2.3.2 Laboratory : Laboratory of Biomacromolecular Chemistry

Member :	Professor	Ueda, Mitsuyoshi, Dr. Engineering
	Associate Professor	Kuroda, Kouichi, Dr. Engineering
	Assistant Professor	Morisaka, Hironobu
	Doctor's program	7
	Master's Program	16
	Undergraduate	5
	Researcher	3

A. Research Activities (2009.4-2010.3)

A-1. Main Subjects

a) Creating the life sciences of the future through exploration and analysis of fundamental biological phenomena

Biological phenomena are among the most important and fascinating research themes in the life sciences. We approach our research from the perspective of biochemistry, both basic and applied, which means that we take a chemically based view of biological phenomena and attempt to explain them in chemical terms. Our aim is to uncover the essence of the diverse and complex phenomena observed in humans and other high-level eukaryotic organisms. To do this we use the latest methods to systematically investigate the genes and proteins enclosed in the cellular envelope which are the vehicles of life, the intracellular transmission of various kinds of biological data, and the mechanisms involved in interactions between cells, proteins, and genes. We are also active in applied biotechnology research, which seeks to advance the development and wellbeing of humankind by rapidly converting basic research findings into practical uses.

b) Using genomic information and the latest techniques to analyze complex biological phenomena at molecular level

Biological data transmission systems, which in high-level eukaryotic organisms underpin biological phenomena such as morphogenesis and development, rely on an interdependent series of complex physical and chemical processes involving huge numbers of molecules. Introducing new and systematic analytical techniques alongside conventional biochemical methodology, we attempt to elucidate complex biological processes at molecular level by

studying cells from yeasts, Arabidopsis thaliana, zebra fish, mouse, and other model eukaryotic organisms in which genomic decoding is advancing.

c) Expanding biological functions through bio- and nano-technology

In order to exploit the functions of living organisms in a wide range of fields, we undertake research which utilizes an understanding of the basic principles of bio-phenomena to modify genomic information and thereby access latent capabilities in living organisms or endow them with novel functions. We led the world in the development of cell-surface engineering, a relevant technique which makes use of the address (signal sequence) information contained in proteins and whose revolutionary approach has allowed the creation of many new cell types. This development has continued with the establishment of a completely new field in biochemistry known as combinatorial bioengineering and through fusion with nanotechnology and other fields to create the concept of nano-biotechnology. Through these, we look forward to creating new bioactive proteins and cells which transcend the limitations of known genomic information.

A-2.Publications and presentations

a) Publications

Original Papers

- Shinya, R., Y. Takeuchi, N. Miura, K. Kuroda, M. Ueda, K. Futai: Surface coat proteins of the pine wood nematode, Bursaphelenchus xylophilus : profiles of stage and isolate-specific characters. Nematology, 11(3); 429-438, 2009
- Matsui, K., K. Kuroda, M. Ueda: Creation of a novel peptide endowing yeasts with acid tolerance using yeast cell- surface engineering. Appl. Microbiol. Biotechnol., 82(1); 105-113, 2009
- Kosugi, A., A. Kondo, M. Ueda, Y. Murata, P. Vaithanomsat, W. Thanapase, T. Arai, Y. Mori : Production of ethanol from cassava pulp via fermentation with a surface-engineered yeast strain displaying glucoamylase. Renewable Energy, 34; 1354-1358, 2009
- Maeda, H., M. Nagayama, K. Kuroda, M. Ueda: Purification of inactive precursor of carboxypeptidase Y using selective cleavage method coupled with molecular display. Biosci. Biotechnol. Biochem., 73(3); 753-755, 2009
- Miura, N., W. Aoki, N. Tokumoto, K. Kuroda, M. Ueda: Cell surface modification for non-GMO without chemical treatment by novel GMO-coupled and -separated cocultivation method. Appl. Microbiol. Biotechnol., 82(2); 293-301, 2009

- Kuroda, K., K. Matsui, S. Higuchi, A. Kotaka, H. Sahara, Y. Hata, M. Ueda: Enhancement of display efficiency in yeast display system by vector engineering and gene disruption. Appl. Microbiol. Biotechnol., 82(4); 713-719, 2009
- Horii, K., T. Adachi, T. Matsuda, T. Tanaka, H. Sahara, S. Shibasaki, C. Ogino, M. Ueda, Y. Hata, A. Kondo: Improvement of isoflavone aglycones production using beta-glucosidase secretory produced in recombinant Aspergillus oryzae. J. Mol. Catalys. B Enzymatic, 59(4); 297-301, 2009
- Kotaka, A., H. Sahara, A. Kondo, M. Ueda, Y. Hata: Efficient generation of recessive traits in diploid sake yeast by targeted gene disruption and loss of heterozygosity. Appl. Microbiol. Biotechnol., 82(2); 387-395, 2009
- Morisaka, H., K. Kobayashi, A. Kirino, M. Furuno, H. Minakuchi, K. Nakanishi, M. Ueda; Performance of wide-pore monolithic silica column in protein separation. J. Sep(aration) Sci(ence), 32(15-16); 2747-2751, 2009
- Inaba, C., K. Maekawa, H. Morisaka, K. Kuroda, M. Ueda; Efficient synthesis of enantiomeric ethyl lactate by Candida antarctica lipase B (CALB)-displaying yeasts. Appl. Microbiol. Biotechnol., 83(5); 859-864, 2009
- Horii, K., T. Adachi, T. Tanino, T. Tanaka, H. Sahara, S. Shibasaki, C. Ogino, Y. Hata, M. Ueda, A. Kondo: Evaluation of cell surface-displayed protein stability against simulated gastric fluid. Biotechnol. Lett., 31; 1259-1264, 2009
- Ito, J., A. Kosugi, T. Tanaka, K. Kuroda, S. Shibasaki, C. Ogino, M. Ueda, H. Fukuda, R. H. Doi, A. Kondo; Regulation of the display ratio for enzymes on the Saccharomyces cerevisiae cell surface by the immunoglobulin G and cellulisomal enzyme binding domains. Appl. Environ. Microbiol., 75(12); 4149-4154, 2009
- Han, Shuang-Yan, Zhi-You Pan, Deng-Feng Huang, M. Ueda, Xiao-Ning Wang, Ying Lin. Highly efficient synthsis of ethyl hexanoate catalyzed by CALB-displaying Saccharomyces cerevisiae whole-cells in non aqueous phase. J. Mol. Catalys. B Enzymatic, 59 (1-3); 168-172, 2009
- Maeda, T., Gab-Soo Do, J. Sugiyama, T. Araki, M. Tsuta, S. Shiraga, M. Ueda, M. Yamada, K. Takeya, Y. Sagara: Visualization and quantification of three-dimensional distribution of yeast in bread dough. Biosci. Biotechnol. Biochem., 73(7); 1586-1590, 2009
- Maeda, T., S. Shiraga, T. Araki, M. Ueda, M. Yamada, K. Takeya, Y. Sagara: Application of cell-surface engineering for visualization of yeast in bread dough: Development of a fluorescent bio-imaging technique in the mixing process of dough. Biosci. Biotechnol. Biochem., 73(7); 1604-1607, 2009

- Sahara, H., A. Kotaka, A, Kondo, M. Ueda, Y. Hata: Using promoter replacement and selection for loss of heterozygosity to generate an industrially applicable sake yeast strain that homozygouslynoverproduces isoamylacetate. J. Biosci. Bioeng., 108(5); 359-364, 2009
- Isogawa, D., T. Fukuda, K. Kuroda, H. Kusaoke, H. Kimoto, S. Suye, M. Ueda: Demonstration of catalytic proton acceptor of chitosanase from Paenibacillus fukuinensis by comprehensive analysis of mutant library. Appl. Microbiol. Biotechnol., 85(1); 95-104, 2009
- Shibasaki, S., A. Kawabata, T. Tanino, A. Kondo, M. Ueda, M. Tanaka: Evaluation of biodegradability using arming yeast for polyurethane containing the dulcitol unit in the main chain. Biocontorol Science, 14(4); 171-175, 2009

Reviews

- Shibasaki, S., H. Maeda, M. Ueda: Molecular display technology using yeast - Arming technology (Cover). Analytical Sciences, 25(1); 41-49, 2009
- Shibasaki, S., M. Ueda: Therapeutic antibodies and other proteins obtained by molecular display technologies. Recent Patents on Biotechnology, 3(1); 19-27, 2009
- Kuroda, K., M. Ueda; Biofuel production from cellulosic biomass by cell-surface engineering - Development of arming technology to design biocatalyst for consolidated bioprocessing (CBP) system. Cellulose: Structure and Properties, Derivatives and Industrial Uses (Nova Science Publisher); 369-383, 2009
- Miura, N., E. Hayashi, H. Morisaka, K. Kuroda, M. Ueda; Construction of molecular catchers for short non-coding RNA (short ncRNA) using mutant ribonuclease 1- and PAZ domain-displaying yeasts. Proc. IFPT'6; 245-248, 2009
- Morisaka, H., K. Hara, M. Ueda: Construction of online continuous chromatography system using monolithic column for single cell analysis. Proc. IFPT'6; 249-250, 2009
- Hara, K., K. Kuroda, M. Ueda: Model screening system for membrane receptor ligands in combination with GPCR fluorescence assay using a single cell, Saccharomyces cerevisiae. Proc. IFPT'6; 375-376, 2009
- Aoki, W., K. Kuroda, M. Ueda: Construction of high-throughput single cell-based system for screening of interactive molecules. Proc. IFPT'6; 243-244, 2009

b) Conference and seminar papers presented

- Annual Meeting of the Society for Biotechnology, Japan 2009: 5 Presentations
- The 32nd Annual Meeting of the Molecular Biology Society of Japan: 9 Presentations

- Annual Meeting of Japan Society for Bioscience, Biotechnology and Agrochemistry 2010: 8 Presentations
- The 82nd Annual Meeting of the Japanese Biochemical Society: 3 Presentations
- APBioChEC 2009: 4 Presentations
- The20th Conference of The Society for Chromatographic Sciences: 2 Presentations
- IFPT: 4 Presentations
- Enzyme Engineering XX; 1 Presentation

A-4.International cooperation and overseas activities

International meetings(country,roles)

- Ueda, Mitsuyoshi, Dr. Engineering: International Conference of Combinatorial Bioengineering (President), International Workshop of Biomass (President)

B.Educational Activities(2009.4-2010.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level: General Biomacromolecular Chemistry (Ueda), Structure and Function of Biomacromolecules (Ueda), Applied Life Sciences (Ueda), Experiments of Biomacromolecular Chemistry (Ueda, Kuroda, and Morisaka)
- Graduate level: Biomacromolecular Chemistry (Ueda), Experiments of Biomacromolecular Chemistry (Ueda, Kuroda, and Morisaka)

B-3.Overseas teaching

International students

- International students : Undergraduate 1 (Korea)