Center for Molecular Spectroscopy and Dynamics, IBS-Korea University

IBS Center for Molecular Spectroscopy and Dynamics

Seminar

- **SPEAKER**
  Dr. Sangkyu Lee (Center for Cognition and Sociality, IBS)

- **TITLE**
  Biomolecular design for Brain Engineering

- **ABSTRACT**
  Communication across multiple scales of biological systems, from molecules to organisms, is essential for sharing information among members of a society. At the molecular level, communication among a particular set of molecules is important not only to determine the functions and fates of individual cells but also to create harmonious and complex multicellular actions such as brain circuit activity that can ultimately change organisms' behaviors. Therefore, understanding the nature of molecular communication and its impact on higher-level communication is a fundamental step toward explaining how the biological system works as a whole. In the first part of my talk, I will briefly introduce a series of molecular optogenetic tools to control molecular communications in living systems. These optogenetic tools based on using plant photoreceptors can be easily applied to a variety of cell types and organisms to control specific molecular functions and corresponding biological processes through light illumination in a highly spatiotemporal manner. In the second part, I will talk about our recent effort in the development of synthetic approaches for the control of direct cell-cell interactions in the brain. We have designed synthetic ligands and receptors to regulate physical cell-cell interactions which resulted in unexpected unidirectional transfer of molecules which is similar to a process known as 'trogocytosis' (trogo-: 'nibble'). This approach can be applied to a variety of cell types, including cancer cells, fibroblasts, astrocytes, microglia, and neurons. We also found that adjacent endogenous molecules along with the ligand are taken up together by receptor-expressing cells. For in vivo applications, we targeted the CA3-CA1 circuit of the hippocampus and successfully induced trogocytosis that in turn functionally modulate the target brain circuit. We anticipate that these synthetic approaches will provide unprecedented opportunities to deeply understand the dynamic nature of molecular and cellular communications in a complex biological milieu and their contributions to higher-order biological functions and diseases.

- **DATE AND VENUE**
  October 13, 2022 (Thursday, 11:00 - 12:00)
  Seminar Room B (119)

- **LANGUAGE**
  Korean

- **INVITED BY**
  Associate Director Wonshik Choi