ministry of Agriculture, Forestry and Fisheries: Assessment of anti-oxidation and stability of nano- and microparticles in food

diversion system and their control (co-operative).

Cooperation of Innovative Technology and Advanced Research in Evolutional Area (CITY AREA), Ministry of Education, Culture, Sports, Science and Technology, Japan: Development of functional food materials (co-operative).

Salt Science Research Foundation: Effect of the counter-ion form of acidic polymer on its degradation in subcritical water. (representative).

Kimura Y.: Japan Society of the Promotion Science Grant, Grant-in-Aid for Scientific Research (C): Effects of pH at high pressure and temperature in subcritical water on hydrolytic kinetics of food components. (representative).

#### **A-4. International cooperations and overseas activities**

##### ***International meetings***

Adachi, S.: International Biotechnology Symposium 2008, Dalian, China (Invited lecture).  
The 10th Korea-China-Japan Joint Symposium on Enzyme Engineering, Busan, Korea (poster presentation)

Kobayashi, T.: International Biotechnology Symposium 2008, Dalian, China (Oral presentation).

##### ***Editorial work for international journals***

Adachi, S.: Bioscience, Biotechnology and Biochemistry (editor). Food Science and Technology Research (editor).

#### **B. Educational Activities (2008.4—2009.3)**

##### **B-1. On-campus teaching**

###### **a) Courses given**

Undergraduate level: Food Engineering (Adachi, S. and Kimura, Y.), Physical Chemistry in Food Science I (Kimura, Y.), Physical Chemistry in Food Science II (Adachi, S.), Basic Laboratory Course in Food Science and Biotechnology (Kimura, Y., Shima, M., Kobayashi, T.), Laboratory Course in Chemical Engineering (Kimura, Y., Shima, M., Kobayashi, T.).

Graduate level: Food Production Technology (Adachi, S.), Bioengineering Seminar (Adachi, S. and Kimura, Y.), Experimental Course in Bioengineering (Adachi, S. and Kimura, Y.).

##### **B-2. Off-campus teaching, etc.**

###### ***Part-time lecturer***

Adachi, S.: Graduate School of Engineering, Osaka City University (Special lecture)

###### ***Open seminar, etc.***

Adachi, S.: Basic Training Course of the Japan Society for Food Engineering (lecturer).

### **B-3. Overseas teaching**

#### ***Students and research fellows from abroad***

Doctor's program: 2 (Thailand, P. R. China)

Foreign research student: 1 (Netherlands)

### **C. Other remarks**

Adachi, S.: Advisory Board for Utilization of Academic Center for Computing and Media Studies, Kyoto University (member), Committee for Information Systems in Faculty of Agriculture (Chairperson), Technical Subcommittee for Information Systems in Faculty of Agriculture, (Chairperson) Committee for Informational Security in the Graduate School of Agriculture (member), Committee for Safety Control in the Graduate School of Agriculture (member).

Kimura, Y.: Committee for Informational Security in the Graduate School of Agriculture (member), Safety Control of Research Activity in Division of Food Science and Biotechnology, Graduate School of Agriculture (Vice-chief) (until Sep. 30, 2008).

Shima, M.: Advisory Board for Information Systems in Faculty of Agriculture (member).

## 2.7.8 Laboratory of Basic and Applied Molecular Biotechnology

*Staff Professor : Murata, Kousaku, Dr. Agric. Sci.*  
*Associate Professor: Hashimoto, Wataru, Dr. Agric. Sci.*  
*Assistant Professor : Kawai, Shigeyuki, Dr. Agric. Sci.*  
*Postdoctoral fellows: Maruyama Yukie, Dr. Agric. Sci.*  
*Postdoctoral fellows: Itoh, Takafumi, Dr. Agric. Sci.*  
*Postdoctoral fellows: Takeda, Hiroyuki, Dr. Philosophy*  
*Postdoctoral fellows: Ochiai, Akihito, Dr. Agric. Sci.*

### *Students and research fellows*

*Doctor's program : (1)*  
*Master's program : (5)*  
*Undergraduate : (3)*

## **A. Research Activities (2008.4-2009.3)**

### **A-1. Main subjects**

#### a) Functional proteomics of pit-forming bacterium

Alginate-assimilating bacterium, *Sphingomonas* sp. strain A1, has the flagellin homologue p5 as an alginate receptor on the cell surface. In this study, alginate-binding regions in p5 were determined by use of deletion mutants. Eleven p5 fragmented proteins ( $\Delta N_{53}C_{10}$ ,  $\Delta N_{53}C_{20}$ ,  $\Delta N_{53}C_{30}$ ,  $\Delta N_{10}C_{45}$ ,  $\Delta N_{20}C_{45}$ ,  $\Delta N_{30}C_{45}$ ,  $\Delta N_{40}C_{45}$ ,  $\Delta N_{20}C_{20}$ ,  $\Delta N_{20}C_{30}$ ,  $\Delta N_{30}C_{10}$ , and  $\Delta N_{30}C_{20}$ ) were expressed in *Escherichia coli*, purified, and subjected to alginate-binding assay by surface plasmon resonance method (Biacore). As a result, the N-terminal (residue Nos. 20-40) or C-terminal (residue Nos. 353-363) region in p5 was found to be responsible for alginate binding.

#### b) Structural proteomics of pit-forming bacterium

In order to clarify the secretion mechanism of alginate receptor p5 to the cell surface, type III secretion system of bacterial flagellin was focused. The strain A1 gene disruptant with a mutation in FlgJ involved in the rod assembly of flagellar basal body and hydrolysis of peptidoglycan showed the low level expression of p5 on the cell surface. Thus, three-dimensional structure of FlgJ-C, peptidoglycan hydrolase domain, was determined at 1.74 Å resolution by X-ray crystallography. The enzyme consists of two lobes,  $\alpha$  and  $\beta$ . A deep cleft located between the two lobes can accommodate polymer molecules, suggesting that the active site is located in the cleft.

#### c) Gas biology

Nitrogen-fixing *Azotobacter vinelandii* assimilates nitrogen to ammonia through the action of nitrogenase in the nitrogen source-free environment. Nitrogenase is immediately inactivated in the presence of oxygen. In this study, the bacterial response to nitrogen and oxygen levels was analyzed. Electron micrograph of cell thin section indicated that a large number of vesicles inducibly formed on the cell surface under condition of low nitrogen level, and alginate multilayer biofilms were constructed through the release of vesicles from the cells. Since the vesicle including alginate seems to be the polymer carrier, we call it as “transalgisome”. This suggests the presence of a novel bacterial transport system of macromolecules through vesicle formation.

d) Interaction between bacteria and hosts: Structural biology of bacterial system for degradation of host cell surface polysaccharide

Unsaturated glucuronyl hydrolase (UGL) catalyzes the hydrolytic release of an unsaturated glucuronic acid from glycosaminoglycan disaccharides, which are produced from mammalian extracellular matrices through the  $\beta$ -elimination reaction of polysaccharide lyases. To investigate UGL gene expression in streptococcal cells, DNA microarray was conducted using the *S. agalactiae* cells grown with or without hyaluronan. Hyaluronan induced the expression of the genetic cluster for UGL and phosphotransferase system of aminosugar, although the increased level was not very high (less than 3-fold). Hyaluronan also slightly upregulated the transcriptional level of putative 2-keto-3-deoxygluconate (KDG) metabolic genes located upstream of the UGL gene. The UGL protein expression in both *S. agalactiae* cells grown with or without hyaluronan was confirmed by western blotting with anti-streptococcal UGL antibodies. These results suggest that *S. agalactiae* UGL is constitutively expressed, but the slight increase in its expression level occurs in the presence of hyaluronan.

e) Physiological function of NADP(H) biosynthesis in yeast *Saccharomyces cerevisiae*

Cells of the yeast *Saccharomyces cerevisiae* contain 3 NAD kinases; namely, cytosolic Utr1p, cytosolic Yef1p, and mitochondrial Pos5p. Previously, the NADH kinase reaction catalyzed by Pos5p, rather than the NAD kinase reaction followed by the NADP<sup>+</sup>-dependent dehydrogenase reaction, had been regarded as a critical source of mitochondrial NADPH, which plays vital roles in various mitochondrial functions. This study demonstrates that the mitochondrial NADH kinase reaction is dispensable as a source of mitochondrial NADPH and emphasizes the importance of the NAD kinase reaction, followed by the mitochondrial NADP<sup>+</sup>-dependent dehydrogenase reaction. The evidence is presented that mitochondrial NADP<sup>+</sup>-dependent dehydrogenase play a prominent role in generating mitochondrial NADPH in the absence of the NADH kinase reaction. In addition, Pos5p is confirmed to have a considerably higher NADH kinase activity than NAD kinase activity. Taking these



results together, it is proposed that there are 2 sources of mitochondrial NADPH in yeast: one is the mitochondrial Pos5p-NADH kinase reaction and the other is the mitochondrial Pos5p-NAD kinase reaction followed by the mitochondrial NADP<sup>+</sup>-dependent dehydrogenase reaction.

f) Biofuel

In order to construct biofuel (ethanol) production system from marine biomass alginate, the two genes for pyruvate decarboxylase and alcohol dehydrogenase of *Zymomonas mobilis* were introduced into the cells of *Sphingomonas* sp. A1, a pit-forming bacterium having an ability to use alginate for their growth. The recombinant cells of strain A1 thus obtained produced ethanol efficiently from alginate and the concentration reached more than 0.7% after 3-4 days incubation.

## A-2. Publications and presentations

a) Publications

**Books**

Hashimoto, W. and K. Murata: Creation of superbacteria and high efficient technology of dioxin degradation. Cleanup and remediation technology of soil and underground water pollution. (NTS Co.), p.137-147, Tokyo, 2008

**Original papers**

Miyagi, H., S. Kawai and K. Murata: Two sources of mitochondrial NADPH in the yeast *Saccharomyces cerevisiae*. J. Biol. Chem., 284 (12), 7553-7560, 2009

Kawai, S., T. A. Pham, E. Kono, K. Harada, C. Okai, E. Fukusaki and K. Murata: Transcriptional and metabolic response in yeast *Saccharomyces cerevisiae* cells during polyethylene glycol-dependent transformation. J. Basic Microbiol., 49 (1), 73-81, 2009

Hashimoto, W., A. Ochiai, K. Momma, T. Itoh, B. Mikami, Y. Maruyama and K. Murata: Crystal structure of the glycosidase family 73 peptidoglycan hydrolase FlgJ. Biochem. Biophys. Res. Commun., 381 (1), 16-21, 2009

Ochiai, A., T. Itoh, B. Mikami, W. Hashimoto and K. Murata: Structural determinants responsible for substrate recognition and mode of action in family 11 polysaccharide lyases. J. Biol. Chem., 284 (15), 10181-10189, 2009

Harada, K. M., K. Tanaka, Y. Fukuda, W. Hashimoto and K. Murata: *Paenibacillus* sp. strain HC1 xylanases responsible for degradation of rice bran hemicellulose. Microbiol. Res., 163 (3), 293-298, 2008

He, J., A. Ochiai, Y. Fukuda, W. Hashimoto and K. Murata: A putative lipoprotein of *Sphingomonas* sp. strain A1 binds alginate rather than a lipid moiety. FEMS

Microbiol. Lett., 288 (2), 221-226, 2008

Ogura, K., M. Yamasaki, B. Mikami, W. Hashimoto and K. Murata: Substrate recognition by family 7 alginate lyase from *Sphingomonas* sp. A1. J. Mol. Biol., 380 (2), 373-385, 2008

Itoh, T., B. Mikami, W. Hashimoto and K. Murata: Crystal structure of YihS in complex with D-mannose: Structural annotation of *Escherichia coli* and *Salmonella enterica* *yihS*-encoded proteins to an aldose-ketose isomerase. J. Mol. Biol., 377 (5), 1443-1459, 2008

### **Reviews**

Kawai, S. and K. Murata: Structure and function of NAD kinase and NADP phosphatase: key enzymes that regulate the intracellular balance of NAD(H) and NADP(H). Biosci. Biotechnol. Biochem., 72 (4), 919-930, 2008

### **Reports**

Hashimoto, W., A. Ochiai, T. Itoh, K. Ogura, B. Mikami, Y. Maruyama and K. Murata: X-ray crystal structure of *Sphingomonas* sp. A1 peptidoglycan hydrolase categorized to family GH-73. SPring-8 User Experiment Report, 2008B1112, 2008

Itoh, T., K. Ogura, Y. Nakamichi, B. Mikami, W. Hashimoto and K. Murata: Crystal structure of alginate-binding protein (AlgQ1) in complex with unsaturated mannuronic acid trisaccharide. SPring-8 User Experiment Report, 2008B1191, 2008

Itoh, T., A. Ochiai, K. Ogura, B. Mikami, W. Hashimoto and K. Murata: Structural insights into the reaction mechanism of coenzyme-independent mannose isomerase. SPring-8 User Experiment Report, 2008A1119, 2008

Ochiai, A., T. Itoh, K. Ogura, B. Mikami, W. Hashimoto and K. Murata: Crystallization and preliminary X-ray crystallographic analysis of peptidoglycan hydrolase from *Sphingomonas* sp. strain A1. SPring-8 User Experiment Report, 2008A1322, 2008

b) Conference and seminar papers presented

The Annual Meeting (2008) of Japan Society for Bioscience, Biotechnology, and Agrochemistry: 7 cases

The Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry (Kansai Branch): 1 case

The Regular Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry (Kansai Branch): 5 cases

The Regular Meeting of The Japanese Society of Applied Glycoscience (Kinki Branch): 1 case

The Annual Meeting (2007) of The Society for Biotechnology, Japan: 2 cases

Japan-Korea Joint Seminar on Biotechnology: 1 case

### **A-3. Off-campus activities**

#### ***Membership in academic societies (roles)***

Murata, Kousaku: Japan Society for Bioscience, Biotechnology, and Agrochemistry (Councilor of Nation-Wide, Editor-in-Chief of “Chemistry and Biology (Japanese)”); The Society for Biotechnology, Japan (Councilor); The Society for Biochemistry, Japan (Councilor. Member of Organizing Committee of the 82<sup>nd</sup> Annual Meeting of the Society for Biochemistry, Japan); The Japan Society for Nutrition and Food (Director); The Vitamin Society of Japan (Councilor of Nation-Wide); Others.

Hashimoto, Wataru: Yeast Research Society of Japan (Operator); Applied Microbiology and Biotechnology (Editor).

Kawai, Shigeyuki: Japan Society for Bioscience, Biotechnology, and Agrochemistry (Representative)

#### ***Research grants***

Murata, Kousaku: Monbukagakusho Research Grant-in-Aid for Scientific Research (B), Principal Investigator, Entry 2008, Structure/function relationship and cell surface localization of bacterial flagellar flagellin; Bio-oriented Technology Research Advancement Institution, Principal Investigator, Entry 2008, Ethanol production basis from marine biomass alginate

Hashimoto, Wataru: Monbukagakusho Research Grant-in-Aid for Scientific Research (C), Principal Investigator, Entry in 2008, Structure/function relationship of streptococcal system for heparin degradation and transport and its involvement in the bacterial infection disease; Monbukagakusho Targeted Proteins Research Program, Principal Investigator, Entry in 2007, Structural biology of bacterial super-biosystem for import and degradation of polysaccharides; Showa Houkokuai Foundation, Principal Investigator, Entry in 2008, Degradation of bacterial cell wall peptidoglycan

Kawai, Shigeyuki: Monbukagakusho Research Grant-in-Aid for Encouragement of Young Scientists (B), Principal Investigator, Entry in 2007, Molecular mechanism and physiological function of the regulation of NAD(H) and NADP(H) corresponding to the extracellular environment (refused for study abroad)

### **B. Educational Activities (2008.4-2009.3)**

#### **B-1. On-campus teaching**

a) Courses given

Undergraduate level: Food Microbiology (Murata); Basic and Applied Molecular

Biotechnology (Murata, Hashimoto); Introduction and Practice in Department of Food Science and Biotechnology (Murata, Hashimoto); Seminar on Food Science and Biotechnology (Murata, Hashimoto); Introduction to Foreign Literature II in Food Science and Biotechnology (Hashimoto, allotment); Laboratory Course in Microbiology (Hashimoto, allotment)

Graduate level: Food Production and Engineering (Advanced Course) (Murata, allotment); Molecular Biotechnology (Advanced Course) (Murata, Hashimoto); Molecular Biotechnology Seminar (Murata, Hashimoto)

### **C. Other remarks**

## 2.8 Chair of Comparative Agricultural Science

## 2.8 Laboratory of Comparative Agricultural Science

*Staff Professor : Hirai, Nobuhiro, Dr. Agric. Sci.*

*Associate Professor: Akamatsu, Miki, Dr. Agric.Sci.*

*Tanaka, Ueru, Dr. Agric. Sci. (Graduate School of Global  
Environmental Studies)*

*Miyake, Takeshi, Dr. Agric. Sci.*

*Students and research fellows*

*Master's program: (3)*

*Research student: (1)*

### A. Research Activities (2008.4-2009.3)

#### A-1. Main subjects

##### a) Chemical ecology of plants

Some ectomycorrhiza form a fairy ring which shows the circular formation of fruit body. The inside of the fairy ring of *Tricholoma* is a whitish mycelium-soil aggregated zone, and called “shiro”. The density of bacteria and fungi in the shiro is significantly lower than that of the outside of the shiro. The researchers of our University demonstrated in 1967 that the shiro had antimicrobial activity against bacteria. However, the antimicrobial compound(s) has been remained unclear. We identified an antimicrobial compound from the extract of *Pinus densiflora* roots forming ectomycorrhiza as a diterpene, totarol, and found localization of totarol in the root. Further analysis of the extract gave six diterpenes including a new one. The new diterpene was identified as (+)-(1*R*)-hydroxytotarol by the X-ray analysis of its *p*-bromobenzoyl derivative. The analysis of other *Pinus* group has shown occurrence of abietic acid and other diterpenes in *P. thunbergi*, *P. strous*, *P. bungeana*, and *P. parviflora*, but totarol was not found in these species, suggesting that totarol was a specific constituent in the root of *P. densiflora*. (Hirai)

##### b) Molecular technology of a plant hormone, abscisic acid

Abscisic acid (ABA) is an important plant hormone that induces adaptative responses in plants upon water stress and low temperature. However, the effect of ABA does not last since ABA is quickly inactivated by the degrading enzyme, ABA 8'-hydroxylase. The inhibitor of the hydroxylase may delay the inactivation of ABA to increase resistance of plants to environmental stress. We developed a hydroxylase inhibitor AHI 1 as an ABA

analog with the researchers at Shizuoka University. Twentysix analogs of uniconazole-P, a known inhibitor of the enzyme, were designed and synthesized. Several analogs showed the inhibitory activity on the hydroxylase and water stress tolerance of apple trees. The analog modified at C-4 of the benzen ring does not inhibit the P-450 enzymes involved in biosynthesis of gibberellins, suggesting that it is a highly selective inhibitor for the hydroxylase. We have started phylogenetic analysis and purification of the hydroxylase for identification of the hydroxylase gene. (Hirai)

c) Mechanism of substrate recognition by P-glycoproteins (P-gp: ATP-dependent efflux pump)

P-gp is one of ABC transporters and acts as an efflux pump with broad substrate specificity. To clarify the substrate recognition mechanism by P-gp based on QSAR analyses, screening of various pesticides and other compounds as P-gp substrates was carried out. As a result, it was shown that several pesticides were recognized as substrates of P-gp. In addition, one of cyclic peptides was likely to be a substrate of P-gp. (Akamatsu)

d) Mechanism of substrate recognition by cytochrome p450s (Enzymes involved in metabolism)

Human cytochrome p450s (CYPs) are primarily membrane-associated proteins, located either in the inner membrane of mitochondria or in the endoplasmic reticulum of cells. CYPs metabolize thousands of endogenous and exogenous compounds. Most CYPs can metabolize multiple substrates, and many can catalyze multiple reactions. To clarify the substrate recognition mechanism by CYPs based on QSAR analyses, firstly one kind of pesticides and CYP3A4 were used. Metabolites of the pesticide were isolated and purified. The chemical structures of the metabolites were also identified by NMR and LC/MS. (Akamatsu)

e) Analysis of pesticide residues in environment around the suburban agricultural fields of Bangkok

Used pesticides were surveyed at the suburban agricultural fields of Bangkok, Thailand, to know whether pesticides are used safely and appropriately. After 2003, river bottom and field soils around the area were sampled and pesticide residues in the samples were analyzed. A few pesticides were detected in several samples although the amount was small. In this year, we re-visited the places where relatively high amount of pesticides were detected last year. However, pesticide residues in the soils of the places were kept at the safety levels. (Akamatsu, Tanaka)

f) Studies on soil management systems and socio-ecological resilience in Semi-arid Africa (Niger, Burkina Faso and Zambia):

Field studies were conducted in the Sahel region of Niger, West Africa, to elucidate the characteristics of ecosystems, soils, local husbandry systems which lead approaches to ecologically sound land use systems, prevention of desertification and restoration of degraded lands. This year, system of risk management inherited in the local husbandry systems was analyzed through the researches on peoples' action to mitigate the damages caused by drought during the "years of crisis" in the past 20 years. In Zambia, southern Africa, mechanisms of "resilience" at household and land use levels were studied. (Tanaka)

g) Studies on rural development, environmental conservation and disaster management at human scale (Viet Nam)

Field studies were conducted in some villages of Central Viet Nam, where natural disaster frequently hits. Agro-ecological characteristics and local husbandry systems were described in order to design research/development project for participatory rural development, environmental conservation and disaster management. This year, the resilience of the community was evaluated through the utilization of local food resources and the food sufficiency. (Tanaka)

h) Genetic diversity and utilization of genetic resources of farm animals

A new association analysis method based on Bayesian estimation was established, which assumed two or more genes and the interactions between genes. Four responsibility genes of the marbling of Wagyu have been identified. By using the field records of carcass traits collected from several fattening farms, significant influences on the marbling of the responsibility genes are clarified based on the new method. Moreover, in order to analyze the genetic inheritance of racing pigeon, the computer program for the collection of the race results and pedigree information was developed. (Miyake)

## **A-2. Publications and presentations**

a) Publications

### ***Books***

Tanaka, U.: Environment and field reality – attitudes for field study -. In "Approaches of Global Environmental Studies", (ed. Team of Global Environmental Studies), Maruzen, p.235-242, 2008 (in Japanese)

### ***Original papers***

Kajikawa, M., Hirai, N. and Hashimoto, T.: A PIP-family reductase is required for biosynthesis of tobacco alkaloids. *Plant Mol. Biol.*, DOI 10.1007/s11103-008-9424-3, 2008

Todoroki, Y., Kobayashi, K., Yoneyama, H., Hiramatsu, S., Jin, M.-H., Watanabe, B., Mizutani, M. and N. Hirai: Structure-activity relationship of uniconazole, a potent

- inhibitor of ABA 8'-hydroxylase, with a focus on hydrophilic functional groups and conformation. *Bioorg. Med. Chem.*, 16; 3141-3152, 2008
- Ihara, M., Okajima, T., Yamashita, A., Oda, T., Hirata, K., Nishiwaki, H., Morimoto, T., Akamatsu, M., Ashikawa, Y., Kuroda, S., Mega, R., Kuramitsu, S., Sattelle, D.B., and Matsuda, K.: Crystal structures of *Lymnaea stagnalis* AChBP in complex with neonicotinoid insecticides imidacloprid and clothianidin. *Invert. Neurosci.*, 8; 71-81, 2008.
- Okamoto, Y., Tanaka, U., Mizuno, K., and Nguyen, P. N.: Seasonal changes of sediment environment and fishery resources management in Sam-An TruyenLago, Central Vietnam. *Agricultural systems*, 25(1), 71 – 78, 2009 (in Japanese)
- Hayashi, K., Abdoulaye, T., Matsunaga, R., Shinjo, H., Tanaka, U., Tobita, S. and Tabo, R. : Sustainable management of soil organic matter for agricultural land in the Sahel, West Africa, *Advances in Geocology*, 39, p.371-378, 2008
- Yamada, T., M. Itoh, S. Nishimura, Y. Taniguchi, T. Miyake, S. Sasaki S, S. Yoshioka, T. Fujita, K. Shiga, M. Morita, Y. Sasaki: Association of single nucleotide polymorphisms in the endothelial differentiation sphingolipid G-protein-coupled receptor 1 gene with marbling in Japanese Black beef cattle. *Anim. Genet.*, 40, 209-216, 2009
- Oki, H., T. Miyake, Y. Kasashima, Y. Sasaki: Estimation of heritability for superficial digital flexor tendon injury by Gibbs sampling in the Thoroughbred racehorse. *J. Anim. Breed. Genet.*, 125, 413-416, 2008

### **Reviews**

- Tamura, H., Hosoda, A., and Akamatsu, M.: Endocrine disruptors that disrupt the transcription mediated by androgen receptor. *J. Pestic. Sci.*, **33**; 33-39, 2008.

### **Reports**

- Hirai, N: Development of drugs for protecting plants from environmental stresses in the semi-arid land. Report (2007) for Monbu-kagakusho Research Grant [Scientific Research (B)]
- Isoi, T. and Tanaka, U.:Field research on areal characteristics and sustainable agriculture in Bhutan-Himalaya. Annual report of Maijo-Asian Study Institute, 36-39, 2008
- b) Conference and seminar papers presented
- The 2008 Annual Meeting of the Japan Society for Bioscience, Biotechnology, and Agrochemistry (Nagoya): 2 reports
- The 43rd Annual Meeting of Japanese Society for Chemical Regulation of Plants (Tsukuba): 3 reports
- The 2008 Annual Meeting of The Japanese Society for Horticultural Science (Tokyo): 1



report

The 52nd Annual Meeting on Chemistry of Terepene, Essential oils, and Aromatics  
(Itakura): 1 report

The Kansai Branch Meeting of the Japan Society for Bioscience, Biotechnology, and  
Agrochemistry: 1 report

The 34th Annual Meeting of Pesticide Science Society of Japan: 1 report

2007 meeting of Japanese Society of International Rural Development: 1 reports

2007 meeting of Japanese Society of Soil Science and Plant Nutrition: 4 reports

2008 meeting of Japanese society of tropical agriculture: 5 reports

Japanese Society of Animal Breeding and Genetics: 1 reports

### **A-3. Off-campus activities**

#### ***Membership in academic societies***

Hirai, N.: Japanese Society for Chemical Regulation of Plants (head of general secretary),  
Japan Society for Bioscience, Biotechnology, and Agrochemistry (councilor of the  
Kansai Branch, and editor of the English journal)

Akamatsu, M.: Pesticide Science Society of Japan (Board member), Division of  
Structure-Activity Studies, the Pharmaceutical Society of Japan (Board member)

Tanaka U.: Japanese Society of International Rural Development (Editorial board  
member)

Miyake, T.: Japanese Society of Animal Science, Japanese Society of Animal Breeding and  
Genetics (Member of organizing committee of new animal breeding seminar),  
Society of Beef Cattle Science (Secretary)

#### ***Research grant***

Hirai, N.: Monbukagakusyo Research Grant, Scientific Research (B): Development of  
drugs for protecting plants from environmental stresses in the semi-arid land  
(Hirai, Head)

Tanaka, U. : Monbukagakusyo Research Grant, Research (B): Approaches of hilizontal  
technoplogy transfer for controlling desertification in Semi-arid West Africa  
(Tanaka, Head)

### **A-4. International cooperations and overseas activities**

#### ***International meetings (roles)***

Hirai, N.: 236th ACS National Meeting (Philaderphia, USA, 1 general paper)

Akamatsu, M.: 20th International Symposium on Medicinal Chemistry, Vienna, Austria  
(general paper)

The 8th China-Japan Joint Symposium on Drug Design and Development, Kobe  
(organizing committee member, general paper)

2nd China-Japan Joint Workshop on Crop Health Chemistry, Kyoto (lecture)

***Memberships in international academic societies***

Hirai, N.: International Plant Growth Substances Association (member)

Akamatsu, M.: American Chemical Society

Tanaka, U.: International Society of Soil Science

Miyake, T.: American Society of Animal Science

***International joint researches, overseas research surveys***

Akamatsu, M.: Pesticide residue analysis in environment around the suburban  
agricultural fields of Bangkok (Bangkok, Thailand)

Tanaka, U.: Development of soil fertility management in Semi-arid tropical Africa (Niger),  
Studies on rural development, Environmental conservation and disaster  
management at human scale in central Viet Nam (Viet Nam), GSGES Asia  
Platform Project (Viet Nam), Socio-ecological resilience (Zambia),  
Agro-ecological study in Bhutan (Bhutan)

**B. Educational Activities (2008.4-2009.3)**

**B-1. On-campus teaching**

a) Courses Given

Undergraduate level: Scientific English (Agriculture) (Akamatsu, Tanaka), Discovery and  
Development of New Drugs (Department of Pharmaceutical Sciences (share,  
Akamatsu), Information Processing Basics (Agriculture) (Miyake), Biometrics  
Practice (Miyake)

Graduate level: Comparative Study of Resources and Environment (Akamatsu, Miyake),  
Comparative Agricultural Science (Hirai, Tanaka), Agriculture and Environment  
in Japan (Hirai, Akamatsu, Tanaka, Miyake)

**B-2. Off-campus teaching, etc**

***Part-time lecturer***

**B-3. Overseas teaching**

***Courses and lectures***

Akamatsu, M.: University of Illinois, Chicago Campus, Chicago, USA (lecture)

**C. Other Remarks.**

Hirai, N.: Member of committee of the Faculty level: Committee of International Exchange,

Counsellor for Harassment, Committee of Center for Ecology Research.

Others: Coordination of the beer project of Kyoto University-Waseda University-Kizakura, coordination of collaboration between the Graduate School of Agriculture and Kyoto Brighton Hotel, and coordination of collaboration between the Graduate Schools of Agriculture and Global Environmental Studies, and Kyoto Brighton Hotel, coordination of researchg meetings between the University researchers and company researchers.

Akamatsu, M.: Member of committee of the Faculty level: Committee of International academic exchange; The Ministry of Agriculture, Forestry, and Fisheries of Japan, tentative member of Councils of agricultural materials, pesticide division; The Ministry of Economy, Trade and Industry, tentative member of Councils of chemicals.

Tanaka, U.: Member of committee of the Faculty level: Committee of International academic exchange; Committee of KUINEP; Global Environmental Forum (member of advisory committee)

Miyake, T.: Research Evaluation Committee of the General Horseracing Institute of Japan Racing Association, Member of committee of the Faculty level: Committee of Technical Section of Information System in Graduate School of Agriculture; Technical Committee of Information Education in Kyoto University