Joint Studies Programs

As one of the important functions of an inter-university research institute, IMS facilitates joint studies programs for which funds are available to cover the costs of research expenses as well as the travel and accommodation expenses of individuals. Proposals from domestic scientists are reviewed and selected by an interuniversity committee.

(1) Special Projects

(a) Construction of Synthetic Microdomains to Artificially Assemble Biological Polymers on Lipid Membranes Using Metal Complex Lipids

OHTANI, Ryo (*Kyushu Univ.*)
KAWANO, Kenichi (*Kyoto Univ.*)
KINOSHITA, Masanao (*Kyushu Univ.*)
YANAKA, Saeko (*IMS*)
KATO, Koichi (*IMS*)

Cell membranes are nonuniform entities characterized by heterogeneous molecular assemblies that mediate biological processes exemplified by signal transduction. Accumulating evidence has indicated that these microdomains comprise various lipid molecules including glycosphingolipids and cholesterol and serve as molecular platforms where specific biomolecules accumulate to perform sophisticated functions. To gain a deeper understanding of these complex membrane functions, we employed a multilateral approach in an attempt to artificially control membrane properties and their molecular assembly.

In this project, we created and applied *metal complex lipids* for (1) manipulating lipid membrane properties such as curvature and viscosity to construct synthetic domain architectures and (2) controlling assemblies of biological polymers thereon. The metal complex lipid consists of a metal complex moiety as its hydrophilic head and an alkyl chain as its hydrophobic tail. It exhibits different physical properties from those of natural lipid species, which further impacts lipid membrane properties. Through investigation of the influence of the metal complex lipids on phase-transition and molecular-assembling behaviors of both artificial and cell membranes, we successfully constructed an artificial phase separation system with micro-sized rigid domains consisting of metal complexes in living cell membranes. Furthermore, we succeeded in synthesizing a new metal complex lipid which could provide unique fluid–fluid phase separation in lipid membranes. The metal complex lipid not only exhibits such domain formation property but also offers a possibility to hybridize with biomolecules via the click chemistry approach due the head part incorporating an ethynyl substituent. We expect that this metal complex lipid will be applicable to assembling and accumulating biomolecules in lipid membranes, which is now underway.

We held three collaboration meetings in the 2019 to extensively discuss our research progress and future planning. All meetings were held at Yamate 3rd Bilding 2F small meeting room on June 10, September 11, and November 11, 2019. Moreover, collaborating experiments to synthesize the hybrid metal complex lipid with sugar chains were carried out at December 18th to 23rd, 2019 in the Kato lab.

(2) Research Symposia

(From Oct. 2018 to Sep. 2019)

Dates	Theme	Chair
Jul. 10, 2019	Design of Molecular Structure Change and Its Function Control Based on Coordination Chemistry	**KOSHIYAMA, Tomomi** **KUSAMOTO, Tetsuro**
Dec. 29, 2019	Joint Workshop on Molecular Science for Young Researcher: Exploring the Unexplored Field of Molecular Science	**KOMATSUBARA, Wataru** **SUGIMOTO, Toshiki**
Dec. 2– 4, 2019	Forefront of Measurement Technologies for Surface Chemistry and Physics in Real-Space, *k*-Space, and Real-Time	**KUMAGAI, Takashi** **SUGIMOTO, Toshiki**

(3) Numbers of Joint Studies Programs

Categories		Oct. 2019–Mar. 2020		Apr. 2020–Sep. 2020		Total		
		Regular	NanoPlat	Regular	NanoPlat	Regular	NanoPlat	Sum
Special Projects		1		1		2		2
Research Symposia		0		1		1		1
Research Symposia for Young Researchers		1		1		2		2
Cooperative Research		22	39	21	18	43	57	100
Use of Facility	Instrument Center		83		58		141	141
	Equipment Development Center	1	4	0	4	1	8	9
Use of UVSOR Facility		94	2	89	1	183	3	186
Use of Facility Program of the Computer Center						268*		268*

* from April 2019 to March 2020