Division of Biosciences

Department of Integrated Biosciences

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Signal Transduction Laboratory	Dr. Yoshikazu Ohya Dr. Kuninori Suzuki	The budding yeast Saccharomyces cerevisiae is a very attractive model organism for studying the fundamental theories and concepts of eukaryotic cells. We applied the power of yeast genetics to understand many aspects of yeast cells. Our current research is mainly focused on (1) system biology based on cell imaging, (2) function of cell wall and cell wall integrity checkpoint, and (3) autophagy. (1) To understand biological system as the network of logical and informational process, one of the invaluable tools is genetics. Global analysis of the mutant phenotypes can provide relationships between knockout of the gene and function in the network. We developed CalMorph image analysis system useful to examine high-dimensional quantitative phenotypes under the fluorescent microscope. This method can be applied to identifying intracellular drug target, monitoring fermentation process during culture and studying biological diversity. Our ultimate goal is to place all yeast genes and their corresponding products on a functional signaling network based on phenotyping. (2) The cell wall is an essential cellular component in yeast. The cell wall is dynamic, because it undergoes remodeling during the cell cycle. We demonstrated that small rho type GTPase Rho1 is regulated by the progression of the cell cycle. We also found that there is a new cell cycle checkpoint mechanism called “cell wall integrity checkpoint” which functions to control cell cycle progression	Budding yeast Saccharomyces cerevisiae, systems biology, imaging, cell cycle, autophagy	(1) Multivariate analysis of high-dimensional morphometric data to our understanding of the pharmacology of antifungal drugs. (2) High-Content, image-based profiling to identify drug target. (3) Chemical genetic analysis of yeast cell cycle (4) High-dimensional quantitative phenotyping of yeast essential genes (5) Single-cell phenomics with morphological data to reveal biodiversity and intra- species variation in yeast. (6) Biochemical study of dual role of the late S-phase transcription factor Hcm1 in yeast cell cycle regulation (7) Genetic study of multiple functional domains of the yeast 1,3-β-glucan synthase subunit by quantitative phenotypic analysis of temperature-sensitive mutants. (8) Phenotypic robustness contributed by the cell wall by protecting the intracellular functional network from environmental conditions. (9) Application of image-based monitoring system for green algal Haematococcus pluvialis (Chlorophyceae) cells during culture (10) Live imaging and biochemical analysis of autophagosome formation and its degradation (11) Chemical genetic analysis of yeast autophagy

		in response to cell wall perturbation. We are now studying such signaling mechanism as well as biosynthesis of the cell wall in yeast.		(12) Cell biological analysis of membrane sources of autophagosomes
Molecular recognition Laboratory	Dr. Shinji NAGATA	My research interest is to find out endocrine control in feeding behavior via the ligand and receptor recognition. Among the GPCRs, one receptor can recognize several different ligands in vivo, eventually harmonizing the biologically crucial events. We use insects, which possess the open circulating system as a model animal, in order to address a receptor-sharing system. Our final investigation goal is to understand the comprehensive ligand-receptor interaction in the body to exert biological processes.	Ligand-receptor recognition Peptide Insect Knockdown MALDI-TOF MS	To know the different ligand recognition in a single receptor, the summer program students first perform calcium imaging to reveal the intracellular response against some ligands, which you chemically synthesized peptidyl factor. The students will experience the confocal-microscope, MALDI-TOF MS, RT-PCR, qRT-PCR, HPLC, Fmoc peptide synthesis, measurement of the biological activity in insects. To further investigate biological function, the program students can experience RNA interference targeting on those receptor gene using that crickets as well.