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. Frontier of the Research on Biological Trace Elements

ITOH, Shinobu (*Osaka Univ.*)
KANO, Kenji (*Kyoto Univ.*)
HIROTA, Shun (*NAIST*)
SHIRO, Yoshitsugu (*Univ. Hyogo*)
AONO, Shigetoshi (*IMS*)

A variety of essential trace elements including transition metal ions are required for normal biological functions. Though they are essential for biological functions, their intracellular concentrations have to control very strictly to maintain cellular homeostasis. Once the homeostasis is disrupted, deficit or excess of specific metal ions is induced to lead diseases. Transition metal ions such as iron, copper, cobalt, nickel, molybdenum, and zinc are utilized as the active sites and/or components of prosthetic groups in metalloproteins, which play crucial roles for transport and activation of small molecules, electron transfer, redox catalysis, and signal transduction. Recently, progress in experimental methods for structural and spectroscopic analyses makes detail studies on the metabolism, functions, and regulation of these trace metal ions in biological systems possible at the molecular level. In this project, we aimed for understanding the functional roles and the regulatory mechanisms of these trace metal ions in biological systems, based on which we will develop the basic research on biomolecular science, which can be contributed for industrial and medical applications. The feasibility studies on the following topics were carried out in this project for the preparation of a grant application to Grant-in-Aid for Scientific Research on Innovative Areas.

1. Elucidation of structure and function of metalloproteins

In this project, we have studied and searched new research targets on the structural and functional elucidation of metalloproteins and metalloenzymes that are responsible for the activation or binding/transport of small molecules, energy transfer/metabolism, and signal transduction.

2. Industrial application of metalloproteins

The feasibility of industrial application of metalloproteins and metalloenzymes have been studied and searched for developing catalysts, fuel cells, sensors, biocompatible materials, and tailor-made artificial metalloenzymes.

3. Medical application of metalloproteins

The feasibility of industrial application of metalloproteins and metalloenzymes have been studied and searched for elucidating the molecular mechanisms of the homeostasis for essential trace elements, of metal-transport and signal transduction reactions, and of protein–protein interactions regulating biological functions.

Two meetings only the core members (the applicants of this project) attended were held to discuss course of action for this project on April 1–2, and April 30, 2016. The third meeting was held at Okazaki Conference Center on May 22, 2016, where 14 speakers including the core members presented their research topics and discussed the feasibility of this project. The fourth meeting was held at IMS room 302 on March 30–31, 2017, where 13 speakers presented their research topics and discussed a future plan to apply the grant.

B. Vibrational Spectroscopy by Quantum Technology

SHIKANO, Yutaka (*IMS*)
NAKAMURA, Kazutaka (*Tokyo Tech*)
KAYANUMA, Yosuke (*Tokyo Tech*)
HORIKIRI, Tomoyuki (*Yokohama Natl. Univ.*)
KOBAYASHI, Hirokazu (*Kochi Univ. Tech.*)
UEDA, Tadashi (*IMS*)
OKANO, Yasuaki (*IMS*)

In order to build up the optical spectroscopy technique by the help of quantum technology, we developed theory of quantum measurement theory and constructed the spectroscopy setups for joint study on the pump-probe experiment under the wide wavelength picosecond laser system and the fixed wavelength (near 800 nm) femtosecond laser system in IMS. Also, in Tokyo Tech, we took the vibrational spectroscopy for the condensed phase system and measured the coherent phonon properties of semiconductor and diamond. We successfully demonstrated the coherent control a la the gas phase experiment and also the long-time lifetime measurement to show the spectral diffusion in terms of molecular science. Furthermore, we will plan to catch up how to emerge the coherence of phonon; the stimulated emission by phonon or other mechanism.

References

1) M. Tukiainen, H. Kobayashi and Y. Shikano, *Phys. Rev. A* **95**, 052301 (6 pages) (2017).
2) Y. Shikano, *AIP Conf. Proc.* **1871**, 020001 (7 pages) (2017).

(2) Research Symposia

(From Oct. 2016 to Sep. 2017)

Dates	Theme	Chair
Nov. 10–11, 2016	Development and Perspective for Next Generation of Molecular Catalyst	**MOMIYAMA, Norie**
Dec. 2, 2016	Frontiers in Surface Science Techniques and Molecular Science (7^{th} Workshop for Young Researchers in Vacuum and Surface Sciences)	**UEBA, Takahiro** **KERA, Satoshi**
Dec. 7– 8, 2016	Advanced Electron Spin Measurement to Investigate for the Origin of Biological and Material Functions	**KOBORI, Yasuhiro** **NAKAMURA, Toshikazu**
Mar. 6– 7, 2017	Information Control and Function Interlock Based on Metal Complexes	**OHBA, Masaaki** **MASAOKA, Shigeyuki**
Jun. 12, 2017	Frontier of Local Structural and Functional Analysis of Liquid Water	**TAKAHARA, Atsushi** **KOSUGI, Nobuhiro**
Jun. 14, 2017	Molecular Scinece of Enzymatic Catalysis	**KONNO, Michiko** **MASAOKA, Shigeyuki**
Jun. 24–25, 2017	Japan-China Joint Interdisciplinary Symposium on Coodination-Based Hybrid Materials	**IMAOKA, Takane** **MASAOKA, Shigeyuki**
Jul. 17–18, 2017	Heterogeneous Fluctuations in Science: The Nishikawa Line —The Second Critical Point	**ABE, Hiroshi** **KERA, Satoshi**
Aug. 18–19, 2017	Mechanical Interactions between Molecules and Radiation Fields under Resonance: Toward Molecular Level Manipulation	**HOSOKAWA, Chie** **OKAMOTO, Hiromi**
Aug. 26–27, 2017	Biometals Dynamics Meeting	**SHIRO, Yoshitsugu** **AONO, Shigetoshi**
Jun. 18, 2017	Meeting for Lectures at 57^{th} Summer School on Molecular Science for Young Scientists	**OKINO, Shunnosuke** **FURUTANI, Yuji**
Jul. 6– 7, 2017	The 15^{th} ESR Summer School: Principle and Perspective of Multi-Frequency Pulsed ESR Measurements	**EMA, Fumitoshi** **NAKAMURA, Toshikazu**
Nov. 23–25, 2016	Advanced Spectroscopy of Organic Materials for Electronic Applications	**KERA, Satoshi**
Mar. 6– 8, 2017	International Symposium on Ultrafast Dynamics in Molecular and Material Sciences	**SHIGETA, Yasuteru** **SAITO, Shinji**
Mar. 18–20, 2017	Grand Challenges in Small-Angle Scattering	**AKIYAMA, Shuji**

(3) Numbers of Joint Studies Programs

Categories		Oct. 2016–Mar. 2017		Apr. 2017–Sep. 2017		Total		
		Regular	NanoPlat	Regular	NanoPlat	Regular	NanoPlat	Sum
Special Projects		0		1		1		1
Research Symposia		4		6		10		10
Research Symposia for Young Researchers		0		2		2		2
Cooperative Research		45	28	35	33	80	61	141
Use of Facility	Instrument Center		72		71		143	143
	Equipment Development Center	1	2	1	2	2	4	6
Use of UVSOR Facility		77	17	53	20	130	37	167
Use of Facility Program of the Computer Center						221*		221*

* from April 2016 to March 2017