# 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 17 laboratories in which 114 master students including 3 students from abroad and 68 Ph D. students including 13 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 : (3)* *JSPS Postdoctoral Fellow : (1)*
*Master's program: (7)* *JSPS Foreingn Research Fellow: (1)*
*Undergraduate : (1)*

#### A. Research Activities (2005.4-2006.3)

#### 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* bybridization 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 have been trying to shed light on the structure of the three wheat genomes by employing various molecular cytogenetic techniques. In order to characterize specific regions of wheat chromosomes efficiently, we have developed a high-throughput marker system derived from the AFLP (amplified fragment length polymorphism) technique. We have also been conducting molecular cloning experiments aimed at isolating genes encoding for centromeric proteins in wheat to elucidate the structure and function of the plant centromers. A major characteristic of wheat genomes is the abundance of repetitive elements. To reveal their structure

and evolutionary consequence in the genomes of wheat and its relatives, we are trying to clone and analyse species-specific repetitive elements.

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

***Original papers***

Yoshida, K. and N. T. Miyashita: Nucleotide polymorphissm in the *Adh2* region of the wild rice *Oryza rufipogon.* Theor. Appl. Genet 111; 1215-1228, 2005.

Miyashita, N. T., K. Yoshida and T. Ishii: DNA variation in the metallothionein genes in wild rice *Oryza rufipogon*: Relationship between DNA sequence polymorphism, codon bias and gene expression. Genes Genet. Syst. 80; 173-183, 2005.

Kawabe A. and S. Nasuda: Structure and genomic organization of centromeric repeats in *Arabidopsis* species. Mol. Genet. Genomics 272; 593-602, 2005.

Nasuda, S., S. Hudakova, I. Schubert, A. Houben and T. R. Endo: Stable barley chromosomes without centromeric repeats. Proc. Natl. Acad. Sci. USA 102; 9843-9847, 2005.

Ogihara Y, Y. Yamazaki, K. Murai, A. Kanno, T. Terachi, T. Shiina, N. Miyashita, S. Nasuda, C. Nakamura, N. Mori, S. Takumi, M. Murata, S. Futo and K. Tsunewaki: Structural dynamics of cereal mitochondrial genomes as revealed by complete nucleotide sequencing of the wheat mitochondrial genome. Nucleic Acids Res.33; 6235-6250, 2005.

Nasuda S, Y. Kikkawa, T. Ashida, A. K. M. Rafiqul Islam, K. Sato, and T. R. Endo: Chromosomal assignment and deletion mapping of barley EST markers. Genes Genet. Syst. 80; 357-366, 2005.

Masoudi-Nejad A, S. Nasuda, M.-T. Bihoreau, R. Waugh, and T. R. Endo: An alternative to radiation hybrid mapping for large-scale genome analysis in barley. Mol. Genet. Genomics 274; 589-594, 2005.

b) Conference and seminar papers presented

The 77th Annual meeting of the Genetic Society of Japan: 10 presentations

The 14th Chromosome Colloquium: 2 presentations

The 17th International Botanical Congress: 1 presentation

## A-3. Off-campus activities

***Membership in academic societies***

Endo, T.: Genetic Society of Japan (Editor-in-Chief)

Endo, T.: Genetic Resources Committee and Resource Center, National Institute of Genetics

(Member)

Miyashita, N.: Genetic Society of Japan (Council Board)

*Research grants*

Grant-in-Aid for Scientific Research from the Ministry of Education, Science, Sports and Culture (C) (Nasuda)

Japan Science and Technology Corporation Project (Endo, Nasuda)

National Bioresource Project (the Ministry of Education, Science, Sports and Culture) (Endo and Nasuda)

## A-4. International cooperations and overseas activities

*Scholars from abroad*

Kyoto University International Symposium (Beijing, China)

Dr. Andreas Houben (Germany)

## B. Educational Activities (2005.4-2006.3)

## 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*

Endo, T.: Faculty of Education, Kyoto University of Education (Genetics)

## B-3. Overseas teaching

*Students and research fellows from abroad*

Doctor's Program: one (Colombia)

JSPS Postdoctoral Fellow, Ali Masoudi-Nejad (Iran)

## 2.4.2 Laboratory of Crop Evolution

*Staff* *Professor* : *Ohnishi, Ohmi, Ph.D.*
*Associate professor* : *Kawahara, Taihachi, Dr. Agr. Sci.*
*Instructor* : *Yasui, Yasuo, Dr. Agr. Sci.*
*Research associate* : *Imai, Takehiro, Dr. Bio. Engi.*
*Students and research fellows:*
*Doctor's program: (2)*
*Master's program: (4)*

### A. Research Activities (2005.1-2005.12)

### A-1. Main subjects

a) Studies on the origin and evolution of cultivated plants

Buckwheat: This year we surveyed cultivated and wild buckwheat species in the Nu river and its tributary valleys of southeastern China. There found no wild ancestor of cultivated buckwheat, *Fagopyrum esculentum* ssp. *ancestrale* in the Nu river valley. Hence we can exclude the Nu river valley from the candidate of the original birthplace of common buckwheat (Now, the Lancan river valley and the Jinsha river valley are the strong candidate of the original birthplace of common buckwheat.). Both common and Tartary buckwheat were cultivated in the Nu river valley. The cultivated populations of the Nu river valley were phylogenetically distinct from those in the Lancan river and Jinsha river valleys, rather they are close to the cultivated populations from eastern Sichuan province. This implies that common buckwheat in the Nu river valley did not come from the adjacent Lancan river valley beyond high mountains, they probably recently came from the lower part of the Nu river.

As for *F. homotropicum*, both diploid and tetraploid cytotypes were growing as a mixed population in the Nu river valley. So the hypothesis that tetraploid F. homotropicum originated in northwestern corner of Yunnan province, and it diffused to cooler northward or to upper stream of big rivers must be reconsidered.

For the detailed analyses of phylogenetic relationships among *Fagopyrum* species and for the study of gene flow between cultivated and natural populations of common buckwheat, about 50 SSR markers have been developed. The study on gene flow between cultivated and natural populations of common buckwheat is now in progress.

Radish: Chloroplast SSR markers have been investigated for their variation among 82 accessions of cultivated and wild radish. Those accessions included wild radish in East Asia, *Raphanus raphanistrum* and *R. landra* from Europe and cultivated radish from Europe, India and the Himalayan region and Far East (China Korea and Japan). The experimental results showed that Spanish black radish situated quite different phylogenetic position from other cultivated radish, indicating distinct origin of Spanish black radish. European cultivated radish, *R. sativus* var. *sativus* and East Asian cultivated radish, *R. sativus* var. *hortensis* were also genetically distinct, indicating independent origin of these varieties. Studies on chlorophyll deficient and other detrimental genes concealed in natural populations of wild radish, *R. raphanistrum*, were conducted for Poland, and Italian populations this year.

b) Studies on the evolution of wheat and its wild relatives

*Ae. tauschii*: Variation of *Aegilops tauschii*, the D genome donor to hexaploid bread wheat was surveyed by using cpDNA SSR regions. We analyzed 20 SSR regions in 210 accessions of *Ae. tauschii* last year and examined, in addition, 240 accessions this year. Since our sample covers the whole distribution range, we will be able to discuss complete geographical distribution of variations in *Ae. tauschii* in near future.

Genus *Triticum* and *Aegilops*: Phylogenetic relationships of diploid and polyploid species belonging to *Triticum* and *Aegilops* have been estimated from cpDNA sequence. The same method was applied to study intraspecific variation in *Ae. mutica* and the variation was successfully resolved by total of 3.5kb cpDNA sequence data. This shows that cpDNA data can be used not only for species phylogeny but also for variations within species. Further, we revealed the evolutionary feature of *Triticum-Aegilops* chloroplast microsatellite sequence. Variability was not high in mononucleotide repeats below 9 but high variability was observed when the number of repeats excess 10.

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. Screening of the genomic library is now under progress. Since we have already got a clone closely linked (0.02 cM,) to the S gene, we are expecting to have clones closer than this in near future. We are also working towards the construction of transformants in common buckwheat.

d) Screening of useful genes in plant genetic resources

Screening of basic useful characteristics is indispensable for utilization of plant genetic resources. We checked spring vs. winter growing habit in 210 accessions of *Ae. tauschii*. We found several accessions with early and spring growing habit and started genetic analysis in these.

## A-2. Publication and presentation

a) Publication

***Original papers***

Kadosumi, S, T. Kawahara and T. Sasanuma: Multiple origins of U genome in two UM genome tetraploid *Aegilops* species, *Ae. columnaris* and *Ae. triaristata*, revealed based on the polymorphism of a genome-specific PCR fragment. Genes & Genetic Systems 80: 105-111. 2005.

Konishi T, Y. Yasui and O. Ohnishi: Original birth place of cultivated common buckwheat inferred from genetic relationships among cultivated populations and natural populations of wild common buckwheat revealed by AFLP analysis. Genes & Genetic Systems 80: 113-119. 2005.

Matsuoka, Y., N. Mori and T. Kawahara: Genealogical use of chloroplast DNA variation for intraspecific studies of *Aegilops tauschii* Coss. Theor. Appl. Genet. 111: 265-271. 2005.

Yamane K, and T. Kawahara: Intra- and interspecific phylogenetic relationships among diploid *Triticum-Aegilops* species based on base pair substitutions, indels and microsatellites in chloroplast non-coding sequences. American Journal of Botany 92: 1887-1898. 2005.

*Reports*

Kawahara, T.: Catalogue of *Aegilops-Triticum* Germ-plasm Preserved in Kyoto University, No. 3. Plant Germ-plasm Institute, Graduate School of Agriculture, Kyoto University. pp. 313. 2005.

b) Conference and seminar papers presented

107-8th annual meeting of the Japanese Society of Breeding: 4 papers

Annual meeting of the Japanese Society of Genetics in 2005: 1 paper

## A-3. Off-campus activities

*Membership of academic societies (roles)*

Ohmi Ohnishi and Taihachi Kawahara: Kihara Memorial Yokohama foundation for the Advancement of Life Sciences (Visiting researchers)

Ohmi Ohnishi: Japanese Society of Breeding (A member of Editorial Board)

*Research Grant*

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 (Kawahara, Yasui)

Grant-in-Aid from the Ministry of Education, Science, Sports and Culture for Exploratory Research: How to estimate plant phylogeny by using a novel plant SINE sequence, Au family (Kawahara, Yasui)

National Bioresource Project KOMUGI (the Ministry of Education, Science, Sports and Culture) (Kawahara, Yasui)

## A-4. International cooperation and oversea activities

*Membership in international academic societies*

Ohnishi, O.: Editor-in-Chief of FAGOPYRUM (International journal of IBRA), A member of the editorial board of Genetic Resources and Crop Evolution (the Netherlands)

Kawahara, T.: A member of the editorial board of Wheat Information Service (Japan)

*International joint Researches, oversea research surveys*

Ohnishi, O.: Field survey of cultivated and wild buckwheat species in the San Jiang area of southwestern China (China), Field survey of cultivated and wild Perilla in southern China (China)

Kawahara, T.: Studies on the variation of wheat and its relatives (Russia)

Yasui, Y.: Construction of AFLP linkage map in buckwheat (Germany)

## B. Educational Activities (2005.4-2006.3)

## B-1. On-Campus teaching

a) Courses given

Undergraduate level: Plant Genetic Resources (Ohnishi, Yasui)

Graduate level: Origin of Cultivated Plants (Ohnishi), Ethnobotany (Kawahara)

Seminar in Origin of Cultivated Plants (Ohnishi, Kawahara, Yasui)

Laboratory Course in Origin of Cultivated Plant (Ohnishi, Kawahara, Yasui)

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

*Part-time lecturer*

Ohnishi, O.: Fac. Agr. Okayama Univ. (Origin of Cultivated Plants), Grad. School of Agr. Kyoto Prefectural Univ. (Plant Genetic Resources), Fac. Agr. Kobe Univ. (Population genetics)

Kawahara, T.: Fac. Agr. Kyoto Prefectural Univ. (Genetics)

### B-3. Oversea teaching

*Students and research fellows from abroad*

Graduate student (1) from China

Research student (1) from Nepal

## 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.*

*Students and research fellows*

*Doctor's Program: (4)* *Undergraduate: (4)*

*Master's Program: (11)*

### A. Research Activities (2005.4-2006.3)

### 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 RNA into virions.

b) Identification of host factors involved in plant virus infection

Viruses utilize host proteins to establish infection in plants. Plant virus-encoded proteins are proposed to have some physical interactions with putative host-derived factors. Surveys for plant genes involved in RNA virus infections have been progressing by developing a PTGS-based

knock-out plant system and 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 lagenarium* that is the causal agent of cucumber anthracnose. Molecular genetic analysis has identified many genes involved in pathogenicity of *C. lagenarium*. Based on information about identified pathogenicity-related genes, we are especially focusing on relation of cellular signaling pathways and peroxisomal metabolic function with fungal infection mechanism. We are also studying nonhost resistance mechanism of plants using *Arabidopsis thaliana* and several *Colletotrichum* species that have different host ranges.

## A-2. Publications and presentations

a) Publications

***Original papers***


Mizumoto, H., H.-O. Iwakawa, M. Kaido, K. Mise and T. Okuno: Cap-independent translation mechanism of *Red clover necrotic mosaic virus* RNA2 differs from that of RNA1 and is linked to RNA replication. J. Virol. 80(8); 3781-3791, 2006

Takao, Y., K. Mise, K. Nagasaki, T. Okuno and D. Honda: Complete nucleotide sequence and genome organization of a single-stranded RNA virus (SssRNAV) infecting the marine fungoid protist *Schizochytrium* sp. J. Gen. Virol. 87(3); 723-733, 2006

Mori, M., H. Kitamura, A. Kondo, K. Dohi, M. Mori, M. Kaido, K. Mise, E. Shimojyo and Y. Hashimoto: Expression of an enhancin gene from the *Trichoplusia ni* granulosis virus confers resistance to lepidopterous insect pests to rice. Plant Biotechnol. 23(1); 55-61, 2006

Shimada, C., V. Lipka, R. O'Connell, T. Okuno, P. Schulze-Lefert and Y. Takano: Nonhost resistance in *Arabidopsis-Colletotrichum* interactions acts at the cell periphery and requires actin filament function. Mol. Plant-Microbe Interact. 19(3); 270-209, 2006

Takano Y., N. Takayanagi, H. Hori, Y. Ikeuchi, T. Suzuki, A. Kimura and T. Okuno: A gene involved in modifying transfer RNA is required for fungal pathogenicity and stress tolerance of *Colletotrichum lagenarium*. Mol. Microbiol. 60(1); 81-92, 2006

Furusawa, G., T. Yoshikawa, Y. Takano, K. Mise, I. Furusawa, T. Okuno and T. Sakata: Characterization of cytoplasmic fibril structures found in gliding cells of *Saprospira* sp. Can. J. Microbiol. 51(10); 875-880, 2005

Takeda, A., M. Tsukuda, H. Mizumoto, K. Okamoto, M. Kaido, K. Mise and T. Okuno: A plant RNA virus suppresses RNA silencing through viral RNA replication. EMBO J. 24(17); 3147-3157, 2005

Iwamoto, T., K. Mise, A. Takeda, Y. Okinaka, K.-I. Mori, M. Arimoto, T. Okuno and T. Nakai: Characterization of *Striped jack nervous necrosis virus* subgenomic RNA3 and biological activities of its encoded protein B2. J. Gen. Virol. 86(10); 2807-2816, 2005

Takao, Y., K. Nagasaki, K. Mise, T. Okuno and D. Honda: Isolation and characterization of a novel single-stranded RNA virus infectious to a marine fungoid protist, *Schizochytrium* sp. (Thraustochytriaceae, Labyrinthulea). Appl. Environ. Microbiol. 71(8); 4516-4522, 2005

Iwahashi, F., K. Fujisaki, M. Kaido, T. Okuno and K. Mise: Synthesis of infectious in vitro transcripts from *Cassia yellow blotch bromovirus* cDNA clones and a reassortment analysis with other bromoviruses in protoplasts. Arch. Virol. 150 (7); 1301-1314, 2005

Sasaki, N., M. Kaido, T. Okuno and K. Mise: Coat protein-independent cell-to-cell movement of bromoviruses expressing brome mosaic virus movement protein with an adaptation-related amino acid change in the central region. Arch. Virol. 150(6); 1231-1240, 2005

Takeda, A., W. Nakamura, N. Sasaki, K. Goto, M. Kaido, T. Okuno and K. Mise: Natural isolates of *Brome mosaic virus* with the ability to move from cell to cell independently of coat protein. J. Gen. Virol. 86(4); 1201-1211, 2005

Watanabe, T., A. Takeda, K. Mise, T. Okuno, T. Suzuki, N. Minami and H. Imai: Stage-specific expression of microRNAs during *Xenopus* development. FEBS Lett. 579(2); 318-324, 2005

Tatsuta, M., H. Mizumoto, M. Kaido, K. Mise and T. Okuno: The *Red clover necrotic mosaic virus* RNA2 trans-activator is also a cis-acting RNA2 replication element. J. Virol. 79(2); 978-986, 2005

Yoshimi A., K. Kojima, Y. Takano and C. Tanaka: Group III histidine kinase is a positive regulator of Hog1-type mitogen-activated protein kinase in filamentous fungi. Eukaryot. Cell 4(11); 1820-1828, 2005

***Reviews***

Takeda, A., K. Mise and T. Okuno: RNA silencing suppressors encoded by viruses of the family *Tombusvuridae*. Plant Biotechnology 22(5); 447-454, 2005

Takeda, A., K. Mise and T. Okuno: Plant Virus and RNAi. (Seminar. RNAi research in plant science—5) Chemistry and Biology. 43(7); 468-475, 2005 (in Japanese)

Mise, K., K. Fujisaki, N. Sasaki, A. Takeda, F. Iwahashi, S. Tsuji, M. Kaido and T. Okuno: Molecular analyses of host specificity in bromovirus infection in plants: Mechanisms of Host Specificity in Plant-Microbe Interactions. PSJ Plant-Microbe Interactions Symposium Report Vol. 41; 101-110. 2005 (in Japanese)

Takano, Y.: Infection mechanism of phytopathogenic fungi and peroxisome. Chemistry and Biology. 43(7); 422-423, 2005 (in Japanese)

b) Conference and seminar papers presented

Annual Meeting of the Phytopathological Society of Japan: 11 presentations

Kansai Meeting of the Phytopathological Society of Japan: 4 presentations

Annual Meeting of the Molecular Biology Society of Japan: 1 presentation

## A-3. Off-campus activities

***Membership in academic societies***

Okuno, T.: The Phytopathological Society of Japan (Councilor), The Japanese Society for Virology (Director), The Molecular Biology Society of Japan, The RNA Society of Japan, The Kansai Plant Protection Society (Editor in chief)

Mise, K.: The Phytopathological Society of Japan, The Japanese Society for Virology, The Molecular Biology Society of Japan

Takano, Y.: The Phytopathological Society of Japan, The Molecular Biology Society of Japan The Kansai Plant Protection Society (Editorial Manager)

Kaido, M.: The Phytopathological Society of Japan

*Research grants*

Grant-in-Aid for Scientific Research from the Ministry of Education, Culture, Sports, Science and Technology, Japan: Grant-in-Aid for Scientific Research in Priority Areas (A)(1) (Okuno, head), Grant-in-Aid for Scientific Research in Priority Areas (A)(1) (Takano, member), Grant-in-Aid for Young Scientists (B) (Kaido, head)

Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science: Grant-in-Aid for Scientific Research (B) (Mise, head)

## A-4. International cooperations and overseas activities

*International meetings (roles)*

The 13th International Congress of Virology, 7.23-28 (2005) San Francisco, CA, USA, 2 poster presentations (Okuno, Mise, Kaido).

The 12th International Congress on Molecular Plant-Microbe Interactions, 12.14-18 (2005) Merida, Mexico, 2 poster presentations (Okuno, Mise, Kaido), 2 poster presentations (Okuno, Takano)

# B. Educational Activities (2005.4-2006.3)

## B-1. On-campus teaching

a) Courses given

Undergraduate level: Plant Pathology I (Okuno), Plant Pathology II (Mise), Seminar in Plant Protection (Okuno), Biotechnology-Novel Strategies for Agriculture (Okuno), Basic Bioresource Science II (Okuno), Microbiology (Okuno), Outline of Bioresource Science IV (Mise, Takano), Laboratory Course in Bioresource Science I, II (Okuno, Mise).

Graduate level: Plant Pathology (Advanced Course) II (Mise), Seminar in Plant Pathology (Okuno, Mise, Takano), Research in Plant Pathology (Okuno, Mise, Takano).

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

*Part-time lecturer*

Okuno, T.: University of Tokyo (Plant Virology), Kobe Plant Protection Station (Plant Pathology)

Mise, K.: Kyoto Institute of Technology (Plant Pathology)

# C. Other remarks

Okuno, T.: The Safety Committee of Kyoto University for Recombinant DNA Experiments, The Steering Committee of Kyoto University Museum, A special research scientist in the Research Center for Science System in Japan Society for the Promotion of Science

Mise, K.: The Committee of Graduate School of Agriculture for the Prevention of Radiation Injury

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*
*Doctor's program : (15)*
*Master's Program : (9)*
*Undergraduate: (7)*
*Post doctoral fellow: (6)*

### A. Research Activities (2005.4-2006.3)

### 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) In Batesian mimicry, mimetic forms of some species are female limited, other species are male limited, whereas the other species are not sex limited. To explain these phenomenon, trade-offs between predation by avian predators and sexual selection are analyzed.

d) Indirect effect of predation on long-term population dynamics - Field observations and laboratory experiments have gradually revealed that prey often suffers more from indirect 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 interspecific competition – Theoretical studies have revealed that reproductive interference between closely related species can explain a wide spectrum of ecological phenomena, such as host range, habitat selection, and geographic distribution in herbivorous insects.

## A-2. Publications and presentations

a) Publications

*Books*

Imai, K.: A protective mechanism in the host plant, Aucuba, against oviposition by the fruit gall midge, *Asphondylia aucubae* (Diptera: Cecidomyiidae) in GALLING ATTHROPODS AND THEIR ASSOCIATES ed. Ozaki, K., Yukawa, J., Ohgushi, T., and Price, P. W., p169-176, Springer, Tokyo.

Nishida, T.: Ecological implication of presence of predators in nature. In BIOHISTORY 2005, p112-119, Shinyosha, Tokyo.

*Original papers*

Egusa S., T. Nishida, K. Fujisaki & H. Sawada: Factors contributing to the seasonal occurrence of the willow leaf beetle *Plagiodera versicolora*. Population Ecology 47: 99-105, 2005

Himuro, C., T. Hosokawa & N. Suzuki: An alternative mating strategy of small male *Megacopta punctatissima* (Hemiptera: Plataspidae) in the presence of large intraspecific males. Annals of Entomological Society of America (in press)

Honma, A., S. Oku, and T. Nishida : Adaptive significance of death-feigning posture as a specialized inducible defense against gape-limited predators. Proceedings of the Royal Society of London B. 273:1631-1636, 2006

Ide, J.: Inter- and intra-shoot distributions of caterpillars of the ramie moth, *Arcte coerulea* (Lepidoptera: Noctuidae), in ramie shrubs. Applied Entomology and Zoology 41 (1): 49-55, 2006

Ide, J.: Sexual and seasonal differences in the frequency of beak marks on the wings of two Lethe butterflies. Ecological Research 21:453-459, 2006

Iida H. & K. Fujisaki: Adaptive significance of the gregarious phase in nymphs of a wolf spider, *Pardosa pseudoannulata* (Araneae: Lycosidae). Applied Entomology and Zoology 40: 649-657, 2005

Imai, K. & N. Ohsaki: Density-dependent egg mortality in early stages of gall induction by the fruit gall midge Asphondylia aucubae Yukawa et Ohsaki. Ecological Research, (in Press)

Imai, K. & N. Ohsaki: Loss of integument in maturing fruits prevents gall induction by the midge, Asphondylia aucubae (Cecidomyiidae: Diptera). Environmental Entomology, (in Press)

Kishi M., K. Fujisaki & T. Harada: How do water striders, *Aquarius paludum*, react to brackish water simulated by NaCl solutions? Naturwissenschaften 93: 33-37, 2006

Lopez Ruf M., P. J. Perez Goodwyn & R. G. Martins Neto : New Naucoridae, and Gelastocoridae, (INSECTA, HEMIPTERA HETEROPTERA) from the Santana Formation, Lower Cretaceous (Northeastern Brazil). Acta Geoloica, 2005

Musolin D.L.: The southern green bug Nezara viridula (L.) expands its distribution range, not only in the U.K. Newsletter of the Heteroptera Recording Schemes 5: 2-3, 2005

Musolin D.L.: Insects in a warmer world: Ecological, physiological and life-history responses of Heteroptera to climate change. Global Change Biology Vol. 12, (in press)

Muzon, J., G.R. Spinelli, P. Pessaco, N. von Ellenrieder, A. L. Estevez, P. I. Marino, P. J. Perez Goodwyn, E. B. Angrisano, F. Diaz, L. A. Fernandez, S. Mazzucconi, G., Rossi & O. D. Salomon: Insectos acuáticos de la meseta del Somuncurá, Patagonia, Argentina. Inventario preliminar. Rev. Soc. Entomol. Argent. 64 (3-4): 120-141, 2005

Ohsaki N.: A common mechanism explaining the evolution of female-limited and both-sex

Batesian mimicry in butterflies. Journal of Animal Ecology 74: 728-734, 2005

Perez Goodwyn, P.J.: Taxonomic revision of the subfamily Lethocerinae Lauck & Menke (Heteroptera: Belostomatidae). Stuttgarter Beiträge zur Naturkunde Ser. A. 474, 2006

Perez Goodwyn, P.J., A. Peressadko, V. Kastner, H. Schwarz, & S. N. Gorb: Material structure, stiffness and adhesion: Why attachment pads in the grasshopper (*Tettigonia viridissima*) adhere stronger than in the locust (*Locusta migratoria*) (Insecta: Orthoptera)? Journal of Comparative Physiology. Vol. 192, (in press)

Shimizu K. & K. Fujisaki: Timing of diapause induction and overwintering success in the cotton bollworm *Helicoverpa armigera* (Hb.) (Lepidoptera: Noctuidae) under outdoor conditions in temperate Japan. Applied Entomology and Zoology: Vol. 41 (1): 151-159, 2006

Tanaka, S. & N. Ohsaki.: Behavioral manipulation of hostcaterpillars by the primary parasitoid wasp Cotesia glomerata (L.) to construct defensive webs against hyperparasitism. Ecological Research 21:570-577, 2006.

Yoshimoto J., T. Kakutani & T. Nishida: Influence of resource abundance on the structure of the insect community attracted to fermented tree sap. Ecological Research 20: 405-414, 2005

Yoshinaga, N., K. Kimihiko, C. Kageyama, K. Fujisaki, R. Nishida and N. Mori: Ultraweak photon emission from herbivory-injurerd maize plants. Naturwissenschaften 93: 38-41, 2006

b) Conference and seminar papers presented

The 49th Annual Meeting of Japanese Society of Applied Entomology and Zoology: 17 presentations

The 52st Annual Meeting of Ecological Society of Japan: 19 presentations

The 22nd Symposium of Population Ecology: 8 presentations

The 4th International Symposium of Gall Forming Insects, Kyoto: 2 presentations

The First International Symposium on the Environmental Physiology of Ectotherms and Plants. Roskilde, Denmark: 1 presentation

The 2nd International Symposium of Entomological Center of Excellence "Innovative Food and Environmental Studies Pioneered by Entomomimetic Sciences". Kyoto, Japan: 2 presentations

5th Asia-Pacific Congress of Entomology. Jeju, Korea: 1 presentation

The Second Japan-Switzerland Workshop on Biomechanics, Kyoto: 1 presentation

Tsukuba NIMS mini-Workshop "Nature Inspired Materials", Tsukuba: 1 presentation

## A-3. Off-campus activities

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

Fujisaki, K.: The Japanese Society of Applied Entomology and Zoology (Executive Committee Member), The Society of Population Ecology (President, Editor)

Ohsaki, N.: The Japanese Society of Ethology (Editor)

Nishida, T.: Ecological Society of Japan (Editor), The Entomological Society of Japan (Editor)

***Research Grant***

21st century COE program: Innovative food and environmental studies pioneered by entomomimetic sciences (Fujisaki, K. project leader).

JSPS grant for foreign researchers: Biomechanical studies on the locomotion systems of watestriders on water surface

Monbu-kagakusyo Research Grant: Scientific Research (C) (2) Effects of parasitoids on the evolution of host range of Pieris butterflies (Ohsaki, N.)

Scientific Research: Nonlethal effects of predation on the community structure of grasshoppers in old fields (Nishida, T.)

## A-4. International cooperations and overseas activities

***International joint research, overseas research surveys***

Fujisaki, K. Integrated biological control of *Pueraria thunbergiana* and *Polygonum perfoliatum*, invasive alien weeds in USA (USDA)

***Scholars from abroad***

JSPS research fellow (Argentina)

COE foreign researcher (Russia)

## B. Educational Activities (2005.4-2006.3)

## B-1. On-campus teaching

a) Courses given

Undergraduate level: Insect ecology l (Fujisaki), Introduction to general bio-resource science II (Fujisaki), Biology of biosphere (Fujisaki), Insect ecology II (Ohsaki), Laboratory course in bio-resource science I and II (Ohsaki, Nishida), Seminar in plant protection (Fujisaki, Ohsaki)

Graduate level: Insect evolutionary ecology (Ohsaki), Seminar in insect ecology (Fujisaki, Ohsaki), Research in insect ecology (Fujisaki, Ohsaki)

## B-2. Off-campus teaching

Part-time lecturer

Fujisaki, K.: Kobe University

Ohsaki, N.: Nagoya University

## 2.4.5 Laboratory of Insect Physiology

*Staff* *Professor* : *Sakuma, Masayuki, Dr. Agric. Sci.*
*Associate Professor:*
*Assistant Professor* : *Fukui, Masao, Dr. Agric. Sci.*
*Technical Staff* : *Suzuki, Mieko*
*Students and research fellows*
*COE Postdoctoral Fellow: (1)*
*Doctor's program* : *(3)*
*Master's program* : *(5)*
*Undergraduate* : *(4)*

### A. Research Activities (2005.4-2006.3)

### A-1. Main subjects.

Notwithstanding their simple organization, the insects interact with environment by sophisticated behaviour. We are studying the unique mechanisms of sensory-motor system of insects and other arthropods, aiming for bio-mimetic engineering as well as insect pest control. 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-compensators (LC), such as a servo sphere LC, a micro LC, and a flight simulator, for precise analysis of sensory-motor context in insects and other arthropods. Since these apparatuses 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 behaviour.

The origin of chemo-orientation behaviour 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.

We are developing a flight simulator for aviatory insects to survey sensori-motor contexts in flight. A tethered test insect is allowed to flap freely in the simulator, where a flowing pattern is displayed on a surrounding screen. Both the visual and olfactory cues steer the insect, so the simulator is now designed to control both cues to steer the insect autonomously.

b) Study on the odour discrimination mechanisms in insects

After convergence, insect's olfactory system represents great similarity to that of mammals. For the system analysis, however, it is advantageous to examine insect's neural network rather than mammals, because of far reduced number of nerve cells. We have been investigating the neural network in the micro-brain of the American cockroach, *Periplaneta americana*, in particular the antennal lobe inter-neurons responding to sex pheromones and general odours such as lower alkyl alcohols.

c) Odour learning in insects

The odour-associative learning of the German cockroach has been demonstrated for the first time. The insect exhibited odour-conditioned upwind anemotaxis in a servosphere apparatus after

being trained for general odour, whereas it always did for the odour of aggregation pheromone.

d) Study on the semiochemicals of insects

Although the American cockroach has already been established as an experimental animal, its semiochemicals have not identified except for its sex pheromone. We started to isolate and identify the aggregation attractant and arrestant pheromones of the species, not only for specifying the relevant neural network but also for the application purpose. For the similar reason, the attractants of the mould mite have been extracted and purified from dry yeast for identification.

e) Study on the evolution of signals relevant to sexual selection

We examined effects of female preference on male song evolution in three *Teleogryllus* sibling species. A previous study of field crickets *Teleogryllus yezoemma* (*T-y*), *T. emma* (*T-e*), and *T. taiwanemma* (*T-t*) suggested that calling songs of the species are effective for species recognition and pre-mating isolation. Males of two allopatric species (*T-y*, *T-t*) with similar songs were preferred by females of other species. A *T-e* male song was discriminated by females of the two species. The *T-y* female uses absolute measurement of the pulse interval duration to recognize male calls, whereas *T-e* and *T-t* females use the pulse rate. Crickets also use a courtship song when mating. Results of playback experiments with courtship songs showed that the *T-y* female is attracted to the courtship songs of partially sympatric species *T-e* and its allopatric species *T-t*. These results suggest that the courtship song contributes little to species recognition at least by *T-y*. These results indicated the close relation between *T-y* and *T-t*.

When on their host plants, male leafhopper *Nephotettix nigropictus* (Insecta; Hemiptera) produce substrate-borne signals to communicate with a female. After receiving a vibrational reply from a female responding to the calling signal, the calling male increases several components of the calling signal then continues in a duet with the female. The function of these signals, both influencing pair formation and the female's willingness to mate, is under study.

## A-2. Publications and presentations

a) Publications

***Books***

Sakuma, M.: Bioassay Methods of Insect Behaviour - From Olfactometers to a Virtual Attractant Odour Source. In *Application of Biotechnology to Sustainable Agricultural Ecosystem.* p.108-134, Yokendo, Tokyo, 2006. (in Japanese)

***Original papers***

Fukui, M., S. Nakao: How do male leafhopper *Nephotettix nigropictus* induce the willingness of females to mate ? Trans. Tech. Common. Psychol. Physiol. Acoustic., The Acoustic Society of Japan **35**(3); 219-224, 2005 (in Japanese)

***Proceedings***

Fukui, M.: Mating signals of the male leafhoppers, Nephotettix nigropictus. – Are these signals used only in the willingness of female to mate. Proceedings of 2005 Autumn Meeting Acoustical Society of Japan. P791-794, 2005 (in Japanese)

b) Conference and seminar papers presented

The 2nd International Symposium of Entomological Science COE "Innmovative food and environmental studies pioneered by entomomimetic sciences": 5 presentations

2005 Autumn Meeting of the Acoustical Society of Japan, Sendai, September 2005: 1presentation

(invited)

The 50th Annual Meeting of Japanese Society of Applied Entomology and Zoology, Tsukuba, March 2006: 2 presentations

## A-3. Off-campus activities

***Research grants***

21th Century COE program: COE for Innovative Food and Environmental Studies Pioneered by Entomomimetic Sciences (Sakuma).

Sakuma, M.: Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science: Grant-in-Aid for Scientific Research (C) (2) (Sakuma, head)

## A-4. International cooperation and overseas activities

***International meetings***

5th Asia-Pacific Congress of Entomology, Jeju, Korea : 2 presentations (Sakuma, M. invited)

## B. Educational Activities (2005.4-2006.3)

## 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)

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

***Part-time lecturer***

Sakuma, M. Faculty of Agriculture, Kobe University, (Integrated Pest Management Course II for JICA students)

Fukui, M. Faculty of Engineering, Kyoto Sangyo University, (Fundamentals of Biological Experiments)

# Chair of Animal Genetics and Reproduction

## 2.4.6 Laboratory of Animal Breeding and Genetics

*Staff* *Professor* : *Sasaki, Yoshiyuki, Dr. Agric. Sci.*
*Associate Professor: Yamada, Takahisa, Dr. Medic. Sci.*
*Assistant Professor : Taniguchi, Yukio*
*Assistant Professor : Miyake, Takeshi*
*Students and research fellows*
*Doctor's program : (2)*
*Master's program : (3)*
*Undergraduate : (3)*

### A. Research Activities (2005.4-2006.3)

### A-1. Main subjects

a) Studies on Genetic Evaluation Procedure and Breeding Scheme for Beef Cattle

Aiming at the development of the national sire evaluation system for Japanese Black cattle, the genetic evaluation method was developled, which accounts for the heterogeniety of variances across subclasses for fixed effects. With the method, the impact of the heterogeniety on the comprehensive evaluation using multiple traits was investigated. Furthermore, By using the field records collected from the two Japanese Black populations (Oita and Hyogo prefectures) and one Japanese Brown population (Kumamoto) during 1988 to 2003, the genetic trends for the carcass traits of Wagyu were clarified. Based on the comparisons of the genetic gains among different breeding programs, the effectiveness of the genetic evaluation method based on field records was clearly elucidated.

b) Studies on Analysis of Quantitative Trait Loci in livestock animals

In order to detect the quantitative trait loci (QTL) for the beef marbling of Japanese Black cattle in Oita prefecture, beef cattle, MQEM-HS method which is the multiple QTL mapping method with epistatic interactions for the half-sib families was developed and applied. The method detected four QTLs with main effects and one epistatic QTL pairs, which was the first case for detecting epistatic QTL pairs for the economically important traits in beef cattle. The linkage disequilibrium between genetic markers was investigated using dense markers in the Japanese Brown population, suggesting the linkage disequilibrium mapping would be useful for the fine mapping of QTLs in the population.

c) Exploration of the Genes Responsible for Beef Marbling

Of the 35 annotated genes of which expression pattern is different and coincident with the process of intramuscular fat accumulation between the two groups of the high-marbled Japanese Black and the low-marbled Holstein steers, the 5 genes (*BTG2*, *WBP2*, *VAPA*, *TTN*, and *EDG1*) have been considered as candidates for beef marbling genes. Genomic structures of the *BTG2*, *WBP2*, *VAPA*, and *EDG1* genes were clarified by cloning and sequencing. Two (-71 bp and +1,702 bp in promoter region), three (-1,723 bp in promoter region, +524 bp in coding region, and +1,192 bp in 3'-untranslated region), and two (+166 bp in 5'-untranslated region and +3,698 bp in

3'-untranslated region) SNPs were found in the *WBP2*, *VAPA*, and *EDG1*, respectively, between high-marbled Japanese Black cattle and low-marbled Holstein cattle, which were used for expression profiling. Any SNPs were not detected in the *BTG2*. The SNPs in the *WBP2* and *VAPA* showed no association with marbling trait. Interestingly, a haplotype comprising *G* allele at +166 bp and *A* allele at +3,698 bp in the *EDG1* was associated with high-marbled phenotype in Japanese Black breed, while another comprising +166 bp *A* allele and +3,698 *G* allele with low-marbled phenotype. Therefore, it is reasonable to conclude that the *EDG1* polymorphism is responsible for controlling beef marbling in Japanese Black cattle breed.

d) Study on the Molecular Mechanism Underlying Marbling in Beef

To study the molecular mechanism of intramuscular-adipogenesis in beef cattle, the temporal and spatial expression patterns in bovine longissimus muscle tissue of transcription factors, membrane proteins and extracellular matrix proteins regulating the adipogenesis, were investigated using molecular biological and immunohistochemical methods. To establish the mouse model showing intramuscular fat deposition, transgenic mice expressing the bovine *ADAM12* gene specifically in muscle tissue were produced and their phenotypes were analyzed.

e) Study on Genetic Dissection of Marbling Traits in Mouse or Rat Model

To identify a positional candidate gene, *Pnlip*, as the gene responsible for intramuscular fat deposition, genetic analysis has been performed using OLETF rat model. We genotyped the VNTR polymorphism in *Pnlip* promoter of 15 inbred rat strains which exhibit no excess fat deposition. All of the strains possessed the same shorter allele as that of the F344, providing circumstantial evidence that *Pnlip* is causal gene.

## A-2. Publications and presentations

a) Publications

***Original papers***


Ibi, T., H. Hirooka, A. K. Kahi, Y. Sasae and Y. Sasaki: Genotype x environment interaction effects on carcass traits in Japanese Black cattle. J. Anim. Sci. 83; 1503-1510, 2005

Ibi, T., T. Miyake and Y. Sasaki: Estimation of heritability for defects of beef carcass using Gibbs Sampling in Japanese Black cattle. Bull. Beef Cattle Sci. 80; 69-73, 2005

Ito, M., K. Moriya and Y. Sasaki: Effects of age of dams on productivity of their progeny in beef cattle. Bull. Beef Cattle Sci. 80; 63-68, 2005

Muramatsu, Y., T. Yamada, Y. Taniguchi, T. Ogino, H. Kose, K. Matsumoto and Y. Sasaki: Pnlip encoding pancreatic lipase is possible candidate for obesity QTL in the OLETF rat. BBRC 331; 1270-1276, 2005

Okano, K., M. Kitagawa, Y. Sasaki and T. Watanabe: Conversion of Japanese red ceder (Crytomeria japonica) into a feed for ruminants by white-rot basidiomycetes. Anim. Feed Sci. Technol. 120; 235-243, 2005

Oki, H., T. Miyake, T. Hasegawa and Y. Sasaki: Estimation of heritability for tying-up syndrome in the Thoroughbred racehorse by Gibbs sampling. J. Anim. Breed. Genet. 122; 289-293, 2005

Oishi, M., H. Gohma, K. Hashizume, Y. Taniguchi, H. Yasue, S. Takahashi, T. Yamada and Y. Sasaki: Early embryonic death-associated changes in genome-wide gene expression profiles in the fetal placenta of the cow carrying somatic nuclear-derived cloned embryo. Mol. Rep. Dev., 73; 404-409, 2006

Sasaki, Y., T. Miyake, C. Gaillard, T. Oguni, M. Matsumoto, M. Ito, T. Kurahara, Y. Sasae, K. Fujinaka, S. Ohtagaki and T. Dougo: Comparison of genetic gains per year for carcass traits among breeding programs in the Japanese Brown and the Japanese Black cattle. J. Anim. Sci. 84; 317-323, 2006

Sasaki, Y., K. Nagai, Y. Nagata, K. Doronbekov, S. Nishimura, S. Yoshioka, T. Fujita, K. Shiga, T. Miyake, Y. Taniguchi and T. Yamada: Exploration of genes sowing intramuscular fat deposion-associated expression changes in Musculus longissimus muscle. Anim. Genet. 37; 40-46, 2006

*Reviews*

Sasaki, Y.: Breeding sires based on sire evaluation systems using field records: Production for the superior new sires beyond excellent old sires. Art. Insem. Livest. 232; 13-21, 2006

*Reports*

The Development Group for the Beef Cattle Breeding System Based on Field Records (Chair: Y. Sasaki): Development of the genetic evaluation systems using field records and its utiliaztions (Highest award in the section of research and development). The Annual Grand Prize to the Best Stock Raisen, Japan Livestock Industry Association, p.47-61, 2006

Sasaki, Y.: Memories for the establishment of the Japanese Society of Animal Breeding and Genetics. J. Anim. Genet. 32; 153-160, 2005

Sasaki, Y.: Gene diagnosis for beef marbling. Patented. Pending number 2006-080720, 2006

b) Conference and seminar papers presented

The 105th Annual Meeting of Japanese Society of Animal Science : 3 presentations

The 106th Annual Meeting of Japanese Society of Animal Science : 6 presentations

The 6th Annual Meeting of Japanese Society of Animal Breeding and Genetics : 5 presentations

The 43th Annual Meeting of the Society of Beef Cattle Science : 3 presentations

Combined symposium with the Society for Animal Breeding, Japanese Society of Animal Breeding and Genetics, and Society of Domestic Animal Sicence: 1 presentation

## A-3. Off-campus activities

*Membership in academic societies*

Sasaki, Y: Japanese Society of Animal Science (Representative), Society of Beef Cattle Science (President), Animal Science Systems Society (Director), Kinki Committee of New Technology for Bioscience in Agriculture, Forestry, Fisheries and Food (Chairman)

*Membership in Science Council of Japan, etc*

Sasaki, Y.: Communication Committee for Research of Genetic Resources (Member), Technical Committee for Reformation of Agricultural Production (Member)

*Research grants*

Monbusho research grant; Grant-in-Aid for Scientific Research (B) (2) Exploration of genes responsible for marbling using somatic nuclear cloning technology (Head: Sasaki, Sharer: Yamada, Taniguchi), Grant-in-Aid for Scientific Research (C) Establishment of mouse model showing intramuscular fat deposition by introducing the bovine *ADAM12* gene (Head: Taniguchi)

Grant-in-Aid-(Bio Design Program) from National Agricultural Research Organization; Spatial regulation of intra-muscular adipocyte differentiation in beef marbling (Head: Sasaki)

Grant-in-Aid-(Bio Design Program) from National Agricultural Research Organization; Exploration of genes involved in developmental abnormality in somatic nuclear cloned animals (Head: Sasaki)

## A-4. International cooperations and overseas activities

***Membership in international academic societies***

Sasaki, Y.: World Congress on Genetics Applied to Livestock Production (Permanent Committeeman), The 29th International Conference on Animal Genetics (Chairman of the Organizing Committee), Journal of Animal Breeding and Genetics (Editor), Asian-Australasian Journal of Animal Science (Section Editor), Bioimaging Society (Editor)

## B. Educational Activities (2005.4-2006.3)

## B-1. On-campus teaching

a) Courses given

Undergraduate level: Outline of Agricultural Science II (Sasaki et al.), Outline of Bioresource Science II (Sasaki et al.), Animal Breeding and Genetics (Sasaki), Animal Breeding (Sasaki), Introduction to Foreign Literature in Bioresource Science IV (Sasaki and Yamada et al.), Basic Laboratory Course in Bioresource Science I, II (Sasaki, Yamada, Taniguchi, Miyake et al.), Technology theory of Animal Husbandry and Practice II (Sasaki, Yamada, Taniguchi, Miyake et al.), Laboratory Course in Bioresource Science I, II (Sasaki, Yamada, Taniguchi, Miyake et al.), Molecular Biology (Yamada), Seminar in Applied Animal Science I, II (Yamada et al.), Domestic Animal Genome Science Biotechnology (Yamada et al.)

Graduate level: Animal Breeding and Genetics (Sasaki), Animal Genomics (Yamada), Seminar in Animal Breeding and Genetics (Sasaki, Yamada), Laboratory Course in Animal Breeding and Genetics (Sasaki, Yamada)

## B-3. Overseas teaching

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

Doctor's program: 1 (Kyrgyz Republic)

## C. Other remarks

Sasaki, Y.: Promotion Conference on Research Project, "Development of Efficient Basic Technology in Fisheries Breeding" in the Ministry of Agriculture, Forestry and Fisheries (External Assessment Committeeman), Committee for Beef Cattle Genomic Research, Development and Promotion in Livestock Technology Association (Member), Agricultural Establishment Research Committee of Kinki, Chugoku, Shikoku Region in National Agriculture and Bio-oriented Research Organization (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.*
*Assistant Professor : Nagao, Yasumitsu, Ph. D.*

*Students and research fellows*
*Doctor's program: (4)* *Master's program : (8)*
*Undergraduate : (3)* *Research student: (1)*

### A. Research Activities (2005.4-2006.3)

### 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, the genes and the 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 the differentiated cells acquire the 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 embryonic stem cells and production of transgenic animals

Development of techniques to establish the embryonic stem cell having totipotency from mammalian embryos are undertaken. Reconstitution of embryos and production of transgenic animals using the stem cells are studied. We are intending to utilize the embryonic stem cells to apply the transgenic technique directly to chromosome for the improvement of livestock animals.

d) Relationship between mitochondria and phenotype of the mouse

Effects of mitochondria derived from different species on the phenotype of the mouse are examined using individuals produced by microinjection or nuclear transfer. In addition, the interaction between mitochondria of different species and cell nuclear is examined using cell and molecular biological techniques.

### A-2. Publications and presentations

a) Publications

*Original papers*

Tsukamoto, S., R. Ihara, A. Aizawa, S. Kishida, A. Kikuchi, H. Imai and N. Minami: Oog1, an oocyte-specific protein, interacts with Ras and Ras-signaling proteins during early embryogenesis. Biochem. Biophys. Res. Commun. 343:1105-1112 (2006).

Hoshino, Y., M. Uchida, Y. Shimatsu, M. Miyake, Y. Nagao, N. Minami, M. Yamada and H. Imai: Developmental competence of somatic cell nuclear taransfer embryos reconstructed from oocytes matured in vitro with follicle shells in minature pig. Cloning and Stem Cells 7:17-26 (2005).

Dateki, M., Horii, T., Kasuya, Y., Mochizuki, R., Nagao, Y., Ishida, J., Sugiyama, F., Tanimoto, K., Yagami, KI., Imai, H. and Fukamizu, A.: Neurochondrin Negatively Regulates CaMKII Phosphorylation, and Nervous System-specific Gene Disruption Results in Epileptic Seizure. J. Biol. Chem., 280: 20503-20508 (2005)

*Patents*

Imai, H., Y. Hoshino, M. Miyake, M. Uchida and M. Shimazu: Methods of efficient production of nuclear transfer animals from somatic cells. No. 2004-16115, 2004

b) Conference and seminar papers presented

The 106th Annual meeting of Japanese Society of Zootechnical Science: 3 presentations

The 12th Annual meeting of Japan Embryo Transfer Society: 1 presentations

The 98th Annual meeting of Japanese Society of Animal Reproduction: 4 presentations

The 127th Annual meeting of Japanese Society of Fertility and Sterility –Kansai Branch-: 1 presentation

The 28h Annual meeting of Japanese Society of Molecular Biology: 3 presentation

## A-3. Off-campus activities

*Roles in academic societies*

Imai, H.: Japanese Society of Animal Reproduction (Director), Japan Embryo Transfer Society (Vice President, Director), Japan Society of Fertility and Sterility (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 of Fertility and Sterility (Councilor), Japan Embryo Transfer Society (Officer), Japanese Society of Animal Reproduction (Editorial Board)

Minami, N.: Japan Embryo Transfer Society (Officer), Japan Society of Fertility and Sterility (Officer)

*Research grants*

Monbusho Research Grants, Grant-in-Aid for Scientific Research (B)(1): Search for abnormal production of cloned animals by exhaustive gene analysis (Sharer: Imai), Grant-in-Aid for Scientific Research (C)(2): Studies on the promotion of cytoplasmic maturation of bovine immature oocytes by cumulus cells (Head: Yamada), Grant-in-Aid for Scientific Research (B)(2): Functional analysis of a novel gene, Oogenesin, which localizes in nucleus at the time of zygotic gene activation (Head: Minami)

Research project for utilizing advanced technologies in agriculture, forestry and fisheries: Establishment of stable and efficient technology of the production of bovine somatic clones (Head: Imai, Sharer: Minami)

## A-4. International cooperation and overseas activities

*International meetings (roles)*

38th Society for the Study of Reproduction, Quebc (presentation: Imai, Minami)

The 2nd Asian Reproductive Biotechnology Conference, Bangkok (presentation: Minami)
Workshop: Mammalian Oogenesis and Epigenetic Modification, Kisarazu (presentation: Minami)
15th International Congress of Animal Reproduction, Port Segro (presentation: Imai, Minami)
The 5th Royan International Congress Tehran (Award lecture)
32st International Embryo Transfer Society, Oland (presentation: Imai, Yamada, Minami, Nagao)

## B. Educational Activities (2005.4-2006.3)

### B-1. On-campus teaching

a) Courses given

Undergraduate level: Reproductive Physiology (Imai), Outline of Bioresource Science III (Imai et al), Outline of Japanese Agriculture (Imai), Program of International Education (Imai), Developmental and Reproductive Technology (Yamada), Introduction to Animal Science Literature I (Yamada and Moriya), Methods and Techniques in Animal Reproduction Experimentation (Imai, Yamada, Minami, Nagao), Biotechnology (Yamada et al)

Graduate level: Advance Course of Reproductive Physiology (Imai), Reproductive Physiology-Seminar (Imai, Yamada), Laboratory Course in Reproductive Physiology (Imai, Yamada), 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.: Clone Technology – Advancement of cloning past 10 years (Lecturer), 2005.

Imai, H.: Cloned animal and Society. Symposium for the Japanese Society for Bioscience, Biotechnology, and Agrochemistry (lecturer), 2004.

### B-3. Overseas teaching

*Lecture and seminars*

Students and research fellows from abroad
Graduate Student: 2 (Korea, India)

## C. Other remarks

Imai, H.: Member of Domestic Animal Improvement Committee of Kyoto Prefecture, Research Adviser of Technology Conference of Agriculture, Forestry and Fishery of Ishikawa Prefecture, 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, The Steering Committee of Research Center for Low Temperature and Materials Science (Kyoto University)

# Chair of Animal Anatomy, Nutrition and Resources

## 2.4.8 Laboratory of Nutritional Science

*Staff* *Professor* *: Yano, Hideo, Dr. Agric. Sci.*
*Associate Professor: Matsui, Tohru, Dr. Agric. Sci.*
*Assistant Professor : Kawachi, Hiroyuki, Dr. Eng.*

*Students and research fellows*
*Doctor's program : (4)*
*Master's program: (7)*
*Undergraduate : (4)*

### A. Research Activities (2005.4-2006.3)

### A-1. Main subjects

a) Mineral nutrition and metabolism

We have studied mineral metabolisms using stable isotopes as tracers in rats. We found that magnesium concentration in drinking water affected its absorption. We clarified that excess calcium increased hepatic copper concentration in rats, which resulted from secondary iron deficiency induced by excess calcium. Fecal phosphorus in pigs contributes to the phosphors pollution problems. We have investigated the increasing phosphorus availability in swine feeds to decrease fecal phosphorus. We observed that phosphorus availability in piglets was improved by the supplementation of phytase having high stability in the stomach.

b) Adipocyte differentiation and function

We found that activin and myostatin, members of TGF-β superfamily, suppressed differentiation of bovine preadipocyte in the early stage and this suppressive effect was reduced by follistatin. Additionally, we found that activin and myostatin suppressed the expressions of PPARγ and C/EBPα in bovine preadipocyte.

c) Vitamins

We found that plasma vitamin C level was decreased by fatty liver and hyperglycemia in lactating cows, which suggested that the supplementation with vitamin C is preferable for lactating cows with fatty liver and hyperglycemia. We investigated that urinary vitamin C excretion in beef cows and found that beef cows excreted vitamin C into urine even when plasma vitamin C level was low. The supplementation of vitamin C increased plasma concentration and urinary excretion of vitamin C. These results suggest that the importance of urinary excretion of vitamin C on its metabolism in cattle and that the lower renal threshold of vitamin C results in the lower plasma vitamin C concentration in cattle. We showed that vitamin C level was higher in mare's milk than in cow's milk and plasma vitamin C concentration was low in lactating mares.

## A-2. Publications and presentations

a) Publications

*Original papers*

Inoue, Y., A. Matsui, Y. Asai, F. Aoki, T. Matsui and H. Yano: Effect of exercise on iron metabolism in horses. Biological Trace Element Research 107; 33-42, 2005

Takasugi, S., T. Matsui, and H. Yano: The effects of excess calcium as different form on mineral metabolism in rats. Animal Science Journal. 76; 469-474, 2005

Padilla, L., K. Shibano, J. Inoue, T. Matsui and H. Yano: Plasma vitamin C concentration is not related to the incidence of ketosis in dairy cows during the early lactation period. Journal of Veterinary Medical Science 67; 883-886, 2005

Tanaka, T., H. Kawachi, T. Matsui and H. Yano: The effect of concentrated and desalted plum vinegar on lipid metabolism in hamsters. Trace Nutrients Researches 22; 131-134, 2005 (in Japanese)

Hirai S., M. Yamanaka, H. Kawachi, T. Matsui and H. Yano: Activin A inhibits differentiation of 3T3-L1 preadipocyte. Molecular and Cellular Endocrinology 232; 21-26, 2005

Padilla L., T. Matsui, Y. Kamiya, M. Kamiya, M. Tanaka and H. Yano: Heat stress decreases plasma vitamin C concentration in lactating cows. Livestock Science 101; 300-304, 2006

*Review*

Kawachi, H. and S. Hirai: Studies on the regulation of preadipocyte differentiation by paracrine factors secreted from muscle cells. Proceedings of Japanese Society for Animal Nutrition and Metabolism 50; 17-33, 2006 (in Japanese)

Yano, H., S. Hirai and M. Kitagawa: Recent advances in research for nutritional physiology of beef cattle (1). Sustainable livestock production and human welfare 59; 1195-1204, 2005 (in Japanese)

Yano, H., S. Hirai and M. Kitagawa: Recent advances in research for nutritional physiology of beef cattle (2). Sustainable livestock production and human welfare 59; 1259-1266, 2005 (in Japanese)

Ohmori, H. and H. Yano: Growth and magnesium. Clinical Calcium 15; 37-41, 2005 (in Japanese)

b) Conference and seminar papers presented

The 105th Meeting of Japanese Society of Animal Science: 4 presentations

The 106th Meeting of Japanese Society of Animal Science: 4 presentations

The Spring Meeting of Japanese Society for Animal Nutrition and Metabolism: 2 presentations

The 55th Meeting of Kansai Society of Animal Science: 2 presentations

The 22nd Symposium on Trace Nutrition Research: 1 presentation

The 25th Meeting of the Japanese Society for Magnesium Research: 1 presentation

## A-3. Off-campus activities

*Membership in academic societies*

Yano, H.: Japanese Trace Nutrients Research Society (President), Japanese Association of Pet Animal Nutrition (Vice President), Japanese Society for Magnesium Research (Director), Japanese Society of Nutrition and Food Science (Councilor), Japanese Society of Nutrition and Food Science-Kinki Section (Councilor), Kansai Society of Animal Science (Councilor), Japanese Society of Animal Nutrition and Metabolism (Councilor), Society of

Beef Cattle Science (Councilor), Japanese Society of Veterinary Science (Councilor)

Matsui, T.: Japanese Trace Nutrients Research Society (Councilor), Japanese Society for Magnesium Research (Councilor, Editor), Japanese Society of Animal Nutrition and Metabolism (Editor), Japanese Association of Pet Animal Nutrition (Editor), Society of Beef Cattle Science (Secretary), Kansai Society of Animal Science (Councilor, Editor),

*Membership in Science Council of Japan, etc.*

Yano, H.: Science Council of Japan (Member), Council of Animal Science (Chairman)

*Research grants*

Monbukagakusho Research Grants: Scientific Research (B) The reduction of environmental loading by utilizing food residues as feedstuffs (Yano), Scientific Research (C) The evaluation of trace mineral bioavailability using stable isotope in animals (Matsui), Encouragement of Young Scientists (A): Studies on the physiological roles of leptin soluble receptor in fattening cattle (Kawachi).

Research Project for Utilizing Advanced Technologies in Agriculture, Forestry and Fisheries: Efficient culture of euglena and technology for feed production using the residue of methane fermentation (Yano), Research Project for Utilizing Advanced Technologies in Agriculture, Forestry and Fisheries: Development of palatable beef by integration of breeding information (Yano and Kawachi). Itoh Memorial Foundation: Studies on regulatory mechanisms of adipocyte differentiation in skeletal muscle (Yano and Kawachi).

## A-4. International cooperations and overseas activities

*International meetings (roles)*

Yano, H.: 2005 Joint Annual Meeting of ADSA-ASAS-CSAS (Participant)

Kawachi, H.: 2005 Joint Annual Meeting of ADSA-ASAS-CSAS (Presentation).

*Membership in international academic societies*

Yano, H.: World Association for Animal Production (Director)

# B. Educational Activities (2005.4-2006.3)

## B-1. On-campus teaching

a) Courses given

Undergraduate level: Basic Bioresource Science I (Matsui et al), Basic Bioresource Science II (Yano et al), Outline of Bioresource Science II (Yano et al), Applied Animal Sciences (Yano et al), Animal Physiology (Matsui et al), Animal Nutrition (Matsui and Yano), Physiological Nutrition of Animals (Matsui Kawachi and Yano), Fundamentals for the Experiments for Bioresource Science (Matsui and Kawachi et al), Laboratory Course in Bioresource Science I and II (Matsui and Kawachi et al), Introduction to Foreign Literature in Bioresource ScienceIV (Matsui et al), Seminar for Applied Animal Science I and II (Matsui et al)

Graduate level: Nutritional Physiology of Animals (Yano), Seminar in Nutritional Science of Animals (Yano and Matsui), Laboratory Course in Nutritional Science of Animals (Yano and Matsui)

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

*Part-time lecturer*

Yano, H.: School of Environmental Science, The University of Shiga Prefecture (Environmentology for Animal Production)

Matsui, T.: School of Environmental Science, The University of Shiga Prefecture (Environmentology for Animal Production)

## B-3. Overseas teaching

*Students and research fellows from abroad*

Doctoral course: 3 students (Korea and Honduras)

## C. Other remarks

Yano, H.: Subcommittee of Agricultural Technology, Evaluation Committee of Incorporated Administrative Agency, 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). Policymaking Advisory Board of Food, Agriculture and Agricultural Community, The Ministry of Agriculture, Forestry and Fishery (Temporal Member). Committee of Grant-in-Aid for Scientific Research, Japan Society for the Promotion of Science (Member). Advising Committee of Science and Technology of Gifu Prefecture (Member). Evaluation Committee of Research Institutes of Gifu Prefecture (Chairman)

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).

## 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.*
*Students and research fellows*
*Research fellows of the Japan Society for the Promotion of Science: (1)*
*Doctor's Program: (3)*
*(Including 1 of Research fellows of the Japan Society for the Promotion of Science)*
*Master's Program: (3)*
*Undergraduate : (4)*

### A. Research Activities (2005.4-2006.3)

### A-1. Main subjects

a) Clarification of the effect of environmental pollution on physiology and reproductive functions of mammals.

Endocrine disrupters can bind to nuclear receptors including estrogen receptors and interfere with the reproductive functions in animals. We have been evaluating the effects of endocrine disrupters and other environmental load substances on the biological functions in mammals to develop a method that reduces their undesired effects. Effects of endocrine disrupters on nuclear receptors in bones, kidneys and small intestines are being examined in pregnant mice and domestic animals.

b) Assessments of the effect of global warming 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***

Kume S., K. Nonaka, T. Oshita, T. Kozakai and K. Kojima: Feeding alfalfa silage on methane production in dry and lactating cows. Proc. 2nd Greenhouse Gases and Animal Agriculture. 428-431, 2005.

Kojima H., S. Kume, K. Nonaka, T. Oshita, T. Kozakai and H. Hirooka: Effects of feeding and animal performance on nitrogen, phosphorus and potassium excretion by Holstein cows. Animal Science Journal. 76; 139-145, 2005.

Chan MPL., S. Morisawa, A. Nakayama, Y. Kawamoto, M. Sugimoto and M. Yoneda: Toxicokinetics of (14)C-endosulfan in male Sprague-Dawley rats following oral administration of single or repeated doses. Environmental Toxicology. 20; 533-541, 2005.

Nishizawa H., M. Morita, M. Sugimoto, S. Imanishi, and N. Manabe: Effects of in utero exposure to bisphenol A on mRNA expression of arylhydrocarbon and retinoid receptors in murine embryos. Journal of Reproduction and Development. 51; 315-324, 2005.

Morita, J., Y. Terada, Y. Hosoi, N. Fujinami, M. Sugimoto, S-I. Nakamura, T. Murakami, N. Yaegashi and K. Okamura: Microtubule organization during rabbit fertilization by intracytoplasmic sperm injection with and without sperm centrosome. Reproductive Medicine & Biology, 4; 169-177, 2005.

Kawamoto Y., W. Matsuyama, M. Morikawa, M. Morita, M. Sugimoto, N. Manabe and S. Morisawa: Disposition of bisphenol A in pregnant mice and fetuses after a single and repeated oral administration. Toxicological & Environmental Chemistry, 87; 199-213, 2005.

***Patents***

Patent issued/granted

Patent no. 3694730 'Cryopreservation solution for tissue', inventor: Miyamoto, H., Sugimoto, M., Manabe, M., patentee: Kyoto University, registration date: July. 8, 2005

***Reviews***

Sugimoto, M: Application of magnetic resonance microscopy to examination of small experimental animals. Low temperature and Materials Scence (Kyoto University), 6; 28-34, 2005 (in Japanese).

b) Conference and seminar papers presented

The 140th Annual Meeting of Japanese Society of Veterinary Science : 2 presentations

The 141th Annual Meeting of Japanese Society of Veterinary Science : 2 presentations

The 106th Annual Meeting of Japanese Society of Animal Science: 2 presentations

## A-3. Off-campus activities

***Membership in academic societies***

Kume, S.: Japanese Society of Equine Science (Editor), Japanese Society of Animal Nutrition and Metabolism (Councilor)

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

***Research grants***

Kume, S.: Grant-in-Aid for Scientific Research from the Japanese Society for Promotion of Science (B) (Kume Sharer), The Ito Foundation (Kume Head)

Sugimoto, M.: Grant-in-Aid for Scientific Research from the Japanese Society for Promotion of Science (C) (Sugimoto Head)

## A-4. International cooperation and overseas activities

***International meetings***

Kume, S.: 2nd International Conference on Greenhouse Gases and Animal Agriculture, Zurich (Presentation)

## B. Educational Activities (2005.4-2006.3)

### B-1. On-campus teaching

a) Courses given

Undergraduate level: Outline of Bioresource Science II (Kume et al.), Animal Physiology (Kume et al.), Fundamentals for the Experiments of Bioresource Sciences (Sugimoto et al.), Animal Physiology and Anatomy (Kume), Introduction to Foreign Literature in Bioresource Science II (Kume et al.), Laboratory *Course* in Bioresource Science I and II (Sugimoto et al.), Applied Animal Sciences (Kume et al.), Animal Environmental Physiology (Kume), Livestock Production Techniques and Practice II (Kume et al.),

Graduate level: Animal Physiology and Anatomy (Kume), Seminar in Animal Physiology and Anatomy (Kume), Laboratory Course in Animal Physiology and Anatomy (Kume)

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

*Part-time lecture*

Kume, S.: University of Miyazaki (Animal Environmental Physiology)

*Open seminar, etc*

Kume, S.: Improvement of reproduction and nutrition in high producing cows. Symposium in Hokkaido Embryo Transfer Society (lecture) 2006

Kume, S.: Dairy cattle nutrition. Overseas Agricultural Technique Seminar (lecture) 2006

## C. Other remarks

Kume, S.: Subcommitee of Japanese Standard for Dairy Cattle (member), Assessment Committee of Research Grant of Ministry of Agriculture, Forestry and Fisheries (member)

## 2.4.10 Laboratory of Animal Husbandry Resources

*Staff* *Professor : Hirooka, Hiroyuki, D. Agric. Sci.*

*Lecturer : Ishida, Joken, D. Agric. Sci.*

*Students and research fellows*

*Doctor's program: (3)*

*Master's program: (3)*

*Undergraduate : (3)*

### A. Research Activities (2005.4-2006.3)

### 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 and feeding systems 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.

c) Studies on regional properties of vegetation and nomadic livestock in arid areas.

For the purpose of defining and settling the problems found in traditional animal production systems in arid areas, the evaluations of regional woody and herbaceous plants as the feed resources with reference to the physiological properties of nomadic animals have been investigated. The studies performed in 1996 were as follows. 1) Strategy of reclaiming the grassland devastated by over-grazing in Syria. 2) Feeding and management techniques of nomadic animals in Gobi district, Mongolia. 3) Feeding and management techniques of farm animals in northern step, southern desert and eastern mountains of Kazakhstan.

d) Studies on environmental problems in animal production.

In recent, because 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.

### A-2. Publications and presentations

a) Publications

*Books*

H. Hirooka: Plant Production Systems (Chapter 7 Section3) "Mixed Farming System of Stock-Holding Agriculture in Asia" (Edited by T.Imamura ), Asakura Publishing, 2005 (in Japanese)

*Original papers*

Kahi, K. and Hirooka, H.: Genetic and economic evaluation of Japanese Black (Wagyu) cattle breeding schemes. J. Anim Sci. 83: 2021-2032, 2005.

Xiong, Y., Muramatsu, M., Hirata, M., Oishi, K., Kaihotsu, I., Takamura, T., Furumi, S. and Fujiwara, N.: Approximation method for time-integral of photosynthesis for NPP estimation using remotesensing data: case study in Mongolia. Journal of The Remote Sensing Society of Japan. 25: 179-190, 2005.

Kojima, H., Kume, S., Nonaka K., Oshita, T., Kozakai T. and Hirooka, H.: Effects of feeding and animal performance on nitrogen, phosphorus and potassium excretion by Holstein cows. Animal Science Journal. 76: 139-146, 2005.

Ibi, T., Hirooka, H., Kahi, AK., Sasae, Y. and Sasaki, Y.: Genotype × environment interaction effects on carcass traits in Japanese black cattle. Journal of Animal Science. 83; 1503-1510, 2005.

Hirooka, H., Nomura, T., Satou, M., Muramoto, T., Komeya, H. and Ozawa, S.: Population structure and genetic diversity of Mishima cattle. Native Livestock. 23: 177-183, 2005.

Tabata, Y., Kitagawa, M., Inamura, T., Ishida, J. and Hirooka, H.: Farm level nitrogen utilization and cycling in the mixed farming system of beef fattening and rice production. Nihon Chikusan Gakkaiho. 76: 321-330, 2005.

Hirooka, H. and Choumei, Y.: A study of the change for growth patterns of Wagyu females from the beginning of the Showa era to the present. Society of Beef Cattle Science. 79: 9-14, 2005.

Komura, T., Hirooka, H. and Moriya, K.: Optimization of an energy consumption model about a beef cattle fattening and a feed production composition system by differential evolution. The Japanese Agricultural Systems Society. 21: 217-224, 2005.

Hayashi, Y., Shah, S., Shah. S. K. and Kumagai, H.: Dairy production and nutritional status of lactating buffalo and cattle in small-scale farms in Terai, Nepal. Livestock Research for Rural Development. 17: 2005.

Hirooka, H. and Choumei, Y.: An analysis for impression of residents on livestock waste management system. The Japanese Agricultural Systems Society. 21: 15-24, 2005.

*Reviews*

Hirooka, H.: Similarity of clone cattle and clone test. Study of Animal Husbandry. 59: 1921-1300, 2005.

Hirooka, H.: Application of animal breeding in tropical developing regions. Theory and application of animal breeding (73)(74)(75) Study of Animal Husbandry. 59: 993-995, 1130-1140, 1223-1229, 2005.

Yasumatuya, K. and Hirooka, H.: Present condition and movement of organic farming at home and abroad (1). Study of Animal Husbandry. 59(6)(7): 659-664, 749-758, 2005.

b) Conference and seminar papers presented

The 105th Annual Meeting of Japanese Society of Animal Science: 5 presentations

The 106th Annual Meeting of Japanese Society of Animal Science: 5 presentations

The Spring Symposium of Japanese Agricultural System Society in 2005: 2 presentations

The Autumn Symposium of Japanese Agricultural System Society in 2005: 1 presentation

The 43th Annual Meeting of Society of Beef Cattle Science: 1 presentation

The 55th Annual Meeting of Kansai Society of Animal Science: 1 presentation

The 3rd Annual Meeting of Japanese Society of Goat Science: 1 presentation

## A-3. Off-campus activities

***Membership in academic societies***

Hirooka, H.: Japanese Agricultural System Society (Director, Editor), Society of Beef Cattle Science (Secretary)

***Research grant***

Monbushou Research Grants, Promotion Research: Theoretical Studies on Animal Genetic Conservation and Construction of a Database system (Head: Hirooka), Evaluation of Advanced Japanese Beef Cattle Breeding Schemes Incorporating Performance Testing for Blood Serum Insulin-Like Growth Factor I and Carcass Traits (Head: Hirooka), 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)

## A-4. International cooperation and overseas activities

***Overseas researcher receiving***

Inviting researcher: Doctor Kahi Alexander Kigunzu (Assistant professor of Animal Husbandry at Egerton University)

## B. Educational Activities (2005.4-2006.3)

## B-1. On-campus teaching

a) Courses given

Undergraduate level: Outline of Bioscience Ⅲ (Hirooka et al.), International Animal Agriculture (Ishida)

Graduate level: Seminar of Animal Husbandry Resources (Hirooka, Ishida), Laboratory Course of Animal Husbandry Resources (Hirooka, Ishida)

## B-3. Overseas teaching

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

Master course student: 1 (Honduras)

# Chair of Marine Biological Reosources

## 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, MSc. Agric. Sci.*
*Students and research fellows*
*Doctor's program : (3)*
*Master's program : (4)*
*Undergraduate : (5)*
*Research Student: (1)*

### A. Research activities (2005.4-2006.3)

### 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 the Seto Inland Sea (SIS): Nutrient pools of the oceanic origin are located in the lower layer at the openings of SIS and that of terrestrial origin lies on the bottom of Harima-nada. These nutrients are transported to the central SIS by the estuarine circulations and then upwell into the upper layer at Bisan Strait (central SIS).

b) Study on eutrophication and hypoxia in semi-enclosed coastal seas

Excess amount of loads of nitrogen and phosphorus flowing into Ise Bay, Tokyo Bay and Seto Inland Sea causes eutrophication and hypoxia in these seas. Mechanisms generating hypoxic water mass in Ise bay and Hiuchi-nada were studied and modeled.

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 not so. We gathered data of water qualities, hydrographic parameters and meteorological parameters over 20 ~ 30 years to make data-base. It was revealed that WQBS varies with low correlation 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 food chain by using stable isotope ratio

Marine food chains are 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 clarified that corbicula (*Corbicula japonica*), which can digest terrestrial organic matter, have cellulase. It is also found that most animals in estuaries digest marine produced organic matter but cannot digest

terrestrial matter.

## A-2. Publications and presentations

a) Publications

***Books***

Kasai, A.: Cultivation system in Asia (Fisheries), Cultivation system (edited by Inamura). pp. 150-160, Asakura Shoten, Tokyo, 2005 (in Japanese)

***Original papers***

Kasai, A., H. Toyohara, A. Nakata, T. Miura and N. Azuma: Food sources for the bivalve *Corbicula japonica* in the foremost fishing lakes estimated from stable isotope analysis. Fisheries Science 72; 105-114, 2006

Sugimoto, R., A. Kasai, S. Yamao, T. Fujiwara and T. Kimura: Short-term variation in behavior of allochthonous particulate organic matter accompanying changes of river discharge in Ise Bay. Estuarine, Coastal and Shelf Science 66; 267-279, 2005

Suzuki, K., A. Kasai, K. Nakayama and M. Tanaka: Differential trophic enrichment and half-life of stable carbon and nitrogen isotopes among tissues observed in a diet-switch experiment of Japanese temperate bass (*Lateolabrax japonicus*) juveniles: implications for analyzing fish migration. Canadian Journal of Fisheries and Aquatic Science 62; 671-678, 2005

Kakehi, S., T. Fujiwara, and H. Yamada: Seasonal variation in nutrient budget in Ise Bay. J. Oceanography 14; 527-540, 2005

***Reports***

Fujiwara, T.: Varing ecosystem and fisheries production in coastal seas - Interaction between Seto Inland sea and Kuroshio. Monthly Report of Japan Fisheries Resource Conservation Association 487; 3-5, 2005

Fujiwara, T.: Systematic understanding and modeling of coastal seas. Kaiyo Monthly 40; 80-85, 2005

Kasai, A., H. Takeda and T. Yamada: Formation mechanism of the hypoxic water in Hiuchi-Nada, Seto Inland Sea, Japan. Comprehensive and responsible coastal zone management for sustainable and friendly coexistence between nature and people 389-397, 2005

Kasai, A. and K. Komatsu: Transport and survival processes of eggs and larvae of jack mackerel in the East China Sea. Extensive collection of Reports and Meeting Documents for the 2005 Annual Science Conference of ICES CD-ROM, CM 2005/O: 14, 2005

Kasai, A.: Numerical model of transport of fish eggs and larvae. Elucidation of variability in fish stocks and development of advanced prediction of variability; 56-57, 2005

Sugimoto, R., A. Kasai, S. Yamao, T. Fujiwara and T. Kimura: Influence of changes in river discharge on the variation in particulate organic matter in Ise Bay. Proceedings of International Symposium on Long-term Variations in the Coastal Environments and Ecosystems 206-211, 2005

Sugimoto, R., A. Kasai, S. Yamao, T. Fujiwara, and T. Kimura: Behavior of terrestrial particulate organic matter loaded by the flood in Ise Bay, Japan. Workshop on the Marine Environment in the East Asian Marginal Seas – Transport of Material-; 25-26, 2005

b) Conference and seminar papers presented

2005 Annual meeting of the Japan. Soc. Fish. Sci.: 3 presentations

2005 Spring meeting of the Oceanographic Soc. Japan: 2 presentations

2005 Autumn meeting of Kinki Branch of the Fisheries Soc. Japan: 1 presentation

2005 Annual meeting of the Japan. Soc. Fish. Oceanogr.: 5 presentations

Hokkaido Univ.- Kyoto Univ.- Ryukyu Univ. Collaborative field science symposium: 2 presentations

14th Hiuchinada symposium: 1 presentation

2005 Annual Science Conference of ICES (U.K.): 1 presentation

2005 Annual Science Conference of PICES (Russia): 1 presentation

2005 Joint meeting of the Plankton Soc. Japan and the Japan. Assoc. Benthology: 1 presentation

2005 Autumn meeting of the Japan. Biochemical Soc.: 1 presentation

2005 Joint symposium of the Seinan Branch of the Oceanographic Soc. Japan, the Marine Meteorological Soc. and the Japan. Soc. Fish. Oceanogr: 1 presentation

2005 DOBIS International Symposium -Dynamics of the Ocean Biosystem-: 1 presentation

2005 Annual meeting of the Environ. Protection committee of the Japan. Soc. Fish. Sci.: 1 presentation

2005 Workshop on the Marine Environment in the East Asian Marginal Seas: 1 presentation

2005 21st century COE symposium: 1 presentation

Seto Inland Sea Forum in Nara: 1 presentation

2005 Spring Symposium of the Coastal oceanography Study: 1 presentation

The 35 Workshop on Marine Research and Technology: 2 presentations

## A-3. Off-campus activities

*Membership in academic societies*

Fujiwara, T.: The Oceanographic Society of Japan (Counselor), Coastal Oceanography Division of the Oceanographic Society of Japan (Committeeman), The Marine Meteorological Society (Director, Editor), The Japanese Society of Fisheries Oceanography (Committeeman), Japanese Society of Civil Engineers (Committeeman)

Kasai, A.: Coastal Oceanography Division of the Oceanographic Society of Japan (Editor, Committeeman), The Japanese Society of Fisheries Oceanography (Committeeman)

*Research grants*

Fisheries Agency; Variability of fisheries resources and its prediction (Kasai)

Foundation of River and Watershed Environment Management; Water purification by benthic animals in tidal flats (Kasai)

## A-4. International cooperation and overseas activities

*International meetings (roles)*

Kasai, A.: Annual Science Conference of ICES (Aberdeen, U.K., Oral presentation), Annual Science Conference of PICES (Vladivostok, Russia, Poster presentation), DOBIS International Symposium -Dynamics of the Ocean Biosystem- (Tokyo, Japan, Poster presentation), Workshop on the Marine Environment in the East Asian Marginal Seas (Kasuga, Japan, Oral presentation)

## B. Educational Activities (2005.4-2006.3)

### B-1. On-campus teaching

a) Courses given

Undergraduate level: Marine Environment (Fujiwara), Marine Ecosystem (Kasai), Practical Course in Marine Bioscience and Technology (Fujiwara), Laboratory Course in Bioresource Science (Kasai), Outline of Bioresource Science (Fujiwara), Seminar in Marine Bioresources Science (Fujiwara, Kasai)

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

# 2.4.12 Laboratory of Marine Stock-Enhancement Biology

*Staff* *Professor* *: Tanaka, Masaru, Dr. Agric. Sci.*
*(Nakabo, Tetsuji, Dr. Agric. Sci. Ichthyology, Kyoto University Museum)*
*Associate Professor: Tagawa, Masatomo, Dr. Sci.*
*Assistant Professor : Nakayama, Kouji, Dr. Agric. Sci.*
*COE Post doctor :Shoji, Jun, Dr. Agric. Sci (～2006.1)*

*Students and Research Fellows*
*Doctor's program : (4)*
*Master's program : (11)*
*Undergraduate : (4)*
*JSPS post-doctor : (2)*

## A. Research Activities (2005.4-2006.3)

### 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 the systematic study of marine fishes based on the specimens from the Indo-Pacific region. We have an 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.: Ecosociology of linking forest-sato-sea and regeneration of wooden culture.「Creating green era」(eds. by Amano, R., C. W. Nicol, W. Tatematsu), pp216-223, Junposya, 2005

Tanaka, M.:4.3.2 Fish biodiversity-mysterious background of Ariake temperate bass.「Outline of bioresource sciences」(ed. by Department of Bioresource Sciences, Faculty of Agriculture Kyoto University), pp177-180, Syowado-epress, 2005

Tagawa, M.: Metamorphosis in flatfishes.「Living Marine Resources」(ed. by Watanabe Y.), pp102-119, Tokai University Press, 2005

Nakayama, K.: Molecular analysis of population structure and phylogeny.「Encyclopedia of fish science」(eds. by Taniuchi T. et al.). pp13-18, Asakura Shoten, 2005

***Original papers***

Suzuki, K., A. Kasai, K. Nakayama and M. Tanaka: Differential isotopic enrichment and half-life among tissues in Japanese temperate bass (*Lateolabrax japonicus*) juveniles: implications for analyzing migration. Can. J. Fish. Aquat. Sci. 62; 671-678, 2005

Islam, M. S., H. Ueda and M. Tanaka: Spatial distribution and trophic ecology of dominant copepods associated with turbidity maximum along the salinity gradient in a highly embayed estuarine system in Ariake Sea, Japan. J. Exp. Mar. Biol. Ecol. 316; 101-115, 2005

Islam, M. S. and M. Tanaka: Nutritional condition, starvation status and growth of early juvenile Japanese sea bass (*Lateolabrax japonicus*) related to prey distribution and feeding in the nursery ground. J. Exp. Mar. Biol. Ecol. 323, 172-183, 2005

Shoji, J., E. W. North and E. D. Houde: The feeding ecology of *Morone americana* larvae in the Chesapeake Bay estuarine turbidity maximum: the influence of physical conditions and prey concentrations. Journal of Fish Biology 66; 1328-1341, 2005

Shoji J. and M. Tanaka: Distribution, feeding condition and growth of Japanese Spanish mackerel (*Scomberomorus niphonius*) larvae in the Seto Inland Sea. Fishery Bulletin; 371-379, 2005

Shoji J. and M. Tanaka: Larval growth and mortality of Japanese Spanish mackerel *Scomberomorus niphonius* in the central Seto Inland Sea, Japan. J. Mal. Biol. Ass. U. K.

85; 1253-1261, 2005

Shoji J. and M. Tanaka: Daily ration and prey size of juvenile piscivore, Japanese Spanish mackerel. J. Fish Biol. 67; 1107-1118, 2005

Shoji J., Y. Yamashita, R. Masuda and M. Tanaka: Predation on fish larvae by moon jellyfish *Aurelia aurita* under low dissolved oxygen concentrations. Fish. Sci. 71; 748-753, 2005

Kamisaka Y., O. Drivenes, T. Kurokawa, M. Tagawa, I. Ronnestad, M. Tanaka and J. V. Helvik: Cholecystokinin mRNA in Atlantic herring, *Clupea harengus* – molecular cloning, characterization, and distribution in the digestive tract during the early life stages. Peptides 26; 385-393, 2005

Okada N., T. Morita, M. Tanaka and M. Tagawa: Thyroid hormone deficiency in abnormal larvae of the Japanese flounder *Paralichthys olivaceus*. Fish. Sci. 71; 107-114, 2005

Harada Y., K. Kuwamura, I. Kinoshita, M. Tanaka and M. Tagawa: Histological observation of the pituitary – thyroid axis of a neotenic fish (the ice fish, *Salangichthys microdon*). Fish. Sci. 71; 115-121, 2005

Tanaka Y., H. Yamaguchi, W. S. Gwak, O. Tominaga, T. Tsusaki and M. Tanaka: Influence of mass release of hatchery-reared Japanese flounder on the feeding and growth of wild juveniles in a nursery ground in the Japan Sea. J. Exp. Mar. Biol. Ecol. 314; 137-147, 2005

Dou S. Z., R. Masuda, M. Tanaka and K. Tsukamoto: Effects of temperature and delayed initial feeding on the survival and growth of Japanese flounder larvae. J. Fish Biol. 66; 362-377, 2005

Shoji J., R. Masuda, Y. Yamashita and M. Tanaka: Effect of low dissolved oxygen concentrations on behavior and predation rates on fish larvae by moon jellyfish *Aurelia aurita* and by a juvenile piscivore, Spanish mackerel *Scomberomorus niphonius*. Marine Biology 147; 863-868, 2005

Tagawa, M. and M. Aritaki: Production of symmetrical flatfish by controlling the timing of thyroid hormone treatment in spotted halibut *Verasper variegatus*. Gen. Comp. Endocrinol. 141; 184-189, 2005

Kinoshita, A., M. Fujita, M. Tagawa, T. Mizuyama and T. Sawada: The physiological impact of turbid water caused by sediment flushing on fish and a prediction method. Sabou Gakkaishi 58; 34-53, 2005

***Reports***

Tanaka M.: Present significance of macrobiology based on field works in fisheries science. Aquabiology 157: 139-147, 2005

Tanaka, M.: Transformation of national Universities to agency: Do the universities survive? Noctiluca 30: p.1, 2005 (in Japanese)

Tanaka, M.: Establishment of Field Science Education and Research Center-Toward creation of integrated science of linking forest, sato and sea. Noctiluca 30: 17-22, 2005 (in Japanese)

Tagawa, M., K. Nakayama, M. Tanaka: Metamorphosis and early mortality in fishes. Report of Monbu-kagaku-sho Research Grant (Creative-basic Research), 393-398, 2005 (in Japanese)

Tanaka, M., K. Nakayama: Genetic stock structure and regional characteristics of ecophysiology in Japanese flounder H17 Research report on the development of seed production and release techniques for establishing ecosystem-conservation culture system. Plan for the 2nd Phase (H16-18). 34-35, 2005 (in Japanese)

Tagawa, M.: Eye translocation in flatfish metamorphosis-mechanism of asymmetrical morphogenesis by thyroid hormone. Report of Monbu-kagaku-sho Research Grant (Scientific Research(C)), 0-77, 2005 (in Japanese)

b) Conference and seminar papers presented

29th Larval Fish Conference: 3

6th International Symposium on Flatfish Ecology: 6

International Symposium sponsored by 21st Century COE program「Entomomimetic Science」: 2

DOBIS (Dynamics of the Ocean Biosystem) International Symposium and JSPS (Japanese Society for promotion and science) Meeting: 2

H17 Annual Meeting by the Society of Erosion Control: 1

42nd Fish Natural Hystory Meeting: 1

33rd Ocean Technology Pannel by the Society of Ocean Technology: 1

H17 Annual Meeting by the Society of Ichthyological Research of Japan: 2

## A-3. Off-campus activities

*Membership in academic societies (roles)*

Tanaka: The Japanese Society of Fisheries Science (Vice president, Council member of Kinki Branch), Japan Aquaculture Society (Council member), The Japanese Society of Fisheries Oceanography (council member), The Ichthyological Society of Japan (council member).

*Research grants*

Monbusho Research Grant: Scientific Research (A), Fisheries resource biology and conservation ecology on the Chinese temperate bass and the hybrid population of Ariake temperate bass (Tanaka, Nakayama), Scientific Research (C), Differentiation mechanisms of left-right asymmetry, and preventinon of juvenile malformation during flatfish metamorphosis in aquaculture (Tagawa), Research for the future, Wooden artificial reef-basic investigation to see a mechanism of ecological linking between forest and sea (Tanaka), Research for the future, Identification of fish eggs and larvae using molecular biological methods and application to searching their predators (Nakayama), Scientific Research (S), Biological and biochemical researches on enhancement and culture for the bluefin tuna (Tanaka)

Entrust Research Grant:「Research on development of seed production and release techniques for establishing ecosystem-conservation culture system」(Tanaka, Nakayama)

## A-4. International cooperations and overseas activities

*International meetings (roles)*

Tanaka, M.: 6th International Flatfish Ecology Symposium (Chairman)

Tagawa, M.: 6th International Flatfish Ecology Symposium (Organizing committee)

Nakayama, K.: 6th International Flatfish Ecology Symposium (Organizing committee)

*Membership in international academic society*

Tanaka, M.: Journal of Applied Ichthyology (editorial board), Aquatic Living Resources (Scientific Advisary Committee)

*International Joint Researches, Overseas Research Surveys*

Tanaka, M.: Cooperative research on the early development and rearing techniques for marine

fish larvae (Malaysia).

Tanaka, M., 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 (2005.4-2006.3)

### B-1. On-campus teaching

a) Courses given

Undergraduate level: Marine Ecology (Tanaka), Marine Physiology (Tagawa), Laboratory Course in Marine Resource Biology (Tagawa, Nakayama), Seminar in Fisheries Science (Tanaka, Tagawa, Nakayama), Course in Marine Bioscience and Technology I (Nakayama), Pocket Seminar (Tanaka, Tagawa, Nakayama)

Graduate level: Seminar in Marine Resource Biology (Tanaka, Tagawa, Nakayama), Laboratory Course in Marine Resource Biology (Tanaka, Tagawa, Nakayama), Biology of Marine Resources (Tagawa)

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

*Part-time Lecture*

### B-3. Overseas teaching

Students: Doctoral course student 1 (Bangladesh)

## C. Other remarks

*Committees in the Faculty*

Tanaka, M.: Director of Field Education and Research Center, Council member, Curriculum committee, Pocket seminar committee (chairman), Council member of Graduate School of Global Environmental Studies, Council member of University Museum, Council member of Ecological Research center

*Committees out of the University*

Tanaka, M.: Shiga Prefectural committee for adjustment of Lake-Biwa Fisheries, Evaluating committee member of National Research Institute of Aquaculture

# Chair of Marine Microbiology

## 2.4.13 Laboratory of Physiology and Genetics of Marine Microbes

*Staff* *Professor* : *Sako, Yoshihiko, Dr. Agric. Sci..*
*Assistant Professor* : *Yoshinaga, Ikuo, Dr. Agric. Sci.*
*Nomura, Norimichi, Dr. Agric.Sci.*

*Students and research fellows*
*JSPS fellow (PD)* : *(1)*
*Post-doctoral fellow*: *(1)*
*Doctor's program* : *(2)*
*Master's program* : *(8)*
*Research student* : *(1)*
*Undergraduate* : *(5)*

### A. Research Activities (2005.4-2006.3)

### A-1. Main subjects

In the sea, there are many different environmental conditions such as open ocean, deep sea, hydrothermal vents, polar circles, red tide sea, coastal area, where many kinds of marine microbes (bacteria, archaea, 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 marine microbes.

Our main themes are as follows:

a) Studies on novel marine hyperthermophilic microorganisms and their development of genetic resources
   (1) Pysiological 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 micorobes
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 dinoflagellates
   (2) Genomics of organelle DNA in toxic dinoflagellates

### A-2. Publications and presentations

a) Publications

***Books***

Sako, Y.: Microbial role in marine specific environments 0. Introduction p.91, 1. Role of hyperthermophilic microbes in marine hydrothermal environmens, p.91-100, In "Marine

Enviromental Microbiology" Yuzaburou Ishida & Haruo Sugita (eds.), Kouseishakouseikaku, Tokyo, 2005 (in Japanese).

Yoshinaga, I.: Microorganisms contributing biogeochemical cycling in marine environments 0. Introduction p.61-62, 1. Carbon cycle and microbial metabolism, p.63-70, In "Marine Enviromental Microbiology" Yuzaburou Ishida & Haruo Sugita (eds.), Kouseishakouseikaku, Tokyo, 2005 (in Japanese).

***Original papers***

Kim C.-J., C.-H., Kim and Y. Sako: Paralytic shellfish poisoning toxin analysis of the genus *Alexandrium* (Dinophyceae) occurring in Korea coastal waters. Fish. Sci. 71(1); 1-11 (2005).

Nomura N, Y. Morinaga, N. Shirai and Y. Sako.: I-ApeI: a novel intron-encoded LAGLIDADG homing endonuclease from the archaeon, *Aeropyrum pernix* K1. Nucleic Acid Res., 33: e116 (2005)

Hosoi-Tanabe S and Y. Sako.: Species-specific detection and quantification of toxic marine dinoflagellates *Alexandrium tamarense* and *A. catenella* by real-time PCR assay. Marine Biotechnol., 7: 506-514 (2005)

Hosoi-Tanabe S and Y. Sako.: Rapid detection of natural cells of *Alexandrium tamarense* and *A. catenella* (Dinophyceae) by fluorescence in situ hybridization. Harmful Algae, 4: 319-328 (2005)

Hosoi-Tanabe S, S. Tomishima, S. Nagai and Y. Sako.: Identification of a gene induced in conjugation-promoted cells of toxic marine dinoflagellates *Alexandrium tamarense* and *Alexandrium catenella* using differential display analysis. FEMS Microbiol. Lett., 251: 161-168 (2005)

Nakagawa S, K. Takai, F. Inagaki, H. Hirayama, T. Nunoura, K. Horikoshi and Y. Sako.: Distribution, phylogenetic diversity and physiological characteristics of epsilon-*Proteobacteria* in a deep-sea hydrothermal field. Environ. Microbiol., 7: 1619-1632 (2005)

Nakagawa S, K. Takai, F. Inagaki, H. Chiba, J. Ishibashi, S. Kataoka, H. Hirayama, T. Nunoura, K. Horikoshi and Y. Sako.: Variability in microbial community and venting chemistry in a sediment-hosted backarc hydrothermal system: Impacts of subseafloor phase separation. FEMS Microbiol. Ecol., 54: 141-155 (2005)

Nakagawa S, K. Takai, F. Inagaki, K. Horikoshi and Y. Sako.: *Nitratiraputor tergarcus* gen. nov., sp. nov. and *Nitratifractor salsuginis* gen. nov., sp. nov., nitrate-reducing chemolithoautotrophs of the ε-*Proteobacteria* isolated from a deep-sea hydrothermal system in the Mid-Okinawa Trough. Int. J. Syst. Evol. Microbiol., 55: 925-933 (2005)

Nakagawa, S., F. Inagaki, K, Takai, K. Horikoshi, and Y. Sako: *Thioreductor micantisoli* gen. nov., sp. nov., a novel mesophilic, sulfur-reducing chemolithoautotroph within the ε-*Proteobacteria* isolated from the hydrothermal sediments in the Mid-Okinawa Trough. Int. J. Syst. Evol. Microbiol. 55; 599-605 (2005).

Kamikawa R., S. Hosoi-Tanabe, S. Nagai, S. Itakura. and Y. Sako.: Development of a quantification assay for the cysts of the toxic dinoflagellate *Alexandrium tamarense* using teal-time polymerase chain reaction. Fish. Sci., 71: 987-991 (2005)

Kim C.J., C.H. Kim and Y. Sako.: Development of molecular identification method for genus *Alexadrium*(Dinophyceae) using whole-cell FISH. Marine Biotechnol., 7: 215-222 (2005)

Nunoura T., Y. Sako, T. Wakagi And A. Uchida: Cytochrome aa3 in facultatively aerobic and hyperthermophilic *Pyrobaculum oguniense*. Can.J.Microbiol., 51: 621-627 (2005)

Nakagawa S., Z. Shtaih, A. Banta, T.J. Beveridge, Y. Sako and A.-L. Reysenbach: *Sulfurihydrogenibium* yellowstonense sp. nov., an extremely thermophilic, facultatively heterotrophic sulfur-oxidizing bacterium from Yellowstone National Park, and emended descriptions of the genus *Sulfurihydrogenibium, Sulfurihydrogenibium subterraneum* and *Sulfurihydrogenibium azorense*. Int. J. Syst. Eol. Microbiol., 55: 2263-2268 (2005)

Kim C.-J. and Y. Sako: Molecular identification of toxic *Alexandrium tamiyavanichii* (Dinophyceae) using two DNA probes. Harmful Algae 4: 984-991 (2005)

Ishikawa K., S. Hosoi-Tanabe and Y. Sako: Molecular detection of *Uroglena americana* (Chrysophyceae), a freshwater red-tide agent in Lake Biwa, Japan. Ver.Internat.Verein.Limnol. 29: 1103-1106 (2005)

Nakagawa S. and Y. Sako: Distribution, activity, diversity, and physiological characteristics of extremophiles in deep-sea hydrothermal environments Bul. Jap. Soc. Microbial. Ecol. 20(2): 39-46 (2005)

Mori, T., M. Hayashi, N. Nozaki, K. Tarutani, I. Yoshinaga, S. Kawawasaki, T. Fuchima, M. Nishiyama and A. Sasaki: Research report of the estuary of Yodo Rever. Annual Reports of Faculty of Marine Sciences in Kobe University, vol.2, 115-126 (2005)

***Reports***

Sako,Y.: Development of molecular detection method of toxic planktons and cysts (in Japanese). Reports of counterplanning for protection of shellfish poisoning damage (Ministry of Agriculture), 2006. Development of molecular identification method of red tide planktons (in Japanese). Reports of counterplanning for protection of red tide damage (Ministy of Agriculture), 2006.

b) Conference and seminar papers presented

The 2005 Annual Meeting of the Japanese Society of Fisheries Science: 7

The 8th Meeting of the Japanese Society of Marine Biotechnology: 3

The 21th Annual Meeting of the Japanese Society of Microbial Ecology: 2

The 78th Annual Meeting of the Japanese Biochemistry Society: 1

The 7th Annual Meeting of Protein Science Society of Japan: 1

## A-3. Off-campus activities

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

Sako, Yoshihiko: Japanese Society of Fisheries Science (Trustee in Kinki Branch, Publication committee Member, Member of Symposium Organizing Committee,), Japanese Society of Microbial Ecology (Secretary), Japan Society for Archaea (Executive Committee Member), Japanese Society of Marine Biotechnology (Trustee)

Yoshinaga, Ikuo: Japanese Society of Microbial Ecology (Business affairs)

***Research Grant***

Sako, Yoshihiko: Monbukagakusho Grants-in-Aid for Scientific Research (A), Massive collection of metagenomes occurring at deep-sea hydrothermal environments and their application to industrial processes (Head: Sako); Monbukagakusho Grants-in-Aid for Exploratory Research, Study on future hydrogenase applicable to hydrogen energy from marine hyperthermophilic archaea (Head: Sako), Monbukagakusho Grants-in-Aid for Scientific

Research (B) (2), Structural biological studies of target DNA recognitions by endonucleases (Head: Keiko Kita [Div. of Applied Life Sciences], Collaborator: Sako), Entrust Research Grant by Ministry of Agriculture, Forestry and Fisheries: Technical development in counterplanning for protection of shellfish poisoning damage (Head: Sako), Technical development in counterplanning for protection of red tide damage (Head: Sako), National Project on Protein Structural and Functional Analyses, Metabolic Enzymes (Head: Toshihisa Ohshima [Univ. Tokushima], Collaborator: Sako); COE for Microbial-Process Development Pioneering Future Production Systems (Head: Sakayu Shimizu [Div. of Applied Life Sciences], Collaborator: Sako)

Yoshinaga, Ikuo: Monbukagakusyo Grants-in-Aid for Scientific Research (B)(2), Prevention of harmful algal blooms using epiphytic algicidal bacteria abundantly associated with macroalgae (Head: Ichiro Imai [Div. of Applied Life Sciences], Collaborator: Yoshinaga)

Tanaka, Reiji: Monbusho Grants-in-Aid for for JSPS Fellows, Development of genetic manipulation technologies of marine hyperthermophilic archaea toward the genome-wide functional analyses (Head: Tanaka)

## A-4. International cooperations and overseas activities

*International meetings (role)*

*Overseas research surveys*

Sako, Yoshihiko: Development of genetic diagnosis for toxic microalgae (USA, Korea), Search for extremophilic microorganisms at sub-seafloor biotopes in cooperation with IODP (USA)

*Editorial work for international jounals (role)*

Nomura, Norimichi: Archaea, Heron Publishing, British Columbia, Canada (Editorial Review Board)

## B. Educational Activities (2005.4-2006.3)

## B-1. On-campus teaching

a) Courses given

Undergraduate level: Marine Microbiology I (Sako), Marine Microbiology II (Sako), Seminar of Marine Microbiology (Sako), Fundamentals for the experiments of Bioresource Science (Sako, Yoshinaga, Nomura), Basic Bioresource Science I (Sako), Biotechnology - New Strategies in Agriculture- (Sako), Basic Bioresource Science I (Sako, sharer), Microbiology(Sako)

Graduate level: Current Topics in Marine Microbiology (Sako), Seminar in Marine Microbiology (Sako), Laboratory Course in Marine Microbiology (Sako)

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

*Part-time lecturer*

Sako, Yoshihiko: Mie University Faculty of Bioresources (Marine microbial physiology), Nishinomiya High School (Specially Science Class)

## 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: Special Committee Member of Project on the Deep-sea Research in Japan Marine Science and Technology Center, Member of evaluation committee in Extremobiosphere Research Center of Japan Marine Science and Technology Center, Member of Research administrative committee of Geo Biotechnology Development Organization

# 2.4.14 Laboratory of Marine Environmental Microbiology

*Staff* *Professor* : *Nakahara, Hiroyuki, Dr. Sci.*

*Associate Professor: Imai, Ichiro, Dr. Agric. Sci*

*Instructor* : *Ajisaka, Tetsuro, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program : (4)*

*Master's program : (8)*

*Undergraduate : (3)*

*Research fellow : (2)*

*Research student : (1)*

## A. Research Activities (2005.4 - 2006.3)

### A-1. Main subjects

a) Effects of eutrophication and loading of pollutants on fishery resources.

The exponential expansion of human development, industrialization and exploitation of various resources has resulted in an undesirable nutrient enrichment and contamination of aquatic environment. The loadings from municipal, industrial urban and agricultural pollutants are a serious threat to the conservation of the global aquatic ecosystem and fisheries resources. So, we are studying the effects of nutrient enrichment, heavy metals and agricultural chemicals on the aquatic primary producers, phytoplankton and benthic macroalgae, in laboratory and field conditions and in single species and community levels.

b) 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.

c) Taxonomical 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 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 analysis.

d) Multilateral studies of freshwater macroalgae in the Mekong water

Freshwater macroalgae (*Cladophora glomerata* , *Spirogyra* spp. and *Nostochopsis* spp.) are used for food in the vicinity of the Mekong, South-east Asia. Multilateral studies on these algae is now studying in Laos and Thailand.

## A-2. Publications and presentations

a) Publications

***Books***

Imai, I.: Harmful algal blooms and fishery damages. In "Marine Environmental Microbiology" (Ishida, Y. and H. Sugita eds.), pp.115-126. Koseishakoseikaku, Tokyo, 2005 (in Japanese).

Imai, I.: Elimination of red tides. In "Marine Environmental Microbiology" (Ishida, Y. and H. Sugita eds.), pp.184-185. Koseishakoseikaku, Tokyo, 2005 (in Japanese).

Imai, I.: Ecological control of flagellate red tides by diatoms. In "Marine Environmental Microbiology" (Ishida, Y. and H. Sugita eds.), pp.192-194. Koseishakoseikaku, Tokyo, 2005 (in Japanese).

***Original papers***

Yamamoto, Y. and H. Nakahara: Competitive dominance of the cyanobacterium *Microcystis aeruginosa* in nutrient-rich culture conditions with special reference to dissolved inorganic carbon uptake. Phycological Research 53 (3) 201-208, 2005

Nishitani, G., M. Yamaguchi, A. Ishikawa, S. Yanagiya, T. Mitsuya and I. Imai: Relationships between occurrence of toxic *Dinophysis* species (Dinophyceae) and small phytoplankton in Japanese coastal waters. Harmful Algae 4; 755-762, 2005

Hiroishi, S., H. Okada, I. Imai and T. Yoshida: High toxicity of the novel bloom-forming species *Chattonella ovata* (Raphidophyceae) to cultured fish. Harmful Algaey 4; 783-787, 2005

Naito, K., M. Matsui and I. Imai: Ability of marine eukaryotic red tide microalgae to utilize insoluble iron. Harmful Algae 4; 1021-1032, 2005

Kubota, S., Okita, K., Tanase, H. and Ajisaka, T. : Stranding of living Strombus (Conarium) terevellatus attached with barnacles and marine algae on "Kitahama beach" at Shirahama, Wakayama Prefecture, Japan. J. Jap. Driftological Soc. 3: 45-46, 2005.

***Reviews***

Ajisaka, T., T. Komatsu, and K. Tachikawa : Distribution and ecology of the genus *Sargasum* (Phaeophyta). Kaiyo Monthly 37(7): 457-459, 2005 (in Japanese)

Ajisaka, T. and S. Uwai : On the morphological variation of vesicles and receptacles in *Sargassum*

*horneri*/ *S. filicinum* group. Kaiyo Monthly 37(7): 460-465, 2005(in Japanese)

Uwai, S., Kogame, K., Yoshida, G., Kawai, H. and T. Ajisaka : Genetic diversities among the pupulations of *Sargassum horneri*/*S. filicinum* group. Kaiyo Monthly 37(7): 466-470, 2005 (in Japanese)

Komatsu, T., Fillipi, J.B., Matsunaga, D., Mikami, A., Sagawa, T., Ishida, K., Tachikawa, K., Ajisaka, T., Tanaka, K., Oaki, M., and T. Sugimoto : Distribution of drifting seaweed in the East China Sea, Kaiyo Monthly 37(7): 522-526,2005 (in Japanese)

***Reports***

Imai, I., T. Watanabe and T. Ishida : Ecological characteristics of the distribution of diatom resting stage cells in sediments of the Ariake Sea. Report of Counterplanning for Fisheries Damages by Diatom Red Tides (Fisheries Agency); p.12-22, 2005 (in Japanese).

Imai, I., Y. Matsuyama and G. Nishitani: Search for microorganisms responsible for diarrhetic shellfish poisoning and development of feasible monitoring. Report of Counterplanning for Protection of Shellfish Poisoning Damage (Ministry of Agriculture, Forest, and Fisheries); p.1-22, 2005 (in Japanese).

Imai, I., A. Tanabe and K. Naito: Effects of macro- and micro-nutrients on the growth of diatoms. Report on Technical Developments for Reducing Fishery Damages of Nori Aquaculture by Diatom Red Tides, Upgrading Project of Agriculture, Forestry and Fisheries by Using of High Technology (Fisheries Agency); p.57-67, 2005 (in Japanese).

Ajisaka, T. and I. Wakana : Research of *Cladophora glomerata* and *Spirogyra* spp. from the Mekong River, Laos. A Transdisciplinary study on the regional eco-history in tropical Monsoon Asia: 1945-2005. Res. Inst. Humanity and Nature, pp. 338-344, 2005 (in Japanese)

b) Conference and seminar papers presented

2005 Meeting of the Japanese Society of Scientific Fisheries: 2 presentations

First International Workshop on on HAB in the Northwest Pacific Region: 3 presentations

17th International Botanical Congress: 1 presentation

2005 Joint Meeting of the Plankton Society and the Benthos Society: 2 presentations

2005 Meeting of Kinki Branch of Japanese Society of Scientific Fisheries: 2 presentations

The 30th Annual Meeting of Phycological Society of Japan: 3 presentations

## A-3. Off-campus activities

***Membership in academic societies***

Nakahara, H.: The Japanese Society of Scientific Fisheries (Council Member)

Imai, I.: The Japanese Society of Scientific Fisheries (Chairman of Committee of Protecting Fisheries Environment, Council Member of Kinki Branch), The Plankton Society of Japan (Executive Editor of English Journal, Plankton & Benthos Research), The Japanese Society of Phycology (Council Member, Member of Editorial Board), The Japanese Society of Fisheries Oceanography (Council Member)

Ajisaka, T. : Japanese Society of Phycology (Council Member)

***Research grant***

Monbusho Research Grant: Scientific Research (B) (2), Comparative analysis of algicidal bacteria in red tide areas and seaweed beds, and application of algicidal bacteria in seaweed beds to prevention of harmful red tides (Imai, I. and H. Nakahara). Overseas Research (A):

Distribution and ecological study of *Sargassum* beds in China and its contribution for drifting seaweeds (Ajisaka, T.)

Entrust Research Fund by Ministry of Agriculture, Forestry and Fisheries: Technical development in counterplanning for protection of shellfish poisoning damage (Imai, I.). Urgent counterplanning for diatom red tides (Imai, I.). Urgent counterplanning for *Cochlodinium polykrikoides* red tides (Imai, I.), Upgrading project of Agriculture, Forestry and Fisheries by using of high technology (Imai, I)

## A-4. International cooperation and overseas activities

***International meetings***

Imai, I.: 1st International Workshop on HAB in the Northwest Pacific Region, Toyama, June 30 – July 1, 2005 (invited speaker); 17th International Botanical Congress, Vienna, Austria, July 17 – 23, 2005 (invited speaker); North Pacific Marine Science Organization 14th Annual Meeting, Vladivostok, Russia, September 28 – October 3, 2005 (Delegate of Japanese committee members in Harmful Algal Bloom section)

Ajisaka, T.: Yunnan University and Research Institute of Humanity and Nature, Japan, with financial assistance from the JSPS Project entitled "Distribution and Sharing of Resources in Symbolic and ecological Systems: Integrateive Model-building in Antheropology", JSPS Multilateral Cooperative Research Program, June 17, 2005, in Yunnan University. (invited speaker); The Second Joint Seminar on Coastal Oceanography, Oct. 26, 2005, in the Tokyo University, (invited speaker); Workshop in NAFRI (Laos) Eco-history Study Project in Vientiane Plain-water, resources-use and daily life in Xaytani District -in Laos PDR, March 1, 2006, NAFRI, Laos (invited speaker)

***International Joint Researches, Overseas Research Surveys***

Nakahara, H: Recent Changes in the Ecosystems of the Northern Coast and the Syr-darya Delta of the Small Aral Sea (Republic of Kazakhstan)

Ajisaka, T.: Biodiversity in Southeast Asian coastal area (Vietnam), Distribution and ecological study of *Sargassum* beds in China and its contribution for drifting seaweeds (China), A Trans-Disciplinary Study on the Regional Eco-History in Tropical Monsoon Asia (Laos, Thailand)

# B. Educational Activities (2005.4 - 2006.3)

## B-1. On-campus teaching

a) Courses given

Undergraduate level: Aquatic Microbial Ecology I (Nakahara), Aquatic Microbial Ecology (Imai), Importance of Global Environmental Study (Imai, Partaker), Practical Course in Marine Bioscience and Technology (Nakahara, Imai, partaker), Seminar in Marine Microbiology (Nakahara, Imai, partaker), Laboratory Course in Bioresource Science I, II (Imai, partaker), Marine Practice I, II (Imai, Ajisaka, partaker), Marine Practice III (Faculty of Science) (Ajisaka, partaker)

Graduate level: Aquatic Environmental Microbiology (Nakahara), Aquatic Microbial Ecology (Imai), Seminar of Aquatic Environmental Microbiology (Nakahara, Imai and Ajisaka), Laboratory Course of Aquatic Environmental Microbiology (Nakahara, Imai), Graduate School of Global Environmental Studies: Management of Global Resources and Ecosystems(Nakahara, partaker), Conservation of Coastal Ecosystems (Nakahara, Imai),

Seminar in Environmental Management (Summer Practice) (Nakahara, Imai,, Ajisaka, partaker)

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

*Part-time lecturer*

Nakahara, H.: Coastal Ecosystems and Global Environment, Face-to-face instruction, The University of the Air

Ajisaka, T.: Mari-culture of seaweeds, Faculty of Agriculture, Kinki University; Marine Practice, Faculty of Science, Nara Women's University, Environmentology, Faculty of Literature, Kansei-gakuin University

## B-3. Overseas teaching

Ajisaka, T.: Nhatrang Institute of Oceanography in Vietnam (Lecture), NAFRI in Laos (Lecture)

*Students and research fellows from abroad*

Doctor Course Student 1 (Korea)

## C. Other remarks

Nakahara, H.: Kyoto Prefectural committee for adjustment of inland fisheries; Temporary member of the committee of the Council of Environment, Ministry of Environment,

Imai, I.: North Pacific Marine Science Organization (Delegate of Japanese Committee Member of Harmful Algal Bloom section); Fisheries Agency of Japan (Committee member); Ministry of Environments (Committee member); Supervisor of the permanent exhibition "Biodiversity" (Chromophyta) in the National Science Museum

Ajisaka, T.: Researcher of Research Center for the Pacific Island, Kagoshima University

# 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.*
*Assistant Professor : Kinoshita,Masato, Dr.Agric.Sci.*

*Number of Students and research fellows*

*Doctor's program* *: (2)*
*Master's program* *: (11)*
*Undergraduate* *: (4)*
*Research fellow* *: (1)*
*Special Research student : (1)*

### A. Research Activities (2005.4-2006.3)

### 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) Pigment-proteins from Porphyra sp. and carotenoids from brown algae and Dinoflagellates inhibit a degranulation of mast cells. These results suggests that these pigments have anti-inflammative activities. (2) Carotenoids from algae were studied from the perspective of their absorption, metabolism through intestinal tract, and anti-proliferative activities of the metabolites against various cell lines. We found for the first time that esterification of oxgenated carotenoids by intestinal cells.

b) Studies on reguration of lipid metabolism via nuclear receptors and nuclear transcription factor.

Modulation of lipid metabolism is important to decrease the risk of life-style related diseases. Recently, it has been known the mechanism of lipid metabolic gene expression through nuclear receptors. In this study, we examined the effect of structural modified EPA (trans-isomers and oxidized forms) on lipogenetic gene expression via liver-X receptor (LXR) and sterol regulatory element binding protein-1c (SREBP-1c) in HepG2 human hepatoma cells. Our results show that trans-isomers of EPA and oxidized EPA decrease the expression of lipogenic gene more potently the lipogenic gene expression than its intact form. We tried to elucidate the mechanisms of the regulation of the lipogenic gene expression by the EPA derivatives.

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 confirmed that hemocyanin-derived phenoloxidase activity plays the major role in the black spot

development, especially in fronzen-thawed prawns. This year we demonstrated monopheol oxidase activity of hemocyanin both in kuruma prawn and in Austrarin lobster. Oxidation of tyrosine is much slower process than that of DOPA, resulting that monopheol oxidase activity of hemocyanin has been passed over in crustacean so far.

d) Production of transgenic fish and regulation of expression of transgene.

Transgenic technique is one of the most powerful tools for the investigation of gene function. In this study, we used medaka as a model. I optimized the gene transfer conditions using microinjection method and particle delivery method with gene gun. And I also developed some vector cassettes, which regulate tissue specific gene expression (in muscle, nerve system, and liver). I also adopt Cre-LoxP system and IRES (Internal Ribosome Entry Site) system in medaka transgenesis. I also tried to develop gene transfer method into red sea bream, which is commercially important seawater fish in Japan.

e) Development of transgenic medaka for the detection of endocrine disrupting substances.

In addition to ChgH-GFP transgenic medaka, which is a sensitive endocrine-disrupting substances monitoring animal, we developed unique transgenic medaka, 42Sp50-GFP transgenic medaka. With this transgenic medaka, we can detect testis-ova in live fish.

## A-2. Publications and presentations

a) Publications

***Books and Review***


Sugawara, T.: Metabolism and biological function of brown algae fucoxanthin. In Advanced Utilization of Fish and Fisheries Products (M. Sakaguchi and T.Hirata, eds.). pp162-168, NTS, Tokyo, 2005 (in Japanese)

Song, X., T. Hirata, and M.Sakaguchi: Are fish guts really unacceptable? In Advanced Utilization of Fish and Fisheries Products (M. Sakaguchi and T.Hirata, eds.). p. 234-243, NTS, Tokyo, 2005 (in Japanese)

Wang, X., T. Hirata, M. Kinoshita, Y. Fukuda, and M. Sakaguchi: Preference survey of Chinese and Japanese to kamabokos prepared from silver carp and Alaska Pollack. In Advanced Utilization of Fish and Fisheries Products (M. Sakaguchi and T.Hirata, eds.). p. 404-412, NTS, Tokyo, 2005 (in Japanese)

Adachi, K., T. Hirata, and M. Sakaguchi: Blackspot development on shrimp and its prevention. In Advanced Utilization of Fish and Fisheries Products (M. Sakaguchi and T.Hirata, eds.). p. 454-468, NTS, Tokyo, 2005 (in Japanese)

Adachi, K., and T. Hirata: Effects of freezing and thawing on melanosis of shrimp. Refrigeration 81, 32-35, 2006 (in Japanese)

Sugawara, T.: Detection and semi-quantitative determination of lipids by TLC. In the know-how to detect and determine the quantity of biological samples. (T. Moriyama, ed.). pp180-186, Yodosha, Tokyo, 2005 (in Japanese).

Sugawara, T.: Quantitative determination of lipids by commercial kit systems. In the know-how to detect and determine the quantity of biological samples. (T. Moriyama, ed.). pp195-198, Yodosha, Tokyo, 2005 (in Japanese).

Sugawara, T.: Quantitative determination of lipids by HPLC. In the know-how to detect and determine the quantity of biological samples. (T. Moriyama, ed.). pp199-204, Yodosha, Tokyo, 2005 (in Japanese).

Sugawara, T.: Quantitative determination of lipids by HPLC with evaporative light scattering detection. In the know-how to detect and determine the quantity of biological samples. (T. Moriyama, ed.). pp212-217, Yodosha, Tokyo, 2005 (in Japanese).

Sugawara, T.: Quantitative determination of lipids by gas-liquid chromatography. In the know-how to detect and determine the quantity of biological samples. (T. Moriyama, ed.). pp218-224, Yodosha, Tokyo, 2005 (in Japanese).

Sugawara, T.: Detection and quantitative determination of lipid peroxidation. In the know-how to detect and determine the quantity of biological samples. (T. Moriyama, ed.). pp225-230, Yodosha, Tokyo, 2005 (in Japanese).

*Original papers*

Adachi, K., K. Kato, K.Wakamatsu, S. Ito, K. Ishimaru, T. Hirata, O. Murata, and H. Kumai,: The histological analysis, colorimetric evaluation, and chemical quantification of melanin content in 'suntanned' fish. Pigment Cell Research 18; 465-468, 2005

Adachi, K., K. Wakamatsu, S. Ito , N. Miyamoto , T. Kokubo , T. Nishioka , T. Hirata: An oxygen transporter hemocyanin can act on the late pathway of melanin synthesis. Pigment Cell Research 19: 214– 219, 2005

Kotake-Nara, E., T. Sugawara and A. Nagao: Antiproliferative effect of neoxanthin and fucoxanthin on cultured cells. Fisheries Science 71; 459-461, 2005

Zaima, N., T. Sugawara, H. Arai, K. Nakamura, M. Takasugi, K. Fukunaga, R. Noguchi and T. Hirata: Characterization of trans eicosapentaenoic acid isomers: Oxidative stability and anti-inflammatory activities. Journal of Oleo Science 54; 505-512, 2005

Bubenshchikova, E., B.Ju, I. Pristyazhnyuk, K. Niwa, E. Kaftanovskaya, M. Kinoshita, K. Ozato, Y. Wakamatsu: Generation of Fertile and Diploid Fish, Medaka (Oryzias latipes), from Nuclear Transplantation of Blastula and Four-Somite-Stage Embryonic Cells into Nonenucleated Unfertilized Eggs. CLONING AND STEM CELLS, 7 (4) 255-264 (2005)

Scholz, S., K Kurauchi, M. Kinoshita, Y. Oshima, K. Ozato, K. Schirmer, and Y. Wakamatsu: Analysis of estrogenic effects by quantification of green fluorescent protein in juvenile fish of a transgenic medaka. Environmental Toxicology and Chemistry, 24, (10) 2553-2561 (2005)

Kurauchi, K., Y. Nakaguchi, M. Tsutsumi, H. Hori, R. Kurihara, S. Hashimoto, S R. Ohnuma, Y. Yamamoto, S. Mastuoka, S. Kawai, T. Hirata, M. Kinoshita: An in vivo visual reporter system for detection of estrogen-like substances by transgenic medaka. Environ. Sci. Technol., 39, (8), 2762-2768 (2005)

Hano, T., Y. Oshima, T. Oe, M. Kinoshita, M. Tanaka, Y. Wakamatsu, K. Ozato, T. Honjo: A quantitative bioimaging analysis in the evaluation of sexual differentiation on germ cells of olvas-GFP/ST II-YI medaka, Oryzias latipes, nanoinjected with ethinyl estradiol. Environ . Toxicol. Chem. 24, 70-77 (2005)

b) Conference and seminar presented

Annual meeting of the Society of Scientific Fisheries: 6 presentations

Annual Meeting of the Japan Society for Bioscience, Biotechnology, and Agrochemistry, 2006: 5 presentations

The 44rd Annual Meeting of the Japan Oil Chemists' Society: 2 presentations

The 59th Annual Scientific Meeting of Japanese Society of Nutrition and Food Science: 1 presentation

2nd JOCS-ILSI Japan Joint Symposium 2005: 1 presentation
The 2nd Annual Scientific Meeting of Japanese Association for Food Immunology: 1 presentation
Annual Meeting of the International Aquagenome Society (Domestic meeting): 1 presentation
The 76rd Annual Meeting of the Zoological society of Japan: 1 presentation

## A-3. Off-campus activities

***Membership in academic societies (role)***

Hirata,Takashi: The Japanese Society of Fisheries Science (Symposium planning committee, Fisheries science education committee), World fisheries congress (Program committee), The Society of Packaging Science and Technology (vice-President, Editor), The Japanese Society for Food Science and Technology (Councilor, Auditor)

Sugawara Tatsuya: The Conference on Lipid Peroxide Biology and Medicine (Executive Committee Member)

***Research grants***

Monbusho Research Grant: Scientific Research; Studies on the novel pathway of melanogenesis in crustaceans and its postharvest control (Hirata, Sugawara, Kinoshita), Germination research; Allergic control by nuclear receptor PPAR gamma ligands derived from marine products (Hirata, Sugawara), Scientific Research; Visualization of water pollutants using transgenic medaka (Kinoshita), Creative Scientific Research; Establishment of Neuroglycobiology (Glycobiological approach for Neuroscience) (Kinoshita), Grant-in-Aid for Scientific Research on Priority Areas 'Mechanisms of Sex Differentiation'; Initiation of oogenesis in medaka (Kinoshita), Misistry of the Enviroment: ExTEND 2005 Feasibility Study; Application of transgenic medaka for the assessment of endcrine disrupers and the study of their disruption mechanism (Kinoshita)

## A-4. International cooperations and overseas activities

***International meetings (roles)***

Kinoshita, M.: International Symposium on Standardization of Medaka Bioresources at Nagoya University Nagoya Japan

Kinoshita, M. Hirata, T.: International Symposium on Standardization of Medaka Bioresources at Nagoya university Nagoya Japan (Poster)

Kinoshita, M.: 15th International Society of Developmental Biologists Congress Sydney Convention & Exhibition Centre, Sydney, Australia (Coauthor)

***International Activity***

Hirata, T : Ocean University of China (Invited lecture)

# B. Educational Activities (2005.4-2006.3)

## 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)

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 lecture*

Hirata,Takashi: Fukui Prefectural University

Kinoshita, Masato: Kyoto Prefectural University of Medicine

*Open seminar*

Hirata,Takashi: Packaging manager course (Lecturer)

Kinoshtia, Masato: Lecture for high-school students (Lecturer)

Kinoshtia, Masato: Lecture for graduated Students in Fukui Prefectural University (Lecturer)

### C. Other Remarks

Hirata, Takashi: Kinki Agri.High Technol.( Director )

Kinoshita, Masato: Award of Fisheries Science in 2004 (Nippon suisan gakkai)

## 2.4.16 Laboratory of Marine Biological Function

*Staff* *Associate Professor: Toyohara, Haruhiko, Dr. Agric. Sci.*

*Students and research fellows*

*Doctor's program: (4)*

*Master's program: (6)*

*Undergraduate : (4)*

### A. Research Activities (2005.4-2006.3)

### 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, etylacetate, n-butanol and water, we screened the anti-allergy activity by using extracts. We successfully identified the anti-allergy substance in some algae.

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. We found that river and coast benthos including shijimi, a species of bivalves, contribute to the breakdown of cellulose similar to the white ants in the wood. We successfully cloned the cDNA from shijimi and found that it has almost 50% identity with that of white ant in the amino acid 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 biominerarization process and isolate two genes that showed the homology with spider silk proteins.

d) Development of the genetically engineered transgenic cultured fish

Fish culture is very important to maintain the food production in Japan. Breeding by crossing, however, is very limited in case of fish culture compared with agriculture. We focused on red seabream, one of the most important cultured fish, and made a specific vector for red seabream carrying actin promoter. We also cloned a TIMP from red seabream (tissue inhibitor for matrix metalloproteinase) gene that suppress the autolytic breakdown of fish. We introduced this gene into red seabream fertilized egg.

## A-2. Publications and presentations

a) Publications

***books***

1. H. Toyohara, K. Kato: Improvement of meat quality by transgenic technology, Kaiyo to Seibutu, 163, 141-151 (2006).

***Original papers***

M. Hosoi, K. Takeuchi, H. Sawada, H. Toyohara H. Expression and functional analysis of mussel taurine transporter, as a key molecule in cellular osmoconforming. J. Exp. Biol., 208:4203-11.2005.

H.Toyohara, S. Yamamoto, M. Hosoi, M. Takagi, I. Hayashi, K. Nakao and S. Kaneko. Scallop DMT functions as a $Ca^{2+}$ transporter. FEBS Lett. 579, 2727-2730 (2005).

H. Toyohara, M. Ikeda, C. Goto, H. Sawada, M. Hosoi, K.Takeuchi, I. Hayashi, S. Imamura, M. Yamashita. Osmo-responsive expression of oyster amino acid transporter gene and analysis of the regulatory region involved. Fish. Sci. 71, 465-470 (2005).

H. Toyohara, M. Yoshida, M. Hosoi, I. Hayashi. Expression of taurine transporter in response to hypo-osmotic stress in the mantle of Mediterranean blue mussel. Fish. Sci. 71, 356-360 (2005).

H. Toyohara, M. Hosoi, I. Hayashi I, S. Kubota, H. Hashimoto, Y. Yokoyama. Expression of HSP70 in response to heat-shock and its cDNA cloning from Mediterranean blue mussel. Fish. Sci. 71, 327-332 (2005).

***Reports***

Toyohara, H: 2005 Annual report on the Bio-Design Project by the Ministry of Agriculture,

Forestry and Fisheries, Japan. 2004 Annual report to Nippon Suisan Fund

b) Conference and seminar papers presented

The 2005 Annual Meeting of the Japanese Society of Fisheries Science: 7

The 2005 Annual Meeting of the Japanese Association of Benthology: 2

The 2005 Annual Meeting of Marine Biotechnology Conference: 2

The 2005 Annual Meeting of Aquatic Genome Conference: 2

International Symposium of Dynamics of Ocean Biosystem: 2

The 2005 Coral Conference: 1

The 2005 Annual Meeting of the Japanese Association of Biochemistry: 1

## A-3. Off-campus activities

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

Toyohara, Haruhiko: Japanese Society for Traditional Food Science (Secretary), Japanese Association of Fisheries Science (Program Committee of International Fisheries Science Conference)

***Research grants***

Toyohara, Haruhiko: Grant-in-Aid for Scientific Research (B) (2), Studies on fish muscle tenderization-analysis of transgenic red sea bream (Head: Toyohara); Grant-in-Aid for Scientific Research, Studies on biomineralization mechanism focusing on bivalve mantle (Head: Toyohara); The Bio-Design project from the ministry of Agriculture, Forestry and Fisheries, Japan; Research aid from Nippon Suisan Kaisha (Head: Toyohara), Development of marine extract library; Reseach Grant from Sekusui Kagaku (Head: Toyohara), Studies on spider silk-like protein in shell.

## A-4. International cooperations and overseas activities

Toyohara, Haruhiko: International Conference on Marine Biotechnology (Canada, invited speaker), Conference on Marine organisms (Taiwan, invited speaker), Japan-Thailand Symposium (Thailand, invited speaker), JAMSTEC Research Program, Conference on Fish Breeding (Tokyo, invited speaker).

# B. Education activities (2005.4～2006.3)

## 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), Cell Technology of Marine Organisms (Toyohara), Laboratory Course in Bioresource Science I and II (Toyohara), Introduction to Foreign Literature in Bioresource Science III (Toyohara), Seminar in Marine Bio-production (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: Marine Station in Okayama University, Institute of Fisheries Technology,

## B-3. Overseas teaching

Lecture in Kasertsart University

## C. Other remarks

***Committees in the Faculty***

Toyohara, Haruhiko: Committee on Biological Education in Kyoto University. Committee on Genetically Engineered Fish, Committee of Evaluation of Post-Doctoral Fellows in JASP

Toyohara, Haruhiko: 2004 Award paper in Fisheries Science.