Okazaki Institute for Integrative Bioscience

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The main purpose of Okazaki Institute for Integrative Bioscience (OIIB) is to conduct interdisciplinary, molecular research on various biological phenomena such as signal transduction, differentiation and environmental response. OIIB, founded in April 2000, introduces cutting edge methodology from the physical and chemical disciplines to foster new trends in bioscience research. OIIB is a center shared by and benefited from all three institutes in Okazaki, thus encouraging innovative researches adequately in advance of academic and social demands. The research groups of three full professors and one associate professor who have the position in IMS join OIIB. The research activities of these groups are as follows.

Aono group is studying the bioinorganic chemistry of hemeproteins that show a novel function. They elucidated the structure and function relationships of the heme-based sensor proteins in which a heme is the active site for sensing gas molecules such as CO and O_2. They are also studying the structure and function relationships of HrtR that is an heme-sensing transcriptional regulator responsible for heme homeostasis in *Lactococcus lactis*. Kato group is studying structure, dynamics, and interactions of biological macromolecules primarily using ultra-high field nuclear magnetic resonance (NMR) spectroscopy. In particular, they conducted studies aimed at elucidating the dynamic structures of glyco-conjugates and proteins for integrative understanding of the mechanisms underlying their biological functions. In this year, they successfully provided atomic views of conformational dynamics and intermolecular interactions of proteins involved in the ubiquitin-proteasome system and molecular recognition events on mammalian cell membranes. Kuwajima group is studying mechanisms of *in vitro* protein folding and mecha-

nisms of molecular chaperone function. Their goals are to elucidate the physical principles by which a protein organizes its specific native structure from the amino acid sequence. In this year, they studied the structural fluctuations of the *Escherichia coli* chaperonin GroEL/ES complex by hydrogen/deuterium-exchange 2D NMR techniques. Fujii group is studying molecular mechanisms of metalloenzymes, which are a class of biologically important macromolecules having various functions such as oxygen transport, electron transfer, oxygenation, and signal transduction, with synthetic model complexes for the active site of the metalloenzymes. In this year, they studied molecular mechanisms of metalloenzymes relating to monooxygenation reactions and denitrification processes.

OIIB is conducting the research program, "Integrated Bioscience to Reveal the Entire Life System with Studies of Biofunctional Molecules" and "Research on the Molecular Mechanisms of Biological Responses toward Environmental- and Biological-molecules." In these research programs, the studies on the following subjects have been carried out: (i) functional analyses of higher-ordered biological phenomena, (ii) comprehensive screening of biofunctional molecules, (iii) computer simulations of higher-ordered biological systems and biofunctional molecules, (iv) molecular mechanisms of response to environmental molecules, of differentiation of germ cells, and of cellular stress-response and defense against stress, (v) studies on perturbation of biological functions induced by environmental molecules, (vi) studies on normal physiological functions regulated by biological molecules, and (vii) construction of integrated data base on the biological influences of environmental molecules.