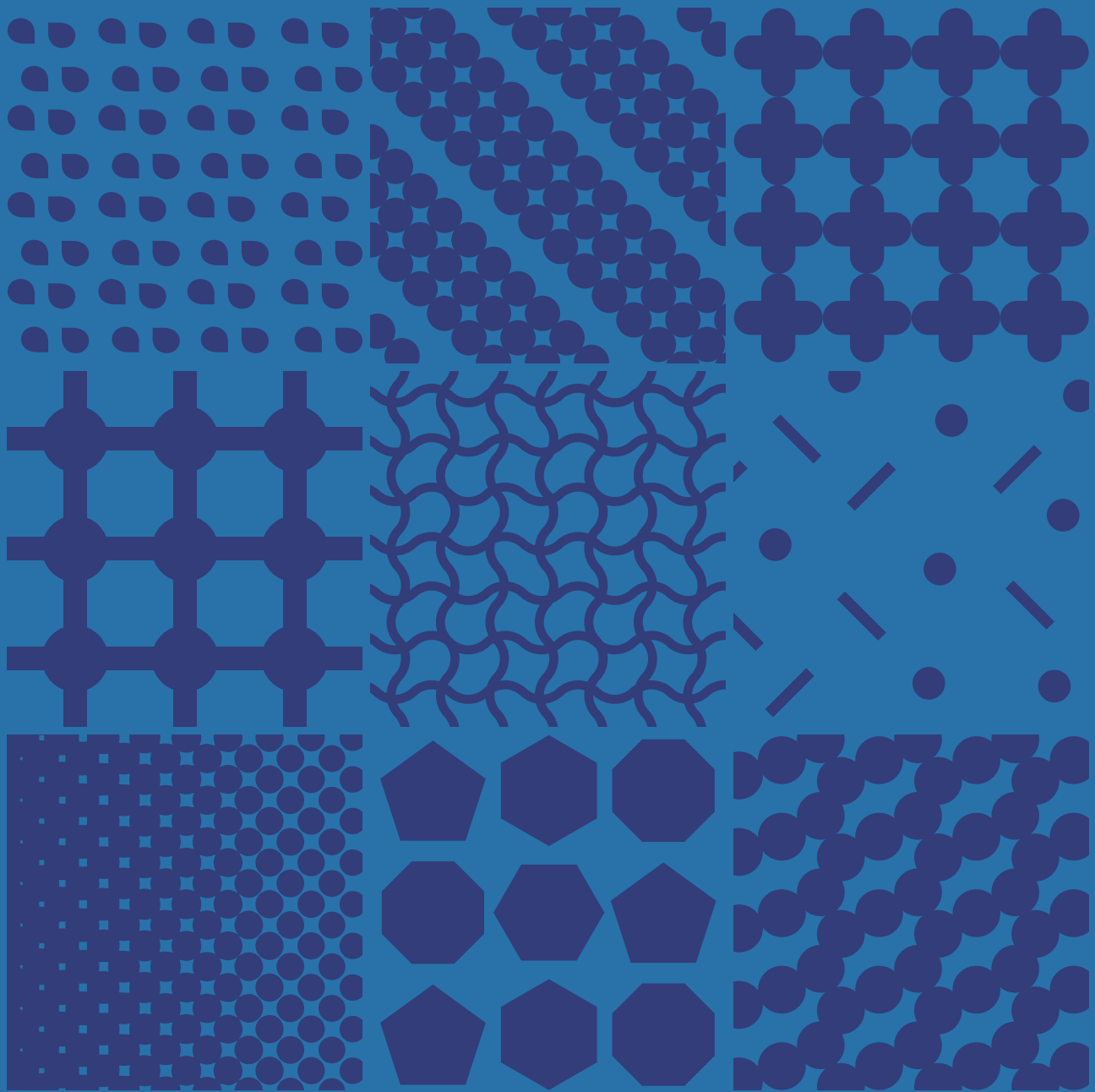
iCeMS Vision Book E

Inspiring Creativity

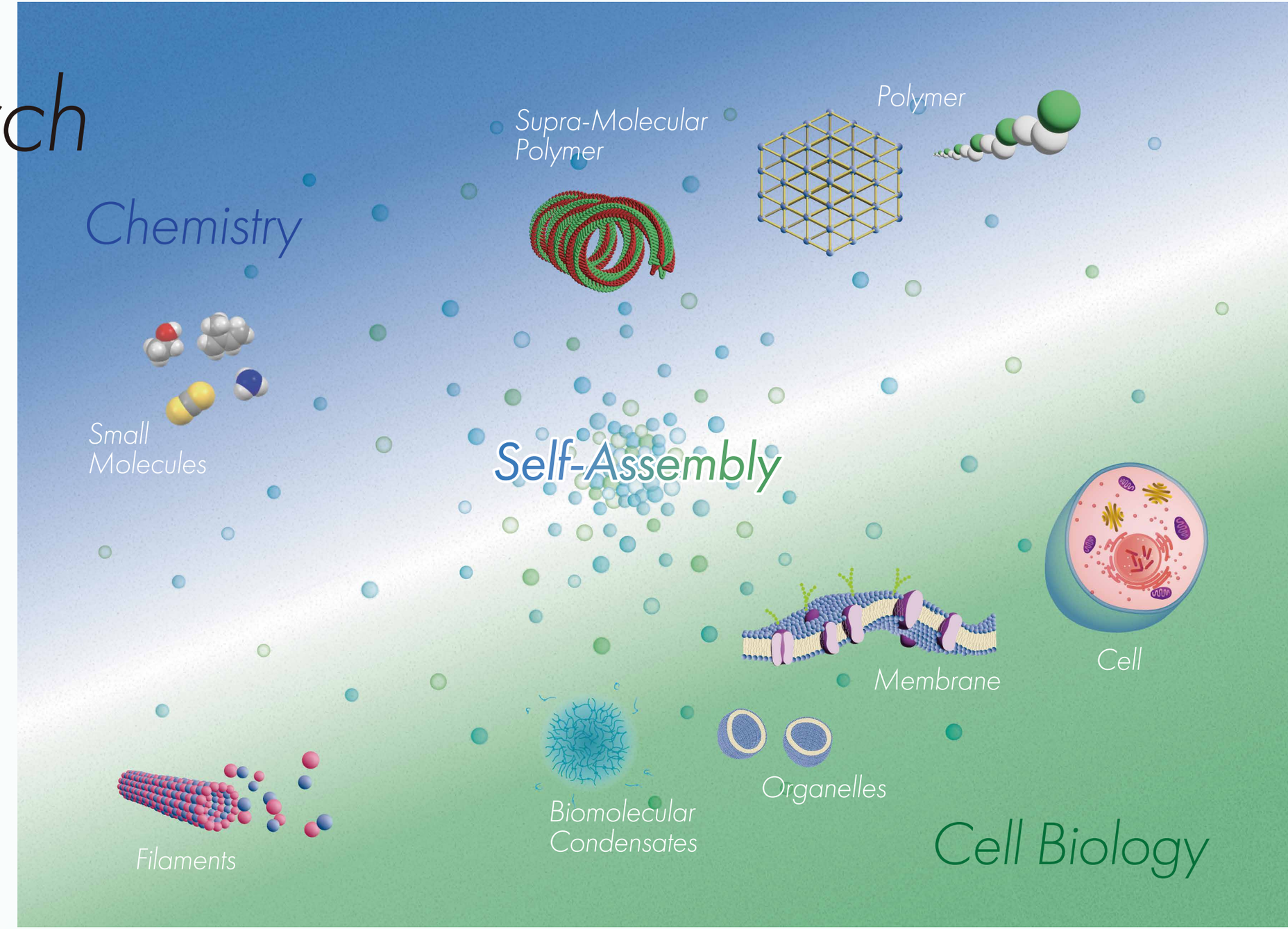
Institute for Integrated Cell-Material Sciences



iCeMS

Vision Book

Our Research



Exploring the Principal of Self-Assembly

In April 2023, Motonari Uesugi became the new director and iCeMS redefined its research vision around the fundamental theme of self-assembly. Through the coordinated fusion of cell biology and chemistry, we endeavor to understand the intracellular self-assemblies at the boundary between life and matter (science) and inspire the innovation of functional self-assembling materials (application).

• Director Motonari Uesugi

Born in Osaka, Uesugi graduated from the Faculty of Pharmaceutical Sciences, Kyoto University in 1990. After obtaining a PhD from the Kyoto University Institute of Chemical Research, he was a postdoctoral fellow at the Harvard University Department of Chemistry from 1995 to 1998. In 2005, he joined the Kyoto University Institute for Chemical Research as a professor. In October 2007, he also joined iCeMS as a professor. He also served as a deputy director and became director in April 2023.

Why Focus on Self-Assembly?

—— Could you tell us about the motivation behind the creation of the new research vision?

iCeMS was originally established to integrate two of Kyoto University's flagship disciplines, chemistry and cell biology. Since its founding in 2007, iCeMS has brought together researchers from diverse fields and we have attained great research achievements. However, in order to continue to grow, we need to streamline decision making and enhance creativity.

In 2023, when I took on the position of director, I revised the research vision with a fresh perspective for iCeMS. "The fusion of chemistry and cell biology" is a single phrase, but there are various ways to think about it, so I attempted to clarify it further.

I focused on the concept of self-assembly. Simply defined, self-assembly is a phenomenon where materials spontaneously assemble and begin to take on some function.

—— What is the relationship between self-assembly and iCeMS specialties of chemistry and cell biology?

Essentially, living organisms are made from chemical compounds. But, chemical compounds are not life. When I try to understand at what point these chemical compounds begin to show life-like characteristics, I think self-assembly offers us a hint. A cell could be said to be the ultimate example of self-assembly. The cell membrane itself is also self-assembled, and inside the cell there are organelles, small structures also bound by membranes. By creating spaces in which chemical reactions can occur these types of self assembled structures allow for intracellular communication, genetic development, force generation, or energy storage. It has recently become clear that all of these processes are made possible by self-assembly.

The reason for this recent understanding comes from the advanced development of "seeing" technology in the last decade. Life phenomena that were previously completely invisible have become observable in minute detail thanks to technological innovations such as electron microscopy. As a result, cell biology has tremendously advanced through the discovery of various self-assemblies around the world.

Is There a Common Language between Cell Biology and Materials?

—— I understand that the study of self-assembly is relatively new in the field of biology, but what about in the field of materials?

In the world of materials, various forms of self-assembly have already been put into practical use and commercialization is underway. For the general public, supramolecular polymers may be easier to understand. A polymer is made of large molecules which are all stuck together. The small parts come together on their own to form self-assemblies. For example, car paint that if scratched can self heal like a living creature has been developed. This is possible because the material is self-assembling. Looking at the history of materials, recently self-assembling materials are being used in manufacturing more and more. LCD displays are one self-assembling material many people are familiar with. PCP/MOFs which iCeMS former director Susumu Kitagawa has been hard at work on have been put to practical application in gas storage. These are very exciting innovations and they are all self-assembling materials which is why at iCeMS self-assembly is an important concet in materials science.

Originally, the materials world was closely related to self-assembly. In the biological world too, when we make careful observations, we also find many self assembling structures. We began to think that there might be some kind of shared boundary or common language between them, or perhaps some unifying theory between these two disciplines. Traditionally, each has been working on its own research, but there must be common ground between the two and our goal is to investigate those scientific principles. If we can advance our understanding of those principles, we may be able to create lifelike materials inspired by biological mechanisms which are useful for humanity. Conversely, through using those newly created materials, we may gain a new understanding of biology. We believe a positive cycle could be born from here.

Understanding Self-Assembly Promises Significant Advancements

—— It seems that understanding the mechanisms of self-assembly will lead to application. What kind of self-assembling materials do you expect will be created?

Looking to the future, I believe that self-assembling medicine will become a trend. The history of pharmaceuticals can be divided into chemical drugs and biological drugs.

Beginning with aspirin, chemical pharmaceuticals have undergone significant developments in organic synthesis leading to larger and larger compounds. The ability to create complex substances has led to the manufacturing of nucleic acid drugs, including mRNA vaccines.

Biological pharmaceuticals started from natural products and have developed in various ways. Originally, living things found around us were used to make herbal medicines. Insulin was discovered and used for treatment. Recently, cell therapy using antibodies and cells themselves as drugs is gaining popularity. At Kyoto University iPS cells are being used for therapy. The trend is that all drugs are becoming very complex and have a large molecular weight.

If we think about making something large and complex from small molecules, it appears to be possible if we think about self-assembly as the key point. We call this self-assembling medicine and we are trying to create the world's first.

Ensuring that fundamental research is firmly linked to practical application is another distinctive feature of iCeMS. We have implemented a system to return our research to society through developing startup companies, such as Atomis Corporation, which aims to commercialize Prof Kitagawa's PCP/MOFs (see p24).

—— Lastly, I believe that creating something new is synonymous with bringing about innovation. Can you tell us about your aspiration for achieving this?

Many researchers from diverse fields have gathered at iCeMS around this way of thinking, that is "self-assembly chemistry and biology". It is crucial that we work not just within iCeMS but collaborate with other researchers working on self-assembly.

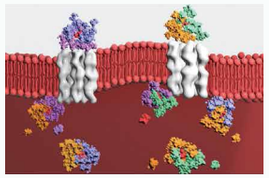
Understanding self-assembly will surely lead to good outcomes. Holding this expectation, working together with all of iCeMS, I aim to foster an environment where we can focus on our daily research.

Key Research Concepts

1 Understanding cellular self-assemblies

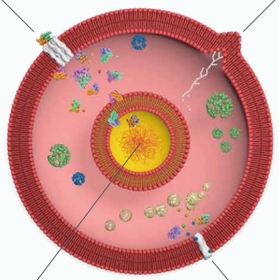
Life is the ultimate example of self-assembly. We will lead the way in understanding intracellular self-assembly mechanisms that govern compartmentalization, signal transduction, gene expression, and energy metabolism, as well as in developing the chemical tools that make that understanding possible.

Signal transduction

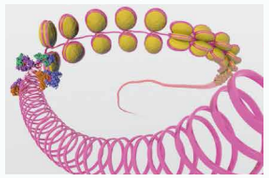


Force generation

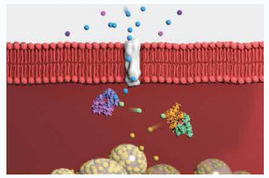
Compartmentalization

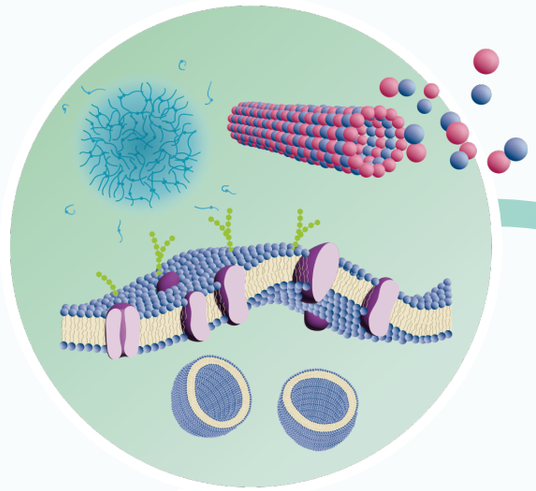


Gene expression



Energy metabolism

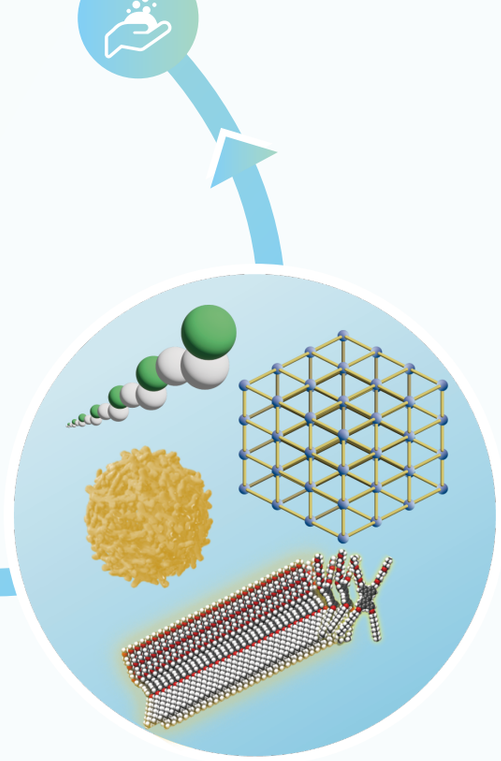




1 Understanding cellular self-assemblies

Providing tools

Inspiration

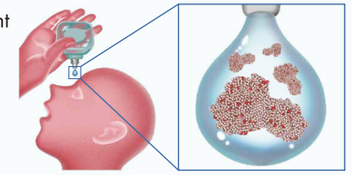


2 Inventing self-assembling materials

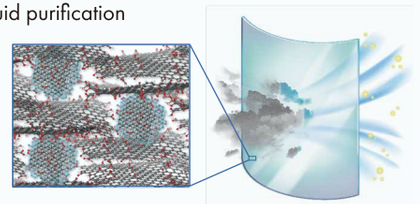
2 Inventing self-assembling materials

Chemists can find inspiration in intracellular self-assembly. Drawing on that inspiration will lead to the creation of novel functional materials to face the challenge of resolving global problems. Self-assembling pharmaceuticals, self-assembling materials for gas or liquid purification, self-assembling materials for energy storage, and self-assembling materials that chemically convert carbon dioxide are being developed.

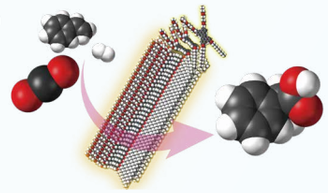
Disease treatment



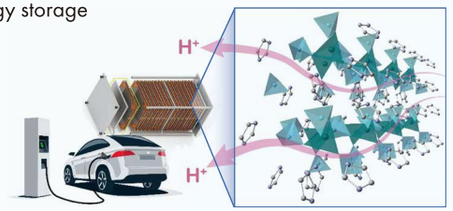
Gas/liquid purification



CO_2 conversion



Energy storage



Researchers
working at iCeMS

Principal Investigators

Daishi Fujita
Associate Professor
Supramolecular Chemistry, Chemical Biology

Aiko Fukazawa
Professor / Deputy Director
Physical Organic Chemistry, Organic Synthesis

Shuhei Furukawa
Professor
Chemistry of Molecular Assemblies

Mineko Kengaku
Professor /iCeMS Analysis Center Director
Developmental Biology of Nervous System

Susumu Kitagawa
Distinguished Professor
Inorganic Chemistry, Chemistry of Coordination Space

Kazuki Nakanishi
Program-Specific Professor
Sol-Gel Science, Porous Materials

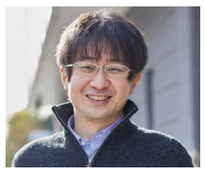
Ganesh Pandian Namasivayam
Junior Associate Professor
Bio-inspired Therapeutics, Epigenetics

Daniel Packwood
Associate Professor
Applied Mathematics and Theoretical Chemistry

Easan Sivaniah
Professor
Clean Technology

Jun Suzuki
Professor / Deputy Director
Medical Biochemistry, Cell Membrane Biology

Fuyuhiko Tamanoi
Program-Specific Professor
Nanoparticles and Cancer Therapy



Yuichi Taniguchi
Professor
Biophysics, Systems Biology

Kazumitsu Ueda
Program-Specific Professor / Research Administrative Director
Agricultural Chemistry

Motonari Uesugi
Professor / Director
Chemical Biology

The Hakubi Project

Tomoko Inose
Program-Specific Associate Professor
Photo Chemistry, Surface Chemistry

Kohei Kusada
Program-Specific Associate Professor
Nanomaterials, Inorganic Chemistry

iCeMS Kyoto Junior Fellow

Sooyeon Kim
Program-Specific Junior Associate Professor
Photochemistry and Bioanalysis

Sayuri Motani
Assistant Professor
Molecular Biology, Cell Differentiation

Adjunct Principal Investigators

Ryu Abe
Professor (Graduate School of Engineering)
Artificial Photosynthesis, Solar Hydrogen Production, Photocatalysts

Itaru Hamachi
Professor (Graduate School of Engineering)
Chemical Biology, Chemistry for Multimolecular Crowding Systems

Satoshi Horike
Professor (Graduate School of Science)
Inorganic Chemistry

Hiroshi Imahori
Professor (Institute for Liberal Arts and Sciences)
Artificial Photosythesis, Organic Photovoltaics

Hiroshi Kageyama
Professor (Graduate School of Engineering)
Solid State Chemistry

Hiroshi Kitagawa
Professor (Graduate School of Science)
Solid-State Chemistry: Electron-Proton Coupled System

Yasuo Mori
Professor (Graduate School of Engineering)
Molecular Biology

Koichiro Tanaka
Professor (Graduate School of Science)
Teraherz Optical Science, Solid State Spectroscopy

Director × Young Researchers

A space for young researchers, inspiration, and interdisciplinary fusion

Program-Specific Junior Associate Professor
Sooyeon Kim

Program-Specific Assistant Professor
Masahiko Yoshimura

Director
Motonari Uesugi

Introduction

Two young researchers who have devoted themselves to research at iCeMS were invited to share their response and perspective regarding the new vision.

Introduction

Connected by the Single Concept of Self-Assembly

—— Today we would like to give young researchers a chance to share their perspectives on iCeMS' new vision with Prof Uesugi.

Yoshimura Of course I agree with iCeMS' new research vision. Especially the part about "understanding intracellular self-assembly at the boundary between life and matter" (see p2). When I was a student, I spent a long time analyzing protein and small molecule interactions. However, I wondered whether this was an accurate model for living organisms. Inside a cell, proteins do not act alone, I thought that they must always work with something else as a cooperative mechanism.

Uesugi Yoshimura, you were studying biology using organic chemical methods and thought, "I wonder if this is right when living organisms are much more complex and made up of many different things". This is right in line with iCeMS' vision, don't you think.

Yoshimura Yes, that's right. Time was quite constrained when I was a student. I managed to graduate despite being a bit bewildered. Now as

a member of iCeMS I am able to pursue my research in a good environment. Coming from chemistry, I want to create tools and techniques to understand biological complexes.

Uesugi The study of self-assmbly has long been addressed in the materials field. Relatively new in the biological field, it seems many people have become interested in the last decade. For example, protein self-assembly is a biological phenomenon which cannot be explained just by looking at individual proteins. It must be looked at as an aggregate structure. One might expect materials self-assembly research and biological self-assembly research to be the same thing, but they are not. This is why they have developed separately. Here at iCeMS there are people working on both the material and biological aspects. I hope through further research might reveal that the fundamental principles of the two are the same. What do you think, Kim?

Kim My background is in chemistry. During my doctoral studies, I focused on self-assembly of materials. When dye molecules self-assemble they can exhibit new functions. It was fascinating to see how simply changing a methyl group could change the way it assembled or its functionality.

Uesugi I see, you enjoyed investigating materials systems and phenomena. Why did you move to working on self-assembly from a biological approach, as you are doing now?

Kim I had hoped that my research in the field of chemistry could contribute to life science and medicine, but I didn't have the knowledge of what kinds of needs existed or what kinds of life phenomena would benefit from my research. At that time, I began studying biology in Yuichi Taniguchi's laboratory, which was at that time at RIKEN. Now, in the Taniguchi Group at iCeMS, seeking to understand the complex behavior of life and to advance medical science, we consider cells the ultimate self-assembly of small molecules. We are investigating the underlying mechanisms, such as from what point does life seem to exist, gene expression, and how molecules regulate each other.

Uesugi When I was a student, I also studied synthetic small molecules and natural compounds. As a postdoctoral researcher, I focused on studying gene expression using spectroscopic and molecular biology techniques. After I became independent, I combined the methods I had been doing and began to challenge myself with compound based biological research. Connecting things you found interesting in your research can be one way for researchers to try new things.
Even if they don't seem related now, I expect that after continued contemplation good ideas will emerge. That is how I have approached my research.

Removing Barriers

——Did you two discover anything new when you came to iCeMS?

Yoshimura When I was a student I was at the ITbM (Institute for Transformative Biomolecular Research) at Nagoya University. Like iCeMS, ITbM also had open labs, so I was familiar with how to use the space. I was also accustomed to an environment which allowed for free communication. One other thing I really enjoyed was the abundance of shared facilities.

Kim Yes, having a lot of research equipment young people can access, it is like an overseas research institute. It is easy to use and I think it encourages active participation from young members. Prof Uesugi, as the new director, do you have any plans for the type of atmosphere you would like to create?

Uesugi The most important point in the new vision is "Optimizing Internal Communication" (see p26). With the Corona disaster, I feel we lost not just external communication, but internal also. Now that things have calmed down, I would like to make internal communication better than it ever was before. Improved internal communication will lead to increased efficiency, heightened awareness of compliance, and greater satisfaction among employees. There will be many good things to come. For example, we've started events like the Friday Beer Bash and Teatime, so keep making new research connections.

Kim I am looking forward to it.

Uesugi We also renovated the director's office. We installed a new kitchen and dining area so that we can share simple meals together with researchers and seminar speakers. We also removed what was originally a wall so that anyone can easily enter.

Yoshimura So, Prof Uesugi, for you this is implementing internal communication, right?

Uesugi Exactly. I want to eliminate both mental and physical barriers. Especially since iCeMS' research laboratories are divided between three buildings.

Yoshimura I certainly don't get out of my own research building very often. People who work in the main building, probably don't go to the other research buildings without a good reason either.

Uesugi But with events like the beer bash and teatime, everyone can get together in one place. I want to get rid of the wall between the buildings too. By optimizing internal communication in this way, I want to create an inclusive environment where people with different nationalities, from different fields, can engage in lively discussion while recognizing and respecting our differences. We want to be an institute where everyone can achieve their personal best.

A Place to Become Yourself

——During your everyday research have you encountered situations where you don't feel any barriers?

Yoshimura I'm involved with collaborative research within the facility, and I appreciate how close my colleagues are. The lab instructor who sits behind me is a collaborator, there are people around me whose research themes are close to mine, so it's an environment where I can easily ask questions about both research and work beyond the lab.

Kim It's great that there are so many experts from different fields here, isn't it! Generally, if you are in biology you specialize in biology or chemistry you stick with chemistry, but it's different here. For example, if during your research you think, "It would be interesting to design some such molecule", you can't synthesize it on your own. But if you call on those researchers around you they will help you out, and there is lab space right there too. It's a place where it is easy to realize the research you want to do.

Uesugi Communication among scientists has two results. One is what Kim just mentioned, the exchange of skills. Science is international, and it's interdisciplinary, but each scientist has their own nationality and specialization. When there is exchange between people from other countries and exchange of skills, it creates an atmosphere where anything is possible.
The second result is being inspired. There are some who seem to get ideas just through talking with others. It's important for every scientist to aspire to become that kind of person.

Yoshimura Collaborating with researchers around you, you come to understand their background and interests. Sometimes starting conversations like this, "Hey, I have this kind of publication, is it something you are interested in?" has let inspiration flow.

Uesugi I imagine it would be pretty interesting if you have enough people around you who can spark ideas you never even considered. Let's make that kind of institute.

Kim Prof Uesugi, were you surrounded by such people while you were conducting your research?

Uesugi Yes, observing the researchers around me, "I would like to be like that", I began to think, so to some degree it was easy to move in that direction. I had a clear objective. Conversely, if your objective is unclear, you won't naturally get closer to your goal. This is not just true for people but also for research institutes. I wanted to create an institute where everyone could clearly understand the objectives. So, the vision must be clear.

Yoshimura Indeed, the new research vision distilled into the single point of self-assembly is very easy to understand.

Uesugi Cell biology and materials science are the flagships areas of Kyoto University. The fusion of the two is the hallmark of this institute. However there are many ways in which biology and chemistry can be combined. So, we clarified self-assembly as the common language between them.

Towards an Era of Interdisciplinary Fusion

——Finally, what is your outlook going forward as researchers as iCeMS transitions to a new vision?

Yoshimura I would like to build my own foundation by piling up some research while I am at iCeMS. There are many young PIs around my age, so even as young members, we can actively participate in discussions. There is a lot of stimulus and so much to absorb. At some point I would like to become a PI myself, being a member of iCeMS seems like laying the groundwork for the next stage.

Uesugi Yes, I want more people who think like that to gather here. Come to iCeMS, make a breakthrough, and start your own research institute! <laughs> Actually, there are many people who have gone on to institutes abroad after achieving good research results at iCeMS.

Kim iCeMS has an international atmosphere, like a foreign country even though it is in Japan. So I am sure that if I can build up a track record here, I will gain confidence that I can do the same in any country.
I am personally focused on my research with the Taniguchi Group, but I would like to actively pursue collaborative research with the chemists around me. I am currently an iCeMS Kyoto Junior Fellow, a position like an associate PI, and I would also like to start my own research area as a PI at some point.

—— Prof Uesugi, do you have any hopes for young researchers?

Uesugi More than 15 years have passed since iCeMS was established. The biggest change in the last decade is the remarkable progress in biological research. Living things can be perceived in the same way as materials, phenomena can be understood by looking with our eyes. This is great progress especially considering that when we started, the way of thinking in biology and chemistry were quite different and mutual understanding between the two was sometimes difficult. The two disciplines have come to understand each other and are now connected. I think we have entered an era where integrated research will flourish. For this reason, I hope you can practice your research with a flexible mindset. Research focused on the theme of self-assembly is our ambition, but we are of course also expecting research brimming with imagination to overflow even beyond that.

Our Strategies

Introducing activities related to system reform and globalization throughout iCeMS. As a testbed for university-wide system reform and model for next-generation research institutes, we are implementing various proof-of-concept trials to realize the following five points from the new vision.

- #1 - Recruitment
- #2 - Globalization through On-Site Labs
- #3 - Core Facility & Collaboration
- #4 - Innovation through Startups
- #5 - Internal Communication

#1 Recruitment

Recruiting outstanding graduate students and researchers from Japan and abroad is essential in maintaining a dynamic research environment. At iCeMS, we offer positions for young researchers to foster independent PIs. We also collaborate with institutions both inside and outside the university to provide all students starting from the undergraduate level with access to cutting-edge research equipment and opportunities for diverse interactions with researchers.

- **iCeMS Kyoto Junior Fellow Program**

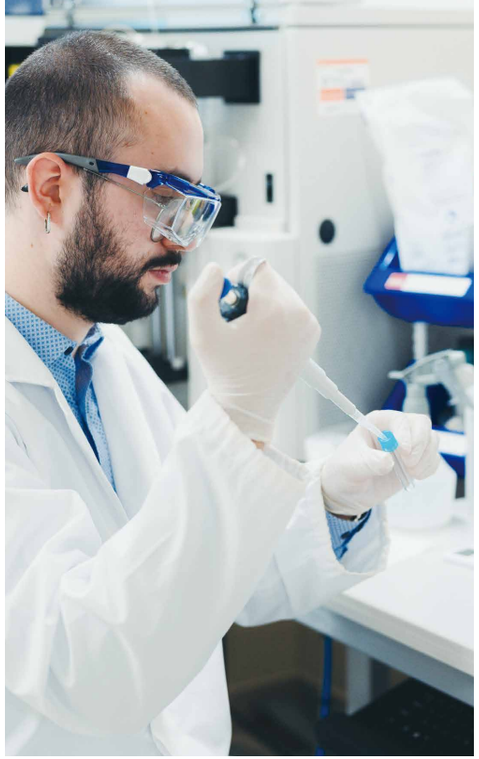
This program supports young researchers to work independently in a position similar to that of a principal investigator (PI). iCeMS Kyoto Junior Fellows will draw on their expertise in biology or materials science, and deepening their understanding in both fields develop their own unique interdisciplinary perspective. They will receive support including biology and chemistry dual-mentorship for the activities that will help them acquire the grounding to become PIs.

- **iCeMS Internship**

This program provides research experience opportunities from undergraduate students affiliated with overseas universities. In 2022, four students participated, and three in 2023. Also in 2023, three students from Shanghai Jiao Tong University participated in a month and a half long research experience.

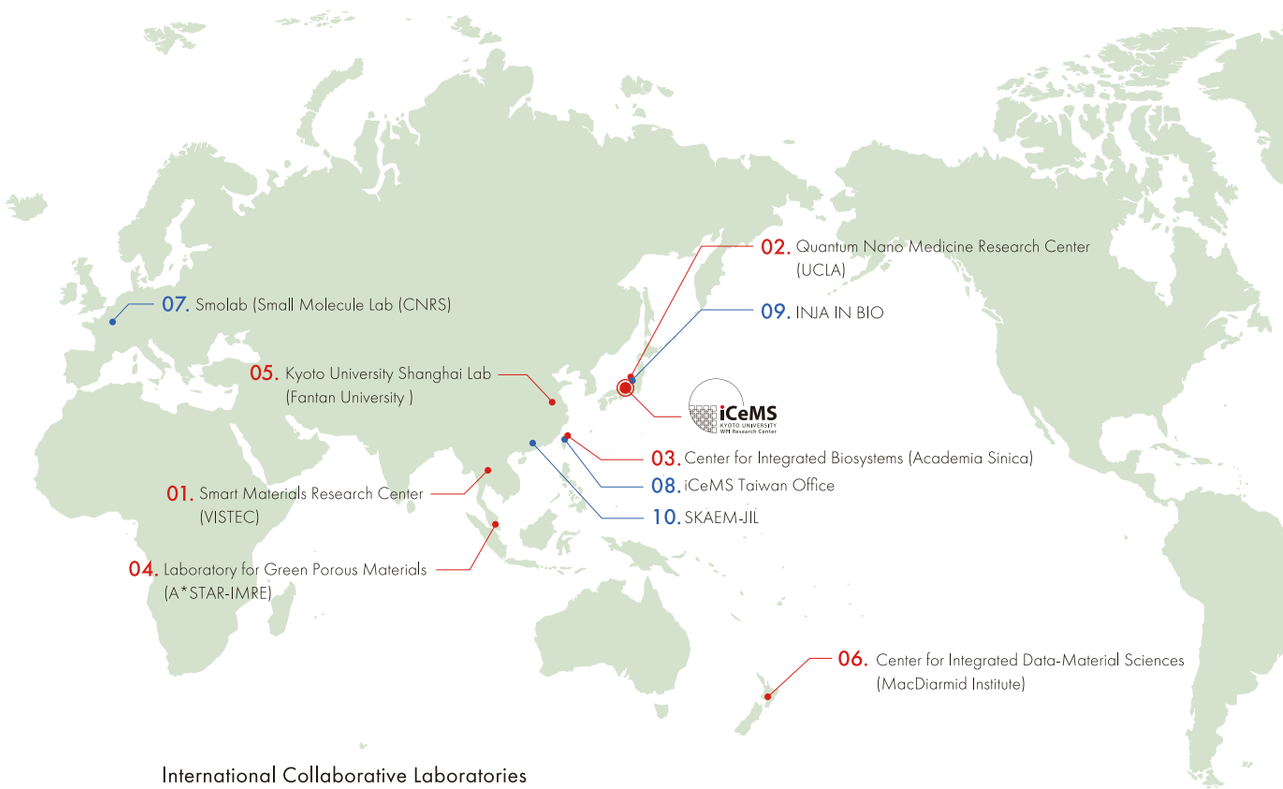
- **Kyoto iUP (International Undergraduate Program) Research Experience**

This program provides Kyoto iUP students from Kyoto University with a research experience of approximately one month. Four students participated in 2023.



#2
Globalozation through On-Site Labs

Since becoming a member of the WPI Academy, iCeMS has been actively promoting research exchange with numerous overseas universities and research institutions, striving to lead the world in cutting-edge research. In order to promote collaborative exchange beyond faculty connections, we have established laboratories that are jointly operated with overseas institutions. In addition to the six research laboratories certified under Kyoto University's On-site Laboratory project, we have also launched iCeMS Project Units. These comprehensive collaborative efforts aim to acquire talented international researchers through promoting "brain circulation". These international laboratories need to adapt their methodologies to the culture and academic systems of the partner country. iCeMS has organized a "Globalization Committee" to share information and ideas throughout the projects to facilitate good management practices.



International Collaborative Laboratories

No.	Partner institution	Leader
01	Smart Materials Research Center Vidyasirimedhi Institute of Science and Technology (VISTEC) (Thailand)	Prof Satoshi Horike
02	Quantum Nano Medicine Research Center University of California Los Angeles (UCLA) (US)	Prof Fuyuhiiko Tamanoi
03	Center for Integrated Biosystems Academia Sinica (Taiwan)	Prof Jun Suzuki
04	Laboratory for Green Porous Materials A*STAR-IMRE (Singapore)	Prof Susumu Kitagawa
05	Kyoto University Shanghai Lab Fantan University (China)	Prof Motonari Uesugi
06	Center for Integrated Data-Material Sciences MacDiarmid Institute (New Zealand)	Dr Daniel Packwood Prof Aiko Fukazawa
07	Smolab (Small Molecule Lab) National Center for Scientific Research (CNRS)	Prof Shuhei Furukawa
08	iCeMS Taiwan Office National Taiwan University, China Medical University Hospital	Prof Jun Suzuki
09	India Japan Initiative for Intelligent Biomaterials (INJA IN BIO)	Dr Namasivayam Ganesh Pandian
10	SUSTech-Kyoto University Advanced Energy Materials Joint Innovation Laboratory (SKAEM-JIL) Southern University of Science and Technology (SUSTech)	Prof Susumu Kitagawa

ON-SITE LABORATORIES PROJECT UNITS

#3
Core Facility & Collaboration

The iCeMS Analysis Center promotes efficient sharing of cutting-edge research equipment, eliminating the need for each laboratory to purchase expensive equipment and allowing young researchers to easily access high-precision analytical tools. Specialized staff oversee the management of shared equipment and facilities, beginning with determining the rules of use. The center consists of three units: The Materials Analysis Unit, which has equipment for measuring the physical characteristics of materials at the molecular and atomic levels; the Bioanalysis Unit, which has equipment for the observation and analysis of biological molecules and cells; and the Shared Equipment Support Unit, which provides comprehensive support for researchers involved in interdisciplinary research, regardless of their field. Aiming to serve as a core facility model for universities, we will continue to focus on education and training for individuals from all over the world fostering young researchers to experts accessing new fields.

iCeMS Analysis Center

- Bioanalysis Unit

Microscopes — Various confocal microscopes, including those equipped with multiphoton excitation units and super-resolution units, enable analysis of cellular microstructures and dynamic multicellular behavior through long-interval observation of living cells.

Molecular/ Cellular Analysis — A flow cytometer and cell sorter for optical characterization and selective isolation of dispersed cells, and a DNA sequencer to contribute to the analysis of even more cellular properties.

- Materials Analysis Unit

Analysis — The unit provides support for precise quantitative measurements and structural analysis necessary for understanding the physical properties of materials including morphology and states at the nanoscale.

Evaluation — Measurement and analysis support necessary for understanding chemical reactions, including quantification of substances in reaction systems, partial structural analysis of organic molecules, and adsorption measurements for porous materials.

Preparation — Sample preparation for electron microscopy and ICP, and handling of hazardous substances using a fume hood are also available.

- Shared Equipment Support Unit

Management — The unit manages many aspects related to research at iCeMS, from shared equipment and laboratories, reservation systems and usage fees, to budget management including external funds.

Support — Providing comprehensive support for researchers engaged in interdisciplinary research outside of their field, by introducing appropriate experimental equipment, consulting regarding equipment transfer and acquisition, and handling administrative procedures for animal experiment facilities.

Training — Working to build and maintain a safe experimental environment through holding training sessions introducing how to use new shared equipment and systems.

ZEISS-iCeMS Innovation Core

iCeMS operates a joint technology development center with Carl Zeiss Microscopy, Germany. Here, research is conducted using pre-release microscope equipment and simultaneously evaluate the performance of the equipment to develop the world's most advanced live cell imaging technology. The latest Zeiss microscopes are available as shared equipment to researchers from inside and outside the university.

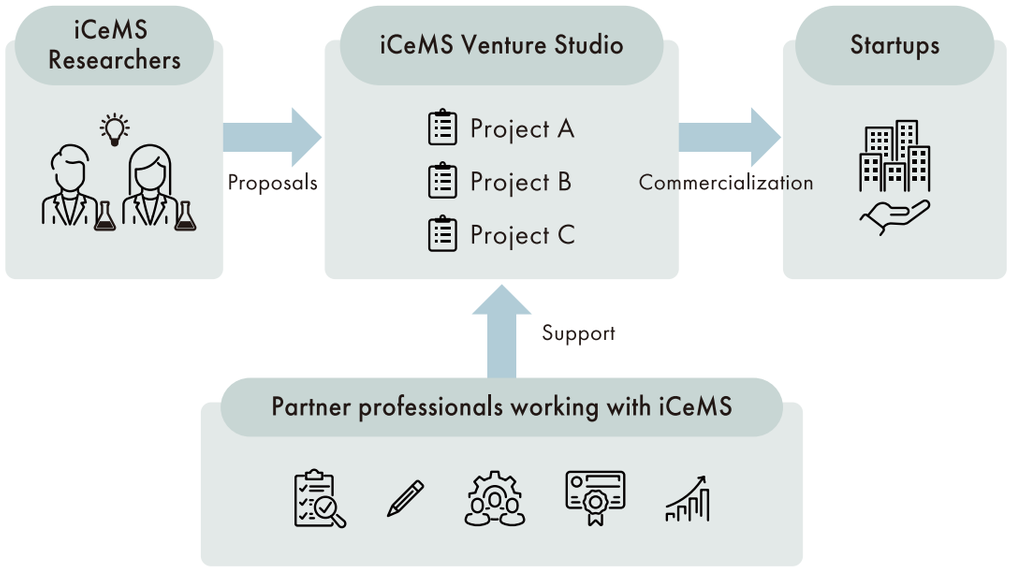
#4
Innovation through Startups

Startups are being created at iCeMS. The results of the fundamental research into revealing the forms of nature can sometimes bring about unexpected transformations for society. At iCeMS we are not just advancing fundamental research, but also exploring effective methods to establish startups and return our research results to society.
iCeMS will continue to collaborate with internal and external organizations including Kyoto University's related offices to safeguard the discoveries that will become the seeds of solutions to the problems facing society.

Startup name	Location	Related iCeMS researchers
Kyoto Monotech Co Ltd	Kyoto, Japan	Prof Kazuki Nakanishi
Emaus Kyoto Inc	Kyoto, Japan	Prof Kazuki Nakanishi
FGH BioTech Inc	Houston, Texas, USA	Prof Motonari Uesugi
tiem factory Inc	Ibaraki, Japan	Prof Kazuki Nakanishi
SnG Inc	Kyoto, Japan	Prof Kazuki Nakanishi
Atomis Inc	Kobe, Japan	Prof Susumu Kitagawa, Dr Masakazu Higuchi
Sihs React Co Ltd	Kyoto, Japan	Prof Kazuki Nakanishi
ANIMOS Inc	Saitama, Japan	Prof Kazuki Nakanishi
ReguGene Co Ltd	Kyoto, Japan	Prof Hiroshi Sugiyama, Dr Ganesh Pandian Namasivayam
OOYOO Co Ltd	Kyoto, Japan	Prof Easan Sivaniah

iCeMS Venture Studio

iCeMS Venture Studio was launched at the end of 2023 to establish and support multiple startups under a single framework with the aim of linking research achievements and inventions to solving societal issues. iCeMS Venture Studio has partnered with experts in industry-academia collaboration, business management, legal affairs, and finance who can provide advice and support for the questions that startups will face inorder to reduce the burden on its researchers when forming their own start-ups.



#5
Internal Communication

Internal communication between members is highly valued at iCeMS. By optimizing internal communication, we aim to improve efficiency, compliance and satisfaction, and to facilitate interdisciplinary collaboration.
At iCeMS, women and international members play active roles as researchers and staff, however we are committed to making progressive steps to address unconscious bias and more fully realize Diversity and Inclusiveness (D&I).
While seeking methods which allow for everyone's participation, we are creating an institution where members can get to know each other, engage in exchange, and understand each other's research needs.

Information Sharing

Internal news is shared with members through newsletters and email. Our internal portal site has also been upgraded, making it easier for members to access information and events.

Retreats

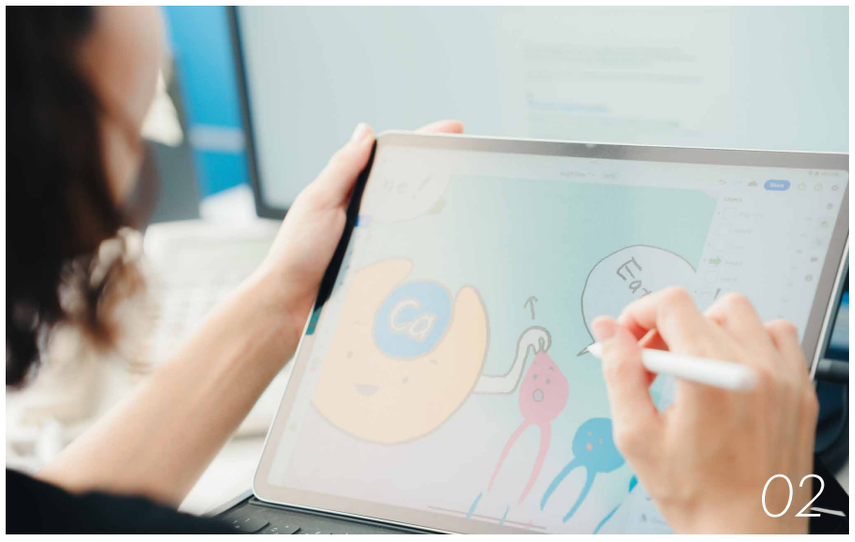
Yearly retreats open to all research members are held to promote academic exchange. Through lectures, poster presentations, and other activities, participants build bridges between fields outside their own.

Tea Time Party

Once a month, staff members gather to exchange conversation over coffee and tea. These meetings serve as valuable opportunities for interaction and information exchange among iCeMS members who work in two separate buildings.

Family-Inclusive Social Events

In addition to researchers and staff, there are social events where their families can participate. These provide opportunities for families who have come from overseas to make new connections as well.



RAD

Research Administration Division

Leveraging expertise as the “engine of the institute”

iCeMS promotes brain circulation with domestic and international universities and institutions, while strengthening our international research network. The RAD is designing initiatives to return the fruits of our research to society. As the “engine” which connects administrative and research roles, the RAD is making various initiatives to promote research activities at iCeMS by capitalizing on several areas of expertise. The RAD is comprised of the following three units.

01 Innovation Unit

To strengthen the research infrastructure at iCeMS, this unit focuses on international collaborative research (e.g., executing agreements), intellectual property/patents/industrial applications, research funding acquisition strategies, and talent exchange.

02 Communication Design Unit

The CD Unit oversees international science communication, outreach events, online and print publications, and international researcher exchanges in order to share iCeMS’ research results with a wide audience and foster brain circulation.

03 Analysis Center

The Analysis Center was established to facilitate access to the experimental equipment and advanced analytical techniques that iCeMS has assembled through its activities as a WPI center. The Materials Analysis Unit, the Bioanalysis Unit, and the Shared Equipment Support Unit work together to support researchers not only in their respective specialized fields but also in interdisciplinary research endeavors.

Message

I would like to express my sincere thanks to Dr Kitagawa, for his service as the director of iCeMS. There have been many challenges over the past 10 years, but Dr Kitagawa has ledi CeMS with his excellent leadership. What impressed me the most was his bold decision to recruit young and talented scientists despite the downsizing of the institute. The culmination of these efforts should be the replacement to Dr Uesugi, who is 16 years younger than Dr Kitagawa. As an Academy Officer, I have high expectations and confidence that the center will make further progress under the new director. Good luck, Dr Uesugi!

Emeritus Professor, Osaka University **Toru Nakano**

Professor Uesugi, congratulations on your appointment as Director of the Kyoto University iCeMS. I was selected as a PI when iCeMS was established in 2007, and later, Professor Uesugi guided my research on pluripotent stem cells from the perspective of chemical biology. I believe that the integration of chemistry and medical science, your specialty, as exemplified by CRISPR-Cas9 technology, is essential for the future development of life sciences. I wish iCeMS continued success in leading the creation of new interdisciplinary fields through the convergence of diverse scientific disciplines.

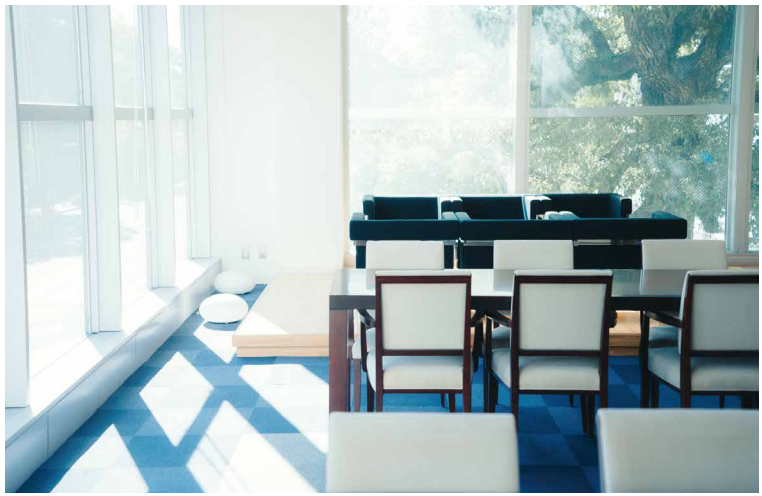
Professor, Director Emeritus, Center for iPS Cell Research and Application, Kyoto University **Shinya Yamanaka**

I would like to congratulate Professor Uesugi on his appointment as Director. He is perfectly suited for iCeMS' fusion of Biology and Chemistry. I am sure that Uesugi's wealth of ideas and strong communication will continue to enhance the reputation of iCeMS. I look forward to future collaborations between iCeMS and RIKEN.

Director, RIKEN Center for Brain Science **Ryoichiro Kageyama**

History

2007	Sep 12	iCeMS is selected for the World Premier International Research Center Initiative (WPI) by Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT).
	Oct 1	iCeMS is established at Kyoto University with Prof Norio Nakatsuji as founding director.
2008	Jan 22	The Center for iPS Cell Research and Application (CiRA) is established under the auspices of iCeMS with Prof Shinya Yamanaka as founding director.
2009	Mar 3	The Center for Meso-Bio Single-Molecule Imaging (CeMI) is established within iCeMS with Prof Akihiro Kusumi as founding director.
	Nov 1	Chemical Screening Center opened in the Main Building.
2010	Apr 1	The Center for iPS Cell Research and Application (CiRA) is re-established as a sister institute to iCeMS with Prof Shinya Yamanaka as founding director.
2013	Jan 1	Prof Susumu Kitagawa succeeds Prof Nakatsuji as director.
2017	Apr 1	iCeMS becomes a research center of Kyoto University Institute for Advanced Study. Integrating CeMI and iCeMS' materials analysis team, iCeMS Analysis Center is established within iCeMS with Prof Mineko Kengaku as founding director.
	May 24	iCeMS is certified as a WPI Academy center by MEXT.
	Oct 5	iCeMS opens the Quantum Nano Medicine Research Center with UCLA.
2018	Aug 22	iCeMS opens the Smart Materials Research Center with VISTEC of Thailand.
2019	Oct 28	The ZEISS-iCeMS Innovation Core is established in iCeMS.
	Dec 1	iCeMS opens the Center for Integrated Biosystems with Academia Sinica of Taiwan.
2021	Feb 4	iCeMS opens the Laboratory for Green Porous Materials with A*STAR-IMRE in Singapore.
	Nov 23	iCeMS opens the Center for Integrated Data-Material Sciences with MacDiarmid Institute for Advanced Materials and Nanotechnology of New Zealand.
2023	Apr 1	Prof Motonari Uesugi succeeds Prof Kitagawa as director.



iCeMS
Vision Book

Institute for Integrated Cell-Material Sciences
Kyoto University

Address	Yoshida Ushinomiya-cho, Sakyo-ku, Kyoto 606-8501, Japan
Phone	+81-75-753-9749
URL	www.icems.kyoto-u.ac.jp
X	iCeMS_KU_INTL
Instagram	iCeMS_KU

Planning and Production	Mari Toyama Izumi Mindy Takamiya Christopher Monahan (RAD Communication Design Unit)
Edit/Photo	Hitoshi Kumagai (Hyakutō)
Design	Rio Sakai
Issue	March 2024


iCeMS
KYOTO UNIVERSITY
WPI Research Center