2nd WPI-NanoLSI Special Seminar
- Frontiers in Chem-Bio -

Prof Satoshi Arai
WPI-NanoLSI Kanazawa University

Thermodynamic Cell Engineering by Nanoheating System
NanoHeating 技術を用いた細胞熱力学エンジニアリング

Probably, almost researchers might be interested in temperature as a physical element because all on the earth are governed by the thermodynamic law. Recent years, we developed "Thermodynamic Engineering Technology", where temperature could be measured and controlled at nano/microscale using photothermal materials and temperature sensing dyes. We demonstrated this technology in the manipulation of cellular functions. For instance, it enables to cause the perturbation for energy metabolism at subcellular level and to alter the protein-protein interaction in muscle cells. In this talk, we are going to share the tips of these topics and more than welcome for fruitful discussion.

Prof Koichiro Uto
WPI-MANA National Institute for Materials Science

Development of Shape Memory Polymer-based Mechano-Biomaterials
形状記憶高分子を基軸としたメカノバイオマテリアルの開発

How do temporal changes of mechanostructural factors, surface topography, and scaffold dimensionality impact dynamic cell behavior? As the cell microenvironment undergoes constant change (e.g., muscle stretching/contraction, heart beating, disease progression), this question remains of primary importance to the field of mechanobiology and to our understanding of many critical life processes. Shape-memory cell culture platforms represent versatile and powerful tools to examine the effects of these changes. In this presentation, I will briefly introduce our established shape memory polymer-based dynamic cell culture platforms and their potentials.

Prof Kazuhito Tabata
The University of Tokyo

Single virus measurements -Highly sensitive detection and distribution of virus populations-

ウイルス 1 粒子をはかる -高感度検出と集団内分布-

Recent years have seen impressive developments in digital bioassays such as digital PCR. These assays can detect single molecules stochastically confined inside a microreactor prepared at large quantities. We have developed a single enzyme molecule detection method and a digital ELISA using an array of microchambers of fL scale. We have also reported a digital influenza assay that stochastically confines single influenza virus particles inside single microchambers. Since this method is equivalent to RT-PCR in detection sensitivity and has a short detection time, it is expected to become a new diagnostic method. Furthermore, because individual viruses are observed, differences in virus particles can also be observed. In this presentation, I will discuss the principles and applications of digital influenza assays including the study of virus population distributions.

Prof Hiroaki Suga
The University of Tokyo
Advisory board member of NanoLSI

Revolutionizing the discovery process of bioactive peptides

特殊ペプチド創薬の革命

This talk discusses recent advances in the discovery of bioactive macrocyclic pseudo-natural peptides containing exotic amino acids using a discovery platform, the RaPID system. This system enables for extremely "rapid" affinity-based screening of pseudo-natural peptides against proteins of interest from a library consisting of a trillion different short sequences, usually less than 15 residues. Yet the discovered molecules exhibit remarkable bioactivity, often single digit nM or sub nM of dissociation constants.

Prof Shinya Tsukiji
Nagoya Institute of Technology

SLIPT: a chemical approach for controlling protein localization and mammalian cell signaling

タンパク質局在と細胞内シグナルを操る化学ツール「SLIPT」

Controlling proteins with synthetic molecules is a key component of chemical biology and synthetic biology. The self-localizing ligand-induced protein translocation (SLIPT) is an emerging chemical approach we recently developed for controlling protein localization and mammalian cell signaling. This approach uses synthetic molecules, termed self-localizing ligands (SLs), which are designed to spontaneously localize to specific subcellular regions in mammalian cells. SLs bind their target proteins and relocate them rapidly from the cytoplasm to their targeting site in a "single ligand-single protein" manner. In this talk, I will present the basic principle, current applications, and future directions of the SLIPT technique.

Prof Hiromi Imamura
Kyoto University

Genetically encoded fluorescent biosensors for understanding of metabolism at single cell level

遺伝子コード型蛍光バイオセンサーを用いたシングルセル代謝解析

Metabolic changes are closely related to various biological processes and diseases. However, it is generally difficult to monitor intracellular metabolites with high spatiotemporal resolution. By combining the subunit of bacterial ATP synthase with fluorescent protein(s), we developed fluorescent biosensors for ATP, “ATeam” and “QUEEN”. We also succeeded in developing a fluorescent biosensor for branched-chain amino acids (BCAA), “OLIVe”, by using a bacterial periplasmic binding protein for BCAA. Imaging of intracellular ATP and BCAA using these fluorescent biosensors has revealed differences and dynamics in the concentrations of these metabolites at the single cell level.

Prof Isao Kii
Shinshu University

An alternative strategy to develop a selective kinase inhibitor

リン酸化酵素フォールディング中間体を標的とした創薬研究

Protein kinases represent an attractive target for drug development. However, most of the currently available kinase inhibitors have low selectivity and sometimes cause adverse side effects by suppressing unintended kinases. In this seminar, I will show an alternative strategy to develop a selective kinase inhibitor. We found a small molecule that selectively inhibits the kinase DYRK1A, which is related to the symptoms of Down syndrome. This inhibitor, called FINDY, suppresses transitional folding intermediate state of DYRK1A. Unlike other kinase inhibitors, FINDY does not inhibit the mature state of DYRK1A. These unique features of FINDY suggest that the strategy targeting the folding process has general validity, and can be applied not only to DYRK1A, but also to other kinases.