Okazaki Institute for Integrative Bioscience

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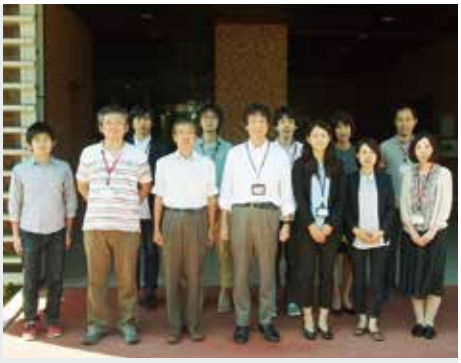

The main purpose of Okazaki Institute for Integrative Bioscience (OIIB) is to conduct interdisciplinary, molecular research on various biological phenomena such as signal transduction, differentiation and environmental response. OIIB, founded in April 2000, introduces cutting edge methodology from the 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. OIIB has started the research programs, "Okazaki ORION Project" and "BioNEXT Program" from 2014. The research groups of three full professors and one associate professor who have the position in IMS join OIIB to be involved in these research projects. The research activities of these groups are as follows.

Aono group is studying the bioinorganic chemistry of metalloproteins that show a novel function. Their research interests are focused on the structure and function relationships of transcriptional regulators and metal transport proteins that are responsible for metal homeostasis, especially iron and/or heme homeostasis, in bacteria. They are also working on a novel photosensor protein that adopts vitamin B_{12} (adenosylcobalamin) as the active site for photosensing, which is a transcriptional factor regulating gene expression in response to visible ligth. In this year, they successfully determined the crystal structures of HtaA and HtaB that are heme-binding and heme-transport proteins responsible for heme uptake reaction in *Croynebacterium glutamicum*. They also determined the crystal structure of a novel photosensor protein CarH from *Thermus thermophilus*, which uses adenosylcobalamin as a photoreceptor. Iino group is studying operation and design principles of molecular machines using single-molecule analysis, structural analysis, and protein engineering. Especially, they focus on rotary and linear molecular motors. In this year, they have succeeded in direct observation of intermediate states during the stepping motion of a linear molecular motor kinesin-1. They also have succeeded in direct imaging of binding, dissociation, and processive movement of a linear molecular motor Trichoderma reesei Cel6A and its domains on crystalline cellulose. Kato group is studying structure, dynamics, and interactions of biological macromolecules using nuclear magnetic resonance (NMR) spectroscopy, X-ray crystallography, and other biophysical methods. In particular, they conducted studies aimed at elucidating the dynamic structures of glycoconjugates and proteins for integrative understanding of the mechanisms underlying their biological functions. In this year, they successfully characterized dynamic processes of protein assembly and disassembly involved in the intracellular protein transport and the proteasome formation by native mass spectrometry and also the drug-induced conformational change of HIV-1 reverse transcriptase by NMR spectroscopy. Kurihara group is studying artificial cells based on molecular assemblies from chemical approach. Their goal is to create artificial cells which have three main elements, *i.e.* information, compartment and metabolism. In this year, they studied catalyst-producing vesicular system: A vesicle is reproduced by the catalyst which was synthesized in the vesicle. In this system, they observed the interaction between the production of compartment membrane molecule and the production of catalyst. In addition, they constructed the self-reproducing oil droplet system, which lead to the formation of giant vesicles.