

World Premier International Research Center Initiative (WPI)

FY2014 WPI Project Progress Report (Post-Interim Evaluation)

Host Institution	Kyoto University	Host Institution Head	Juichi Yamagiwa
Research Center	Institute for Integrated Cell-Material Sciences (iCeMS)	Center Director	Susumu Kitagawa

Common instructions:

- * Unless otherwise specified, prepare this report from the timeline of 31 March 2015.
- * So as to base this fiscal year's follow-up review on the document "Post-interim evaluation revised center project," please prepare this report from the perspective of the revised project.
- * Use yen (¥) when writing monetary amounts in the report. If an exchange rate is used to calculate the yen amount, give the rate.

Summary of State of WPI Center Project Progress (write within two pages)

iCeMS' identity and research goals

What is the difference between "challenging" and "too ambitious" in science? The follow-up report pointed out that iCeMS' identity is ambiguous and too diverse that the terminology and the concept of "mesoscopic" science fail to create a shared impression among the site visit members. These views arose from nothing else than our ultimate goal to create unexplored cross-disciplinary fields through the "Integration of Cell and Material Sciences," a challenging one which we expect to take 10 full years to achieve. Although we have turned to a variety of approaches through trial and error, we have pursued this single goal/identity since the establishment of the institute, and some notable progress has finally begun to take shape.

Research results

As FY2014 was the 8th year in the above context, nearing toward the 10 year mark, results were consolidated into three research pillars to investigate materials for cell control: "Manipulation of Nucleus Information", "Manipulation of Membrane Compartments" and "Manipulation of Cell Communication". Many representative results related to the three pillars have proved remarkable results, including the below achieved in 2014.

iCeMS has published 255 peer-reviewed papers in the last fiscal year, 51 of which are in journals with IF 10 or more. 17 iCeMS researchers have received 19 awards; the most outstanding were Susumu Kitagawa's receipt of 2014 Thomson Reuters Highly Cited Researcher, Motomu Tanaka's receipt of the Philipp Franz von Siebold Award, and John Heuser's E.B. Wilson Medal of the American Society for Cell Biology. iCeMS researchers acquired a total of JPY 1,834 million in research funds except for support from Kyoto University. For the last three years, the amount iCeMS has acquired is 1.39 times greater than the support from WPI.

Due to the self-evaluation, we published 35 highly interdisciplinary and 92 interdisciplinary papers out of 255 papers, and 216 papers (84.7%) were with co-authors outside of iCeMS. We have also been concentrating our efforts to quantitatively present the advancement of cross-disciplinary research at iCeMS. The evolution of the fusion of iCeMS research sub-fields is expressed in the map by publication-based bibliometric methods. Cell-material gaps have been remarkably reduced, and in some cases totally closed.

iCeMS researchers have synthesized or discovered over 1,500 chemical compounds to date. iCeMS added its collection of smart materials or bioactive molecules such as a soft nanoporous crystalline material which are utilized for collaborative researches on materials for cell control.

Globalization of the institution

39 researchers were newly employed, 4 were promoted and 27 scientists left in FY2014. Most of them have found new positions inside and outside of Japan at such institutions as CNRS-CEISAM (France) and iCeMS will keep collaborative research projects with them. We will continue to recruit young researchers even though the five-year extension was not granted.

iCeMS has increased its global recognition as a result of the following overseas initiatives: the publication of *Biomaterial Science* in collaboration with Royal Society of Chemistry; the distribution of "The Chemistry of Life," the first edX course in Japan taught by iCeMS' Deputy Director Uesugi; the establishment of the satellite laboratory in Stem-NCBS, Bangalore, India. These efforts enabled iCeMS to improve the global visibility to the current level.

The opportunities to visit world-class institutions were provided to 13 young researchers from the iCeMS budget (in total 84 researchers since FY2009). It also helped their career development, and increased the worldwide visibility of iCeMS.

Ripple effects on university-wide system reform

As part of the Kyoto University's administration reforms, iCeMS has become to support and accelerate internationalization far beyond iCeMS to other centers and faculty. iCeMS' rich accumulated experience in internationalization is anticipated to have a large impact on them. A new salary system and cross-appointment hiring system were introduced on March 2015. Abolishment of the retirement age has also been implemented in other institutes such as CiRA.

iCeMS's future planning

(1) Research topics: Over the mid-to-long term, we will pursue two bold challenges: one for material science-enabled cell biology through the pursuit of the three research pillars mentioned earlier, and the other for cell-inspired material science. Regarding material science-enabled cell biology, we plan to revert these dormant stem cells into an embryonic-like state and regenerate functional cells and tissues from the rejuvenated stem cells by using new materials. As to cell-inspired material science, iCeMS will develop new porous material systems that generate and store hydrogen, separate and transform carbon dioxide, that clean water, and regulate bioactive gases in living systems.

(2) Research organization: Considering the recent financial situation of the university, maintaining the center's activities at the current level after 2017 will not be an easy task. Even so, to preserve activities of iCeMS after the end of WPI program grant period is a promise that was made at the time of selection; since a total of 13 billion yen of tax revenue has been invested to us for the ten year period, we believe that it is our responsibility to preserve the globally visible institute that iCeMS has become.

Financial and personnel supports from Kyoto University after WPI supports finish have been tentatively agreed upon with President Yamagiwa. The structural details of the International Research Academy (IRA, working title) which iCeMS will join beyond WPI are scheduled to be formally finalized by Kyoto University Deans and Directors Meeting before FY2016 at the beginning of the third mid-term goal period.

iCeMS will work to strengthen its self-sufficiency, since accomplishing the above-mentioned goals and conducting the center's activities would be a nearly impossible task through the university's sole support. To further increase funding, we will merge activities offered by Research Planning and URAs to form a strategic task force for open innovation. In addition, we are considering a redesign of the institute's website and brochures to attract potential donors as well as companies that can become our counterpart for future industry-academia collaborations.

- Please concisely describe the progress being made by the WPI center project from the viewpoints described below.
- In addressing the below-listed 1-6 criteria, please place emphasis on the following:
 - (1) Whether research is being carried out at a top world-level (including whether research advances are being made by fusing fields).
 - (2) Whether a proactive effort continues to be made to establish itself as a “truly” world premier international research center.
 - (3) Whether a steadfast effort is being made to secure the center’s future development over the mid- to long term.
- Please prepare this report within 10 pages (excluding the appendices, and including Summary of State of WPI Center Project Progress (within two pages)).

1. Conducting research of the highest world level

- * Regarding the criteria used when evaluating the world level of center, please note any updated results using your previous evaluation criteria and methods or any improvements you have made to those criteria and methods.

(a) **Representative results achieved**

The research goal/identity of iCeMS is the “**Integration of Cell and Material Sciences**”.

A critical review of ongoing collaborative projects was carried out and resulted in a tightened focus on the **Manipulation of Cell Fundamentals by Synthetic Molecules** that encompasses the following three research pillars with representative results published in top-journals.

i) **Manipulation of Nucleus Information**

Through interdisciplinary approaches (combinations of biology, physics, and chemistry), we are now able to successfully control gene expression for regulating cell fates. Collaborative research among iCeMS groups revealed that gene expression dynamics is important for the activity of transcription factors. Using a new light technology, we found that oscillatory expression of the transcription factors *Ascl1* and *Hes1* activates proliferation of neural stem cells whereas sustained expression of *Ascl1* and *Hes1* promotes neuronal and astrocyte differentiation, respectively [/*Neuron*/ 2014][/*Trends Neurosci.*/ 2014]. We also synthesized bio-inspired targeting small molecules, ‘SAHA-PIPs’ by conjugating sequence-specific pyrrole-imidazole polyamides with the histone deacetylase inhibitor SAHA. One such compound successfully activates pluripotency genes in mouse fibroblasts [/*Sci Rep*/ 2012], while other induces them in human fibroblasts [/*ACS Chem. Biol.*/2014]. Another SAHA-PIP remarkably activates germ cell genes [/*Angew.Chem.-Int. Edit.*/2013]. Distinct SAHA-PIPs also effectively rewires transcriptional activation of therapeutically important genes [/*Sci Rep*/ 2014] to substantiate their potential as artificial genetic switches.

ii) **Manipulation of Membrane Compartments**

The interdisciplinary researches among iCeMS researchers realized the materialization of the concept of membrane compartments using porous coordination polymers (PCPs) with highlighting macroscale compartmentalized superstructures with molecular selectivity [/*JACS*/ 2014] and with high molecular selection and concentration ability stemming from structural dynamics [/*Science*/ 2014, /*Angew. Chem. Int. Ed.*/ 2014]. The collaborative studies on the membrane proteins, such as receptors and transporters, revolutionized our understanding of molecular interactions in the plasma membrane and facilitated development of chemical tools for selective elimination of human pluripotent stem cells [/*Curr Opin Cell Biol*/ 2014, /*JACS*/ 2014].

iii) **Manipulation of Cell Communication**

Multidisciplinary collaborative research among iCeMS and other scientists generated outstanding outcomes in manipulating cell-cell and cell-material interactions. For example, screening of chemical libraries and subsequent chemical synthesis identified small molecules that direct differentiation of late-stage pancreatic beta-cells [/*Nat. Chem. Biol.*/ 2014]. Combining cell biology and material sciences also developed smart materials for cell engraftment [/*Angew. Chem. Int. Ed.*/ 2014] and for selective elimination of human iPS cells [/*J. Am. Chem. Soc.*/ 2014]. Interdisciplinary collaboration between cell biologists and biophysicists revealed cell signaling and mechanics of selective exclusion of cancer cells from epithelial tissues [/*Nat. Commun.*/ 2014].

(b) Junior PIs

In FY2014, six young researchers including Kyoto Fellows were officially added to the PI members as Junior PIs. This change mainly aims at adopting their fresh ideas into the institute's management and also offering them incentives. It has exerted more effect than expected and encouraged them to actively express their creative opinions as a result.

(c) Publication

In FY2014, iCeMS has published **255** peer-reviewed papers, **51 (20%)** of which are in journals with IF 10 or more. The numbers of papers related to the three pillars published in journals with more than IF 10 are 18, 6 and 4 respectively.

(d) Major grants obtained

In FY2014, iCeMS researchers acquired a total of **JPY 1,834 million** in research funds: 599 million from Grants-in-Aid for Scientific Research; 971 million from sponsored research funding; and 264 million from other competitive research funding sources. For the last three years, the amount iCeMS has acquired is **1.39 times** greater than the support from WPI.

(e) Eminent awards received

In FY2014, 17 iCeMS researchers have received 19 awards. The most outstanding awards are Susumu Kitagawa's receipt of 2014 Thomson Reuters Highly Cited Researcher, Motomu Tanaka's receipt of the Philipp Franz von Siebold Award, and John Heuser's E.B. Wilson Medal of the American Society for Cell Biology. 31 iCeMS researchers have received 104 awards since the establishment of the institute including Yamanaka's Nobel Prize and Kitagawa's Thomson Reuters Citation Laureates.

2. Advancing fusion of various research fields

(a) Results of interdisciplinary researches

1. Publications

Out of **255 peer-reviewed papers iCeMS produced in FY2014**, We considered 124 papers to be highly interdisciplinary.

2. Analysis of interdisciplinarity based on bibliometric methods

Efforts are being made to quantitatively assess research 'fusion' at iCeMS. Co-term networks are used to capture the evolution of the iCeMS research landscape over time. These maps link keywords extracted from iCeMS publications based on their co-occurrence. The more often two terms appear together in a paper, the greater their interaction and the closer their location in the maps. By coloring highly interconnected terms with a red-green-blue scale, areas of research fusion at iCeMS are highlighted (*Figure 1, left*). These 'fusion maps' show that research advanced by iCeMS scientists has expanded and intensified across different fields of research over the years. Collaborative schemes tackling research projects involving challenging combinations of interdisciplinary knowledge (biology, physics, and chemistry) have translated into a more coherent iCeMS research landscape. Of greatest importance, cell-material gaps have been reduced, and in some cases totally closed, as shown in the representative examples of fusion research efforts at iCeMS for the FY2014 (*Figure 1, right*). Details on the methods used can be found in <https://sites.google.com/site/knowintmapping2015/home/density-maps>.

3. Collaborative researches achieved

iCeMS has produced **255 peer-reviewed papers with an iCeMS affiliation** in FY2014.

-25% (63) of those were published with co-authors affiliated with overseas institutes

-36% (92) with co-authors affiliated with Japanese institutes other than Kyoto University

-23% (59) with co-authors affiliated with other departments at Kyoto University

-5% (13) were co-authored within iCeMS

This demonstrates the institute's highly positive attitude towards collaborative research activities.

4. More than 1500 new materials synthesized

iCeMS researchers have synthesized or discovered over 1,500 chemical compounds to date. In 2014, iCeMS added its collection of smart materials or bioactive molecules, including a soft nanoporous crystalline material that selectively adsorbs carbon monoxide [/*Science/* 2014], synthetic molecules that protect cells for cell engraftment [/*Angew. Chem. Int. Ed./* 2014], superhydrophobic porous coordination polymers [/*Angew. Chem. Int. Ed./* 2014], and helical tubular DNA origami [/*Angew. Chem. Int. Ed./* 2014].

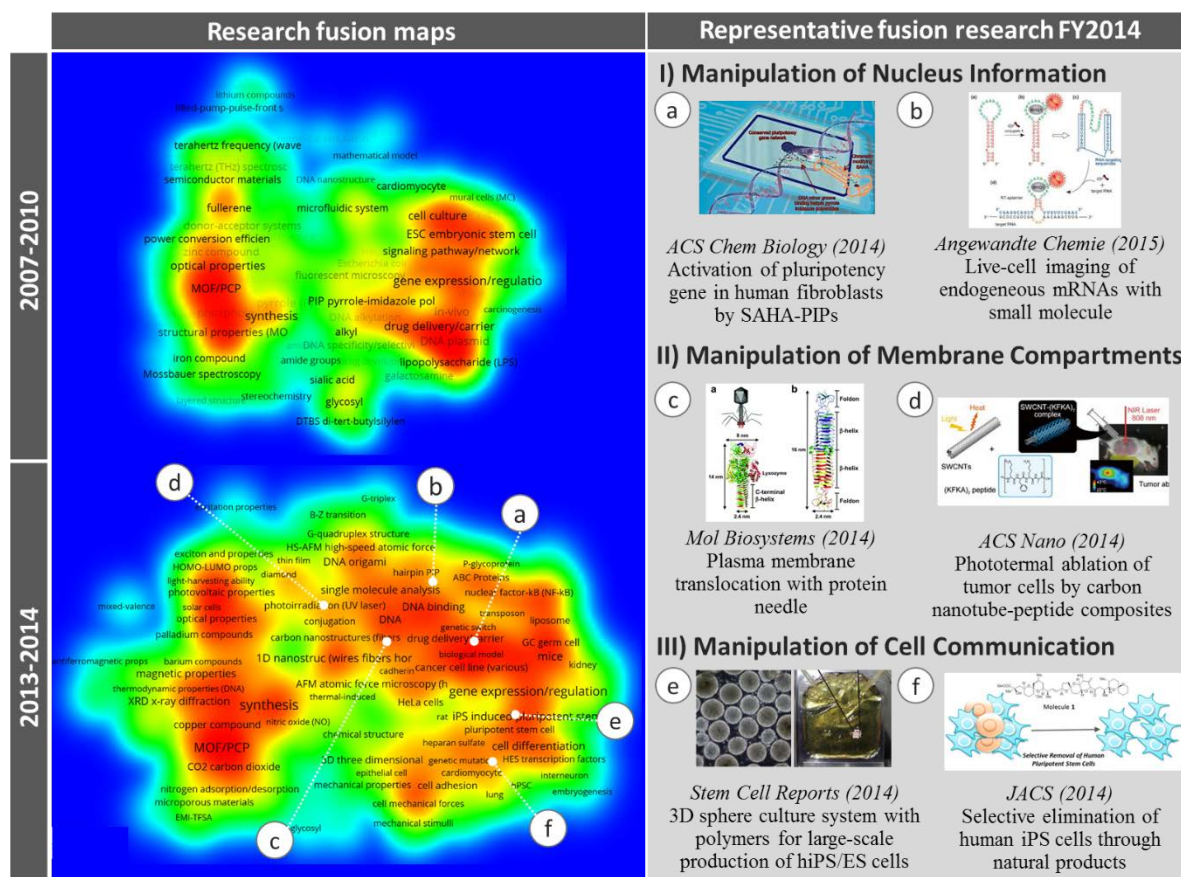


Figure 1 Research fusion at WPI iCeMS, 2007-2010 and 2013-2014

3. Globalization of the institution

- * Describe what's been accomplished or recognized in the efforts to raise the center's international recognition as a genuine top world-level research institute, along with innovative efforts proactively being taken in accordance with the development stage of the center, including the following points, for example:
 - Efforts being developed based on the analysis of number and state of world-leading, frontline researchers; number and state of visiting researchers; exchanges with overseas entities
 - Proactive efforts to raise the level of the center's international recognition
 - Efforts to make the center into one that attracts excellent young researchers from around the world (such as efforts fostering young researchers and contributing to advancing their career paths)

(a) Researchers' circulation

In FY2014, 3 assistant professors and 36 research associates were newly employed and 3 assistant professors were promoted to associate professors and one research associate was promoted to assistant professor.

27 scientists left iCeMS in FY2014. Most of them have found new positions inside and outside of Japan and iCeMS will keep collaborative research projects with them. Some institutes where iCeMS-raised brains newly settled are CNRS-CEISAM (France), CNRS-LRS (France), MIT (USA), NIMS (Japan), University of Tokyo (Japan), Tokyo Institute of Technology (Japan).

Number of new employment in FY2007 includes initial PIs such as Kitagawa, Nakatsuji etc.

	2007	2008	2009	2010	2011	2012	2013	2014	Total
New hire	24	47	70	43	33	32	46	39	326
Promotion	0	3	6	2	1	8	2	4	26
Leaving	0	10	49	26	22	26	44	27	204

(b) International recognition

1. Publication of *Biomaterials Science*

In January 2012, iCeMS began an important new project to contribute to the further development of cell-material integration research as well as mesoscopic sciences by launching a new international journal, *Biomaterials Science*, in collaboration with RSC. 349 articles and 27 issues have appeared in the online journal as of the end of March 2015. *Biomaterials Science* has become the 5th of 32 journals in journal ranking of International Scientific Index 'Biomaterials' Category

2. Joining the new educational consortium edX

Kyoto University announced on May 21, 2013 its alliance with "edX," making it the first Japanese university to take part in the non-profit educational consortium. The first course offered by Kyoto University's "KyotoUx" series is taught by iCeMS deputy director and Institute for Chemical Research **Prof. Uesugi**, titled the "The Chemistry of Life." Student registration for the course in FY2014 is 20,269. Prof. Uesugi also provided the first "flipped class" in the long history of Kyoto University education.

3. Collaboration with National Centre for Biological Sciences (NCBS) in Bangalore, India

The satellite lab is getting popular as a pioneer of practical Japan-India research collaboration. Koichi Hasegawa was invited and became a member of the Expert Group Meeting of India- Japan collaboration in Indian Council of Medical Research. He also gave a seminar in India-Japan Science Seminar for Commemoration of the 30th Anniversary of India-Japan Science & Technology Cooperation in Indian Institute for Technology Delhi at February 2015. Minister of MEXT, Mr. Shimomura visited the lab in inStem-NCBS at August 2014, and discussed Japan-India collaboration with Deans of NCBS and inStem and Hasegawa.

4. Hosting World Stem Cell Summit

iCeMS has been actively involved in co-organizing and participating in World Stem Cell Summit since 2012, the second largest congress of stem cell research in the USA. **Founding Director Nakatsuji** contributed as co-chair and was invited to give the plenary in FY2014 in a row to experts in the stem cell and regenerative medicine fields. iCeMS organized the "Japan Symposium," inviting a panel of experts from academia and industry.

(C) Efforts to attract young researchers

1. Accelerating grants to promote outstanding projects

Following the startup phase, in FY2013 iCeMS undertook a new initiative to accelerate outstanding projects in certain areas of institute-initiated projects. Granted projects are expected to yield results within two years in the highest quality scientific journals.

(million yen, *prototype)

	2012*	2013		2014		Total
Budget	54	36	23	35	99	247
No. of granted projects	10	10	5	9	24	58

2. Support for overseas visit for young researchers

Since 2010, iCeMS has supported more than 84 young researchers in earning opportunities to visit world-class institutions, opening the door to further international collaborations and careers with financial support from JSPS. The priority of the program has been shifted to assisting researcher career development from simply boosting international collaboration, and the program has been run successfully by iCeMS' own budget since FY2013.

(million yen)

	FY2009	FY2012	FY2011	FY2012	FY2013	FY2014	Total
Budget	0.6	9.5	11	13	9	6.2	49.3
No. of granted researchers	1	10	15	27	18	13	84

3. Establishment of Shared Equipment Support Office

The establishment of Shared Equipment Support Office strengthened the management of the common equipment, and got to give researchers and technicians proper instructions. We gained a foothold of issues to be considered for effectively utilizing large-sized or shared equipment in the future. About the large-sized equipment purchased over 5 million yen, its information is shared within iCeMS for attempting common use, and furthermore its utilization and maintenance have been progressed as concrete and effective.

4. Implementing organizational reforms

* If innovated system reforms generated by the center have had a ripple effect on other departments of the host institutions or on other research institutions, clearly describe in what ways.

Kyoto University is making a great effort to embody the **National University Reform Plan** under the leadership of President. iCeMS has been the front runner and the testbeds of these system reforms. The new paradigm created by iCeMS has been highly evaluated and has strongly influenced plans for these Kyoto University reforms described below.

1. Kyoto University international strategy (Formulated in September 2013)

Kyoto University has formulated a new international strategy, the 2x by 2020 Initiatives. 2x by 2020 is the slogan of the new International Strategy by means of which Kyoto University aims to double its international indices in research, education and international service by the year 2020. Goals are clarified in terms of quantity and deadline as WPI missions.

2. Kyoto University level administrative reform (Operational in July 2013)

Kyoto University has undertaken substantial administration reforms, such as the relocation and centralization of staff, new positions for supporting education and research, and implementation of rigorous evaluation and training systems to increase the efficiency of administration. iCeMS has become to support and accelerate internationalization far beyond iCeMS to other centers and faculty.

iCeMS' rich accumulated experience in internationalization is anticipated to have a large impact on them. For example, 10 bilingual administrative staff is allocated to the Institute for Liberal Arts Studies (ILAS), some of whom are now on the job training at iCeMS. University-wide networking of admin staff responsible for overseas affairs is operative under the leadership of iCeMS staff.

3. Kyoto University Research Administration (KURA)

KURA was established at the university in 2012, and subsequently hired nearly 46 university research administrators (URAs). iCeMS' Research Planning Section has been playing an important role in nurturing and collaborating with KURA.

4. Personnel management

Introduction of a new salary system was partially introduced into Kyoto University's personnel management on March 2015 (About 500 faculty members are employed by the new scheme). Cross-appointment hiring system was also introduced on March 2015 by which a faculty member can be employed by multiple organizations based on their effort rates. Abolishment of the retirement age has been implemented in other institutes such as CiRA.

5. Efforts to secure the center's future development over the mid- to long term

* Please address the following items, which are essential to mid- to long-term center development:

- Future Prospects with regard to the research plan, research organization and PI composition; prospects for the fostering and securing of next-generation researchers
- Prospects for securing resources such as permanent positions and revenues; plan and/or implementation for defining the center's role and/or positioning the center within the host institution's institutional structure
- Measures to sustain the center as a world premier international research center after program funding ends (including measures of support by the host institution)

(a) Future prospects for research

1. Research plan

True integration of cell and material sciences should be bidirectional, making ground-breaking contributions to both cell biology and material sciences. For 8 years, iCeMS has focused on utilizing material science technology for cell biology. To accomplish our mission, the "Integration of Cell and Material Sciences," during the remaining 2 years and after WPI grant ends, iCeMS plans to pursue two bold challenges: one for material science-enabled cell biology supported by the three pillars of research, and the other for cell-inspired material science. Two prioritized research topics are as follows:

- **Rejuvenation of Adult Stem Cells for Tissue Regeneration**

Embryonic tissue stem cells actively proliferate and give rise to various mature cells, while adult tissue stem cells are mainly dormant. We plan to revert these dormant stem cells into an embryonic-like state and regenerate functional cells and tissues from the rejuvenated stem cells by using new materials.

iCeMS has already developed seed technologies toward this goal, including SAHA-PIP molecules that regulate specific gene expression, gas-releasing materials that activate signaling pathways, and a light control system that allows precise spatiotemporal gene expression. By combining these technologies, iCeMS will create effective methods to activate dormant stem cells and regenerate functional cells, such as germ cells, cardiomyocytes, and neurons. iCeMS will also pursue the 3-dimensional reconstitution of tissues and organs by developing novel synthetic assemblies. Our approaches may prove useful for regenerating damaged tissues and treating diseases from endogenous dormant stem cells.

- **Cell-Inspired Materials for Energy, Healthcare and Environment**

Whether through vast oceanic pumps or the natural food-chain or the proton-pumps at the cell membrane, we observe nature's simultaneously intricate and immense energy distribution network. The overall strategy is remarkably consistent, as energy is captured within molecular bonds and chemical gradients, to be stored, transported and consumed. Important agents such as carbon dioxide, water, oxygen, nitric oxide regulate such processes, from the subcellular to the cellular to the organs to the human all the way up the global bioscope.

Inspired by this sequential, integrated, hierarchical function of cells in reformulating energy as molecular entities to be captured, separated, transported and released at the point-of-use, iCeMS will develop new porous material systems that generate and store hydrogen, separate and transform carbon dioxide, that clean water, and regulate bioactive gases in living systems. These novel material solutions not only mimic nature's strategy, but will surpass the intrinsic biological limitations of natural systems. Such cell-inspired materials would help to solve critical energy, environmental and healthcare challenges to our future.

2. Research Management System

(i) Reorganize research groups

In order to focus on more goal-oriented research, we will reorganize PIs. We will employ world-renowned professors within Kyoto University as adjunct PIs (Prof. Eisuke Nishida (Graduate School of Life Science), Prof. Ryu Abe (Graduate School of Engineering) and Prof. Takashi Shinohara (Graduate School of Medicine)).

After WPI program funding ends in FY2016, iCeMS will be retained (see (b) below). This institute (iCeMS beyond WPI) plans to include the following two research groups (total number of researchers expected: 106) in order to optimizing personnel management and to raise self-sustainability after the WPI fund is terminated.

1. Main research groups: Tenured Kyoto University faculty will form 5 core research groups, and researchers from other departments or centers of the university will form 10 adjunct groups.
2. Ancillary research groups: 4 research groups will be managed with competitive funding obtained by the main groups.

(ii) Institute Initiated Projects

The director will appoint a leader and provide research funds for each institute-initiated research project. The leader's role will be to recruit multidisciplinary collaborators from other iCeMS groups and hire postdocs or technicians. Such flexible, virtual research groups would promote risk-taking collaborative research activities to achieve the iCeMS' goals. As one of these projects, we are planning to establish Kyoto Advanced Porous Science Group(KAPS) at iCeMS to strengthen the research in 5-(a)-1.

(iii) Increase self-sufficiency beyond WPI

Acquisition of external funds will be critical to sustain iCeMS after the WPI-grant period finishes. To further increase funding, we will merge activities offered by Research Planning and URAs to form a strategic task force for open innovation. Acquisition of external funds from overseas will be considered. In addition, we are considering a redesign of the institute's website and brochures to attract potential donors as well as companies that can become our counterparts for future industry-academia collaborations.

(b) Center's positioning within Kyoto University

In September 2013, Kyoto University announced plans to establish International Research Academy (IRA) as one of its International Strategies (IRA is a working title, subject to change). A formal planning committee to establish the IRA submitted an interim report on the basic framework of the new center on July 10, 2014. In April 2015, discussions have begun to finalize the IRA basic frameworks under the leadership of Vice President Minato responsible for research. The final framework proposal will be referred to the Deans and Directors Meeting no later than the end of FY 2015 for the new center to commence in April, 2016, when the third mid-term goal period begins.

The management principles of the IRA will be as follows:

- Inherit and further develop WPI-iCeMS concepts
- Be defined as a Center of Excellence (COE) where selected, talented Kyoto University scientists and world-renowned scholars can come together
- Provide an environment where young, promising researchers are nurtured

After WPI program funding ends in FY2016, iCeMS will be retained as one of the core centers. And if any applications for 2nd WPI program are accepted, these new WPI centers will join the IRA.

(c) Measures to sustain the center

After WPI program funding ends in FY2016, Kyoto University will continue supporting iCeMS in the same manner it has until now, as listed below.

- Full support of indirect costs associated with competitive grants to iCeMS.
- Provide faculty positions and expenses for principal investigators.
- Provide full-time administrative staff and necessary expenses to support an independent administrative organization.
- Provide a high-quality research environment including exclusive-use facilities and a fully equipped infrastructure.

And in addition to these supports, Kyoto University will

- Place young researchers on tenured track
- Invite renowned international researchers
- Cover operational expenses such as equipment maintenance and administration

Specific details concerning the above-mentioned support will be determined in the formulation of the detailed plan of the IRA by the end of FY2016 (Two seats for tenured track researchers have already been secured).

As we have already mentioned in 5. (a)-(iii), Kyoto University will support the acquisition of competitive funding, including overseas funds.

6. Others

* In addition to the above 1-5 evaluation items, only if there is anything else that deserves mention regarding the center project's progress, please note it.

(a) Establishment of Kyoto Stem Cell Innovation, Inc

Three iCeMS researchers, including the Founding Director Norio Nakatsuji, were inaugurated as technical advisors of Kyoto Stem Cell Innovation, Inc (SCI), which has been aiming at promotion of industrial applications of stem cells. With renowned overseas researchers joining the institution, SCI is expected to further accelerate practical applications of stem cells.

(b) Leading role in local revitalization

ACT Kyoto is a research and development center for chemical research, which is in line with one of the Kyoto city policies of promoting the academy-industry-government cooperation supported by MEXT and METI. iCeMS rents lab space (595 m²) for research and development of gas science technology, and has been in full operation since April 2014.

Here, iCeMS plays a leading role in local revitalization by promoting Kyoto Next-Generation Energy Systems Creation Strategy.

7. Center's response to the results of the FY2014 follow-up (including the results of the site visit)

* Note how the center has responded to the results of FY2014 follow-up. However, if you have already provided this information, please indicate where in the report.

(a) Recommendation given by WPI Program Committee

Although scientific level of iCeMS is very high, including original and interdisciplinary work, the identity of the institute appears to not be firmly settled. This is partially understandable because of its long discussion about "meso-scopic" science, the spin out of CiRA, and the change of directors. Site visit members recommend that iCeMS reconfirms its identity in a realistic and practical way.

(b) iCeMS Response to WPI recommendation

1. iCeMS more focused research targets

Although it's main research theme is the integration of materials and cells, as indicated in the name of the institute, iCeMS' identity and its apparent lack of clarity has been the main point of criticism since its establishment. A future vision task force was created this fiscal year to further clarify the identity of iCeMS. We concluded that iCeMS' central research focus is on "the synthesis of chemical compounds to manipulate cellular functions", supported by three research pillars: the manipulation of nucleus information, the manipulation of membrane compartments, and the manipulation of cell communication.

2. A general lack of understanding to iCeMS ambitious research goals

One of the fundamental reasons as to why iCeMS' identity has failed to be fully recognized by evaluators stems from a general lack of understanding towards our ambitious research goals and efforts to structure our research organization, as listed below.

Mesoscopic science: One of the objectives of the WPI is to create interdisciplinary domains. Interdisciplinary research exists on many levels, including the provision of support to a different field, collaborations with different disciplines, and the generation of a new interdisciplinary domain. iCeMS has strived to establish a new fusion domain called mesoscopic science, focusing on the mesoscopic realm where materials evolve into living organisms; the domain lies above one nano meter ruled by quantum mechanics, and below one micro meter, ruled by Newtonian mechanics and thermodynamics.

Establishment of CiRA: Immediately following the establishment of iCeMS in October 2007, Prof. Yamanaka discovered the human iPS cell. In response to the groundbreaking finding, iCeMS established CiRA within iCeMS in 2008, entrusting Prof. Yamanaka the role of Center Director. As social demand for iPS cell application increased, iCeMS responded by making CiRA the 14th independent research institution at Kyoto University in April, 2010. The two centers were intended for separate roles; iCeMS for the fundamental research of iPS cells and CiRA for research on clinical applications of iPS cells. Such a case of swift implementation of ambitious organizational reform reflects a top-down decision making process that was feasible only under the WPI initiative.

Director change: iCeMS' goal has been to create a new interdisciplinary domain of cell-material integration. To make this goal a reality, Professor Nakatsuji, a cell biologist, took directorship for the first five years, and Professor Kitagawa, a material scientist for the latter five years. If the five year extension had been granted, we had planned on entrusting the director's role to another scientist fostered in our truly interdisciplinary research environment. We believe that such approach of research organization management is one that is dynamic, challenging, and ambitious.

(c) Direction of iCeMS' research

As mentioned in 5. (a)-1, iCeMS aspires to ultimately create a new interdisciplinary science by making a two-way fused approach between cell science and material science for cell-material integration. Prioritized research topics are twofold: rejuvenation of adult stem cells for tissue regeneration and cell-inspired materials for energy, healthcare and environment.

List of Center's Research Results and Main Awards

A. Refereed Papers

List only the Center's papers published in 2014. (Note: The list should be for the calendar year, not the fiscal year.)

(1) Divide the papers into two categories, A and B.

A. WPI papers

List papers whose author(s) can be identified as affiliated with the WPI program (e.g., that state the name of his/her WPI center). (*Not including* papers whose acknowledgements contain the names of persons affiliated with the WPI program.)

B. WPI-related papers

Among papers published in 2014, list those related to the WPI program but whose authors are not noted in the institutional affiliations as WPI affiliated. (*Including* papers whose acknowledgements contain the names of researchers affiliated with the WPI program.)

Note: On 14 December 2011, the Basic Research Promotion Division in MEXT's Research Promotion Bureau circulated an instruction requiring paper authors to include the name or abbreviation of their WPI center among their institutional affiliations. As some WPI-affiliated authors of papers published up to 2011 may not be aware of this requirement, their papers are treated as "WPI-related papers." From 2012, however, the authors' affiliations must be clearly noted and only category A papers will be listed.

Newly selected centers are to list papers under category C below (in addition to categories A and B above).

(2) Method of listing paper

- List only referred papers. Divide them into categories (e.g., original articles, reviews, proceedings).
- For each, write the author name(s); year of publication; journal name, volume, page(s), and article title. Any listing order may be used as long as format is the same. (The names of the center researchers do not need to be underlined.)
- If a paper has many authors (say, more than 20), all of their names do not need to be listed.
- If the papers are written in languages other than English, divide them into language categories when listing them.
- Assign a serial number to each paper to be used to identify it throughout the system.

(3) Submission of electronic data

- In addition to the above, for each paper provide a .csv file output from the Web of Science (e.g.) or other database giving the paper's raw data including Document ID. (Note: the Document ID is assigned by paper database.)
- These files do not need to be divided into paper categories.

(4) Use in assessments

- The lists of papers will be used in assessing the state of WPI project's progress in FY 2014.
- They will be used as reference in analyzing the trends and states of research in all the WPI centers, not to evaluate individual researcher performance.
- The special characteristics of each research domain will be considered when conducting assessments.

(5) Additional documents

After all documents, including these paper listings, showing the state of research progress have been submitted, additional documents may be requested.

Order of Listing

A. WPI papers

1. Original articles
2. Review articles
3. Proceedings
4. Other English articles
5. Articles written in other than English

B. WPI-related papers

1. Original articles
2. Review articles
3. Proceedings
4. Other English articles
5. Articles written in other than English

A. WPI papers

Article

1	Chiba, T; Sakurada, T; Watanabe, R; Yamaguchi, K; Kimura, Y; Kioka, N; Kawagishi, H; Matsuo, M; Ueda, K, 2014, PLOS ONE, 9, 18, Fomiroid A, a Novel Compound from the Mushroom Fomitopsis nigra, Inhibits NPC1L1-Mediated Cholesterol Uptake via a Mode of Action Distinct from That of Ezetimibe
2	Frenkel, N; Makky, A; Sudji, IR; Wink, M; Tanaka, M, 2014, JOURNAL OF PHYSICAL CHEMISTRY B, 118, 8, Mechanistic Investigation of Interactions between Steroidal Saponin Digitonin and Cell Membrane Models
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175	Jeon, HJ; Matsuda, R; Kanoo, P; Kajiro, H; Li, LC; Sato, H; Zheng, YT; Kitagawa, S, 2014, CHEMICAL COMMUNICATIONS, 50, 3, The densely fluorinated nanospace of a porous coordination polymer composed of perfluorobutyl-functionalized ligands
176	Otomo, H; Park, S; Yamamoto, S; Sugiyama, H, 2014, RSC ADVANCES, 4, 4, Amplification of fluorescent DNA through enzymatic incorporation of a highly emissive deoxyguanosine analogue
177	Suzuki, Y; Endo, M; Canas, C; Ayora, S; Alonso, JC; Sugiyama, H; Takeyasu, K, 2014, NUCLEIC ACIDS RESEARCH, 42, 8, Direct analysis of Holliday junction resolving enzyme in a DNA origami nanostructure
178	Pandian, GN; Taylor, RD; Junetha, S; Saha, A; Anandhakumar, C; Vaijayanthi, T; Sugiyama, H, 2014, BIOMATERIALS SCIENCE, 2, 14, Alteration of epigenetic program to recover memory and alleviate neurodegeneration: prospects of multi-target molecules
179	Otsubo, K; Kitagawa, H, 2014, CRYSTENGCOMM, 16, 10, Structural design and electronic properties of halogen-bridged mixed-valence ladder systems with even numbers of legs

180	Inukai, M; Horike, S; Chen, WQ; Umeyama, D; Itakura, T; Kitagawa, S, 2014, JOURNAL OF MATERIALS CHEMISTRY A, 2, 6, Template-directed proton conduction pathways in a coordination framework
181	Seinberg, L; Yamamoto, S; Tsujimoto, M; Kobayashi, Y; Takano, M; Kageyama, H, 2014, CHEMICAL COMMUNICATIONS, 50, 3, CaH ₂ -assisted low temperature synthesis of metallic magnetic nanoparticle-loaded multiwalled carbon nanotubes
182	Yamamoto, S; Gallage, R; Isoda, S; Ogata, Y; Kusano, Y; Kobayashi, N; Ogawa, T; Hayashi, N; Takahashi, M; Takano, M, 2014, CHEMICAL COMMUNICATIONS, 50, 4, Stability of alpha"-Fe ₁₆ N ₂ in hydrogenous atmospheres
183	Zheng, XF; Huang, YM; Duan, JG; Wang, CG; Wen, LL; Zhao, JB; Li, DF, 2014, DALTON TRANSACTIONS, 43, 7, A microporous Zn(II)-MOF with open metal sites: structure and selective adsorption properties
184	Hara, A; Imamura, A; Ando, H; Ishida, H; Kiso, M, 2014, MOLECULES, 19, 24, A New Chemical Approach to Human ABO Histo-Blood Group Type 2 Antigens
185	Huang, YM; Zheng, XF; Duan, JG; Liu, WL; Zhou, L; Wang, CG; Wen, LL; Zhao, JB; Li, DF, 2014, DALTON TRANSACTIONS, 43, 8, A highly stable multifunctional three-dimensional microporous framework: excellent selective sorption and visible photoluminescence
186	Hirai, K; Sumida, K; Meilikhov, M; Louvain, N; Nakahama, M; Uehara, H; Kitagawa, S; Furukawa, S, 2014, JOURNAL OF MATERIALS CHEMISTRY C, 2, 9, Impact of crystal orientation on the adsorption kinetics of a porous coordination polymer-quartz crystal microbalance hybrid sensor
187	Yang, YY; Endo, M; Suzuki, Y; Hidaka, K; Sugiyama, H, 2014, CHEMICAL COMMUNICATIONS, 50, 3, Direct observation of the dual-switching behaviors corresponding to the state transition in a DNA nanoframe
188	Osakada, Y; Prax, G; Sun, C; Sakamoto, M; Ahmad, M; Volotskova, O; Ong, QX; Teranishi, T; Harada, Y; Xing, L; Cui, BX, 2014, CHEMICAL COMMUNICATIONS, 50, 3, Hard X-ray-induced optical luminescence via biomolecule-directed metal clusters
189	Nocera, GM; Ben M'Barek, K; Bazzoli, DG; Fraux, G; Bontems-Van Heijenoort, M; Chokki, J; Georgeault, S; Chen, Y; Fattaccioli, J, 2014, RSC ADVANCES, 4, 5, Fluorescent microparticles fabricated through chemical coating of O/W emulsion droplets with a thin metallic film
190	Babarao, R; Coghlan, CJ; Rankine, D; Bloch, WM; Gransbury, GK; Sato, H; Kitagawa, S; Sumbly, CJ; Hill, MR; Doonan, CJ, 2014, CHEMICAL COMMUNICATIONS, 50, 4, Does functionalisation enhance CO ₂ uptake in interpenetrated MOFs? An examination of the IRMOF-9 series
191	Han, YW; Tsunaka, Y; Yokota, H; Matsumoto, T; Kashiwazaki, G; Morinaga, H; Hashiya, K; Bando, T; Sugiyama, H; Harada, Y, 2014, BIOMATERIALS SCIENCE, 2, 11, Construction and characterization of Cy3-or Cy5-conjugated hairpin pyrrole-imidazole polyamides binding to DNA in the nucleosome
192	Sugi, T; Sakuma, T; Ohtani, Y; Yamamoto, T, 2014, DEVELOPMENT GROWTH & DIFFERENTIATION, 56, 8, Versatile strategy for isolating transcription activator-like effector nuclease-mediated knockout mutants in <i>Caenorhabditis elegans</i>
193	Kongpatpanich, K; Horike, S; Sugimoto, M; Kitao, S; Seto, M; Kitagawa, S, 2014, CHEMICAL COMMUNICATIONS, 50, 3, A porous coordination polymer with a reactive diiron paddlewheel unit
194	Menjo, M; Tamai, H; Ando, H; Ishida, H; Koketsu, M; Kiso, M, 2014, HETEROCYCLES, 88, 8, GLYCOSIDATION REACTIONS OF BENZYL-TYPE SELENOGLYCOSIDE DONORS
195	Park, S; Otomo, H; Zheng, LJ; Sugiyama, H, 2014, CHEMICAL COMMUNICATIONS, 50, 3, Highly emissive deoxyguanosine analogue capable of direct visualization of B-Z transition
196	Takano, Y, 2014, FULLERENES NANOTUBES AND CARBON NANOSTRUCTURES, 22, 7, Intramolecular Electron Transfers in Donor/Acceptor Linked Molecules Based on Endohedral Lanthanide Metallofullerenes
197	Miyazaki, T; Nakatsuji, N; Suemori, H, 2014, GENESIS, 52, 7, Optimization of Slow Cooling Cryopreservation for Human Pluripotent Stem Cells
198	Kobayashi, K; Tanaka, K, 2014, PHYSICAL CHEMISTRY CHEMICAL PHYSICS, 16, 11, Approach to multi-electron reduction beyond two-electron reduction of CO ₂
199	Rajendran, A; Endo, M; Hidaka, K; Tran, PLT; Teulade-Fichou, MP; Mergny, JL; Sugiyama, H, 2014, RSC ADVANCES, 4, 10, G-quadruplex-binding ligand-induced DNA synapsis inside a DNA origami frame
200	Kono, Y; Kawakami, S; Higuchi, Y; Yamashita, F; Hashida, M, 2014, BIOLOGICAL & PHARMACEUTICAL BULLETIN, 37, 8, In Vitro Evaluation of Inhibitory Effect of Nuclear

	Factor-KappaB Activity by Small Interfering RNA on Pro-tumor Characteristics of M2-Like Macrophages
201	Ramaswamy, P; Matsuda, R; Kosaka, W; Akiyama, G; Jeon, HJ; Kitagawa, S, 2014, CHEMICAL COMMUNICATIONS, 50, 3, Highly proton conductive nanoporous coordination polymers with sulfonic acid groups on the pore surface
202	Duan, JG; Higuchi, M; Krishna, R; Kiyonaga, T; Tsutsumi, Y; Sato, Y; Kubota, Y; Takata, M; Kitagawa, S, 2014, CHEMICAL SCIENCE, 5, 7, High CO ₂ /N ₂ /O ₂ /CO separation in a chemically robust porous coordination polymer with low binding energy
203	Ohnishi, Y; Huber, W; Tsumura, A; Kang, MJ; Xenopoulos, P; Kurimoto, K; Oles, AK; Arauzo-Bravo, MJ; Saitou, M; Hadjantonakis, AK; Hiiragi, T, 2014, NATURE CELL BIOLOGY, 16, 20, Cell-to-cell expression variability followed by signal reinforcement progressively segregates early mouse lineages
204	Matsubara, Y; Hightower, SE; Chen, JZ; Grills, DC; Polyansky, DE; Muckerman, JT; Tanaka, K; Fujita, E, 2014, CHEMICAL COMMUNICATIONS, 50, 3, Reactivity of a fac-ReCl(alpha-diimine)(CO)(3) complex with an NAD(+) model ligand toward CO ₂ reduction
205	Fujita, K; Hamidian, MH; Edkins, SD; Kim, CK; Kohsaka, Y; Azuma, M; Takano, M; Takagi, H; Eisaki, H; Uchida, S; Allais, A; Lawler, MJ; Kim, EA; Sachdev, S; Davis, JCS, 2014, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA, 111, 7, Direct phase-sensitive identification of a d-form factor density wave in underdoped cuprates
206	Seinberg, L; Yamamoto, S; Tsujimoto, M; Kobayashi, Y; Takano, M; Kageyama, H, 2014, CHEMICAL COMMUNICATIONS, 50, 3, CaH ₂ -assisted low temperature synthesis of metallic magnetic nanoparticle-loaded multiwalled carbon nanotubes
207	Sakamoto, M; Ieki, N; Miyoshi, G; Mochimaru, D; Miyachi, H; Imura, T; Yamaguchi, M; Fishell, G; Mori, K; Kageyama, R; Imayoshi, I, 2014, JOURNAL OF NEUROSCIENCE, 34, 12, Continuous Postnatal Neurogenesis Contributes to Formation of the Olfactory Bulb Neural Circuits and Flexible Olfactory Associative Learning
208	Kimura, T; Kaga, Y; Ohta, H; Odamoto, M; Sekita, Y; Li, KP; Yamano, N; Fujikawa, K; Isotani, A; Sasaki, N; Toyoda, M; Hayashi, K; Okabe, M; Shinohara, T; Saitou, M; Nakano, T, 2014, STEM CELLS, 32, 11, Induction of Primordial Germ Cell-Like Cells From Mouse Embryonic Stem Cells by ERK Signal Inhibition
209	Kitazume, S; Imamaki, R; Kurimoto, A; Ogawa, K; Kato, M; Yamaguchi, Y; Tanaka, K; Ishida, H; Ando, H; Kiso, M; Hashii, N; Kawasaki, N; Taniguchi, N, 2014, JOURNAL OF BIOLOGICAL CHEMISTRY, 289, 10, Interaction of Platelet Endothelial Cell Adhesion Molecule (PECAM) with alpha 2,6-Sialylated Glycan Regulates Its Cell Surface Residency and Anti-apoptotic Role
210	Suzuki, T; Makyio, H; Ando, H; Komura, N; Menjo, M; Yamada, Y; Imamura, A; Ishida, H; Wakatsuki, S; Kato, R; Kiso, M, 2014, BIOORGANIC & MEDICINAL CHEMISTRY, 22, 12, Expanded potential of seleno-carbohydrates as a molecular tool for X-ray structural determination of a carbohydrate-protein complex with single/multi-wavelength anomalous dispersion phasing
211	Suzuki, T; Komura, N; Imamura, A; Ando, H; Ishida, H; Kiso, M, 2014, TETRAHEDRON LETTERS, 55, 4, A facile method for synthesizing selenoglycosides based on selenium-transfer to glycosyl imidate
212	Hara, A; Imamura, A; Ando, H; Ishida, H; Kiso, M, 2014, MOLECULES, 19, 24, A New Chemical Approach to Human ABO Histo-Blood Group Type 2 Antigens
213	Menjo, M; Tamai, H; Ando, H; Ishida, H; Koketsu, M; Kiso, M, 2014, HETEROCYCLES, 88, 8, GLYCOSIDATION REACTIONS OF BENZYL-TYPE SELENOGLYCOSIDE DONORS
214	Hirai, K; Reboul, J; Morone, N; Heuser, JE; Furukawa, S; Kitagawa, S, 2014, JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, 136, 8, Diffusion-Coupled Molecular Assembly: Structuring of Coordination Polymers Across Multiple Length Scales
215	Nakahama, M; Reboul, J; Kamei, KI; Kitagawa, S; Furukawa, S, 2014, CHEMISTRY LETTERS, 43, 3, Fibrous Architectures of Porous Coordination Polymers-Alumina Composites Fabricated by Coordination Replication
216	Patel, S; Jung, D; Yin, PT; Carlton, P; Yamamoto, M; Bando, T; Sugiyama, H; Lee, KB, 2014, ACS NANO, 8, 9, NanoScript: A Nanoparticle-Based Artificial Transcription Factor for Effective Gene Regulation
217	Fukushima, T; Fukuda, R; Kobayashi, K; Caramori, GF; Frenking, G; Ehara, M; Tanaka, K, 2015, CHEMISTRY-A EUROPEAN JOURNAL, 21, 5, Proton-Induced Generation of Remote N-Heterocyclic Carbene-Ru Complexes

218	Nakajima, K; Morita, Y; Kitayama, T; Suzuki, M; Narumi, K; Saitoh, Y; Tsujimoto, M; Isoda, S; Fujii, Y; Kimura, K, 2014, NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION B-BEAM INTERACTIONS WITH MATERIALS AND ATOMS, 332, 5, Sputtering of SiN films by 540 keV C-60(2+) ions observed using high-resolution Rutherford backscattering spectroscopy
219	Matsuda, R; Kosaka, W; Kitaura, R; Kubota, Y; Takata, M; Kitagawa, S, 2014, MICROPOROUS AND MESOPOROUS MATERIALS, 189, 8, Microporous structures having phenylene fin: Significance of substituent groups for rotational linkers in coordination polymers

Editorial Material

220	Minari, J; Teare, H; Mitchell, C; Kaye, J; Kato, K, 2014, GENOME MEDICINE, 6, 3, The emerging need for family-centric initiatives for obtaining consent in personal genome research
221	Nakatsuji, N, 2014, STEM CELLS AND DEVELOPMENT, 23, 2, An Interview with Norio Nakatsuji
222	Zhou, HC; Kitagawa, S, 2014, CHEMICAL SOCIETY REVIEWS, 43, 4, Metal-Organic Frameworks (MOFs)
223	Saitou, M; Kurimoto, K, 2014, DEVELOPMENTAL CELL, 30, 3, Paternal Nucleosomes: Are They Retained in Developmental Promoters or Gene Deserts?
224	Matsuda, R, 2014, NATURE, 509, 2, MATERIALS CHEMISTRY Selectivity from flexibility

Meeting Abstract

225	Ueno, T; Abe, S; Tabe, H, 2014, JOURNAL OF BIOLOGICAL INORGANIC CHEMISTRY, 19, 1, Solid Artificial Metalloenzymes by Post-Engineering of Porous Protein Crystals
226	Hwang, LC; Vecchiarelli, AG; Han, YW; Mizuuchi, M; Harada, Y; Funnell, BE; Mizuuchi, K, 2014, BIOPHYSICAL JOURNAL, 106, 1, Para Protein Pattern Formation Drives Bacterial Plasmid Segregation
227	Iwasa, T; Han, YW; Yokota, H; Yokokawa, R; Ono, T; Hiramatsu, R; Harada, Y, 2014, BIOPHYSICAL JOURNAL, 106, 1, Single-Molecule Visualization of Ruvb Oligomer for Characterizing a AAA(+) Class Hexameric Atpase with Zero-Mode Waveguides
228	Han, YW; Matsumoto, T; Yokota, H; Tsunaka, Y; Kashiwazaki, G; Morinaga, H; Hashiya, K; Bando, T; Sugiyama, H; Harada, Y, 2014, BIOPHYSICAL JOURNAL, 106, 1, Construction and Characterization of Cy3-or Cy5-Conjugated Hairpin Pyrrole/Imidazole Polyamides Binding to DNA in the Nucleosome

Review

229	Ohnishi, K; Semi, K; Yamada, Y, 2014, BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS, 455, 6, Epigenetic regulation leading to induced pluripotency drives cancer development in vivo
230	Imayoshi, T; Kageyama, R, 2014, TRENDS IN NEUROSCIENCES, 37, 8, Oscillatory control of bHLH factors in neural progenitors
231	Isomura, A; Kageyama, R, 2014, DEVELOPMENT, 141, 10, Ultradian oscillations and pulses: coordinating cellular responses and cell fate decisions
232	Kojima, Y; Tam, OH; Tam, PPL, 2014, SEMINARS IN CELL & DEVELOPMENTAL BIOLOGY, 34, 11, Timing of developmental events in the early mouse embryo
233	Harima, Y; Imayoshi, I; Shimojo, H; Kobayashi, T; Kageyama, R, 2014, SEMINARS IN CELL & DEVELOPMENTAL BIOLOGY, 34, 6, The roles and mechanism of ultradian oscillatory expression of the mouse Hes genes
234	Kawakami, S; Hashida, M, 2014, JOURNAL OF CONTROLLED RELEASE, 190, 14, Glycosylation-mediated targeting of carriers
235	Furukawa, S; Reboul, J; Diring, S; Sumida, K; Kitagawa, S, 2014, CHEMICAL SOCIETY REVIEWS, 43, 35, Structuring of metal-organic frameworks at the mesoscopic/macroscopic scale
236	Matsuda, Y; Semi, K; Yamada, Y, 2014, PATHOLOGY INTERNATIONAL, 64, 10, Application of iPSC cell technology to cancer epigenome study: Uncovering the mechanism of cell status conversion for drug resistance in tumor

237	Kusumi, A; Tsunoyama, TA; Hirose, KM; Kasai, RS; Fujiwara, TK, 2014, NATURE CHEMICAL BIOLOGY, 10, 9, Tracking single molecules at work in living cells
238	Unga, J; Hashida, M, 2014, ADVANCED DRUG DELIVERY REVIEWS, 72, 10, Ultrasound induced cancer immunotherapy
239	Endo, M; Sugiyama, H, 2014, ACCOUNTS OF CHEMICAL RESEARCH, 47, 9, Single-Molecule Imaging of Dynamic Motions of Biomolecules in DNA Origami Nanostructures Using High-Speed Atomic Force Microscopy
240	Hayashi, K; Saitou, M, 2014, ANIMAL SCIENCE JOURNAL, 85, 10, Perspectives of germ cell development in vitro in mammals
241	Nakaki, F; Saitou, M, 2014, TRENDS IN BIOCHEMICAL SCIENCES, 39, 10, PRDM14: a unique regulator for pluripotency and epigenetic reprogramming
242	Yoshizawa, G; Ho, CWL; Zhu, W; Hu, CL; Syukriani, Y; Lee, I; Kim, H; Tsai, DFC; Minari, J; Kato, K, 2014, GENOME MEDICINE, 6, 12, ELSI practices in genomic research in East Asia: implications for research collaboration and public participation
243	Imayoshi, I; Kageyama, R, 2014, NEURON, 82, 15, bHLH Factors in Self-Renewal, Multipotency, and Fate Choice of Neural Progenitor Cells
244	Doherty, CM; Buso, D; Hill, AJ; Furukawa, S; Kitagawa, S; Falcaro, P, 2014, ACCOUNTS OF CHEMICAL RESEARCH, 47, 10, Using Functional Nano- and Microparticles for the Preparation of Metal-Organic Framework Composites with Novel Properties
245	Rajendran, A; Endo, M; Sugiyama, H, 2014, CHEMICAL REVIEWS, 114, 28, State-of-the-Art High-Speed Atomic Force Microscopy for Investigation of Single-Molecular Dynamics of Proteins
246	Foo, ML; Matsuda, R; Kitagawa, S, 2014, CHEMISTRY OF MATERIALS, 26, 13, Functional Hybrid Porous Coordination Polymers
247	Li, HL; Nakano, T; Hotta, A, 2014, DEVELOPMENT GROWTH & DIFFERENTIATION, 56, 15, Genetic correction using engineered nucleases for gene therapy applications
248	Harima, Y; Imayoshi, I; Shimojo, H; Kobayashi, T; Kageyama, R, 2014, SEMINARS IN CELL & DEVELOPMENTAL BIOLOGY, 34, 6, The roles and mechanism of ultradian oscillatory expression of the mouse Hes genes
249	Sakamoto, M; Kageyama, R; Imayoshi, I, 2014, FRONTIERS IN NEUROSCIENCE, 8, 9, The functional significance of newly born neurons integrated into olfactory bulb circuits
250	Imayoshi, I; Kageyama, R, 2014, NEURON, 82, 15, bHLH Factors in Self-Renewal, Multipotency, and Fate Choice of Neural Progenitor Cells
251	Kobayashi, T; Kageyama, R, 2014, CURRENT TOPICS IN DEVELOPMENTAL BIOLOGY: BHLH TRANSCRIPTION FACTORS IN DEVELOPMENT AND DISEASE, 110, 21, Expression Dynamics and Functions of Hes Factors in Development and Diseases
252	Kobayashi, T; Kageyama, R, 2014, BHLH TRANSCRIPTION FACTORS IN DEVELOPMENT AND DISEASE, 110, 21, Expression Dynamics and Functions of Hes Factors in Development and Diseases
253	Kuo, CHR; Lang, J; Lang, O; Kohidai, L; Sivaniah, E, 2014, MICROPATTERNING IN CELL BIOLOGY, PT C, 121, 12, The Facile Generation of Two-Dimensional Stiffness Maps in Durotactic Cell Platforms Through Thickness Projections of Three-Dimensional Submerged Topography
254	Hirai, K; Falcaro, P; Kitagawa, S; Furukawa, S, 2014, METAL-ORGANIC FRAMEWORKS FOR PHOTONICS APPLICATIONS, 157, 20, Host-Guest Metal-Organic Frameworks for Photonics
255	Kobayashi, T; Kageyama, R, 2014, BHLH TRANSCRIPTION FACTORS IN DEVELOPMENT AND DISEASE, 110, 21, Expression Dynamics and Functions of Hes Factors in Development and Diseases

B. Invited Lectures, Plenary Addresses (etc.) at International Conferences and International Research Meetings

- List up to 10 main presentations during FY2014 in order from most recent.

- For each, write the lecturer/presenter's name, presentation title, conference name and date(s)

No.	Lecturer/presenter names and details
1	Motonari Uesugi, Small Molecule Tools for Cell Therapy, the 3rd Asian Chemical Biology Conference (December 15-17, 2014)
2	Susumu Kitagawa, Chemistry and Application of Soft Porous Coordination Polymers, 13th Eurasia Conference in Chemical Sciences (EuAsC2S-13) (December 14-18, 2014)
3	Mineko Kengaku, Mechanical Basis of Cell Motility Control in the Developing Brain, 25th 2014 International Symposium on Micro-NanoMechatronics and Human Science (November 9-12, 2014)
4	Ryoichiro Kageyama, Dynamic Control of bHLH Factors in Multipotency and Fate Choice of Neural Stem Cells, 18th International Conference of ISD in conjunction with BSDB (November 2-5, 2014)
5	Yong Chen, High Efficiency Capture of Circulating Cancer Cells, The 4th International Conference on Microfluidic Chip and Micro/NanoScale Bioseparation Analysis (October 30-November 2, 2014)
6	Michinori Saitou, Mechanism and Reconstitution in Vitro of Mammalian Germ Cell Development, FEBS-EMBO 2014 Conference (August 30-September 4, 2014)
7	Akihiro Kusumi, Tracking Single Molecules at Work in the Plasma Membrane of Living Cells, 1st Adriatic Symposium on Biophysical Approaches in Biomedical Studies (August 24-29, 2014)
8	Yoshie Harada, Studies on Biomolecules Using Single-Molecule Imaging Techniques, The 19th Annual Conference of the Biophysical Society of ROC (May8-9, 2014)
9	Kazumitsu Ueda, Monomer-Dimer Conversion of ABCA1 During HDL Formation, Bordeaux-Kyoto Symposium (May 5-6, 2014)
10	Mitsuru Hashida, Pharmaceutical Sciences 2020: Cutting Edge Technologies in Drug Delivery, 5th FIP Pharmaceutical Sciences World Congress (April 13-16, 2014)

C. Major Awards

- List up to 10 main awards received during FY2014 in order from the most recent.
- For each, write the recipient's name, name of award, and year issued.
- In case of multiple recipients, underline those affiliated with the center.

No.	Recipient names and details
1	Hiroshi Imahori, Fellow, Royal Society of Chemistry
2	Motonari Uesugi, Kyoto University President Lifetime Achievement Award
3	Motomu Tanaka, Philipp Franz von Siebold Award
4	Susumu Kitagawa, 2014 Thomson Reuters Highly Cited Researcher
5	Hideki Hirori, The 6th German Innovation Award "Gottfried Wagener Prize 2014"
6	Joun Heuser, E.B. Wilson Medal of the American Society for Cell Biology
7	Koichiro Tanaka, Commendation for Science and Technology Prize (Research Category)
8	<u>Norio Nakatsuji</u> , Kei Kano and Eri Mizumachi, Commendation for Science and Technology Prize (Public Understanding Promotion Category)
9	<u>Kei Kano</u> and Eri Mizumachi, Knowledge Innovation Award 2nd
10	Shuheii Furukawa, ICCC41 Rising Stars Award

FY2014 List of Principal Investigators

NOTE:

- Underline names of principal investigators who belong to an overseas research institution.
- In case of researchers not listed in the latest report, attach "Biographical Sketch of a New Principal Investigator".

<Results at the end of FY2014> Principal Investigators Total: 25									
Name (Age)	Affiliation (Position title, department, organization)	Academic degree, specialty	Working hours (Total working hours: 100%)				Starting date of project participation	Status of project participation (Describe in concrete terms)	Contributions by PIs from overseas research institutions
			Work on center project		Others				
			Research activities	Other activities	Research activities	Other activities			
Center Director Kitagawa, Susumu (63)	Professor, Institute for Integrated Cell-Material Sciences, Kyoto University	Ph.D. Coordination Chemistry	75%	15%		10%	Oct. 1, 2007	Usually stays at the institution.	
Nakatsuji, Norio (65)	Professor, Institute for Integrated Cell-Material Sciences, Kyoto University	Ph.D. Stem Cell Biology	40%	50%	5%	5%	Oct. 1, 2007	Usually stays at the institution.	
Uesugi Motonari (48)	Professor, Institute for Integrated Cell-Material Sciences, Kyoto University	Ph.D. Chemical Biology	80%	10%		10%	Oct. 1, 2007	Usually stays at the institution.	
Kageyama, Ryoichiro (58)	Professor, Institute for Virus Research, Kyoto University	M.D. Ph.D. Developmental Biology	15%	10%	65%	10%	Feb. 2, 2013	Participates at the 25% effort level. 75% devoted to the Institute for Virus Research.	
Ueda, Kazumitsu (61)	Professor, Institute for Integrated Cell-Material Sciences, Kyoto University	Ph.D. Cellular Bio- chemistry	80%	10%		10%	Oct. 1, 2007	Usually stays at the institution.	
<u>Chen, Yong</u> (58)	Professor, Institute for Integrated Cell-Material Sciences, Kyoto University Research Director, Ecole	Ph.D. Nanobiotech- nology	30%	10%	50%	10%	Mar. 1, 2008	Participates in the institution at the 40% effort level. (Frequency of visits to Japan: 6 times and 54 days in FY2014)	

	Normale Supérieure, CNRS								
Hashida, Mitsuru (63)	Professor, Graduate School of Pharmaceutical Sciences, Kyoto University	Ph.D. Drug Delivery Systems	40%	10%	40%	10%	Jan. 1, 2008	Participates at the 50% effort level. 50% devoted to the Graduate School of Pharmaceutical Sciences.	
Imahori, Hiroshi (53)	Professor, Institute for Integrated Cell-Material Sciences, Kyoto University	Ph.D. Organic Chemistry	80%	10%		10%	Oct. 1, 2007	Usually stays at the institution.	
Kengaku, Mineko (48)	Professor, Institute for Integrated Cell-Material Sciences, Kyoto University	Ph.D. Developmental Neurobiology	90%	10%			Oct. 1, 2008	Usually stays at the institution.	
Kiso, Makoto (67)	Professor, Faculty of Applied Biological Sciences, Gifu University	Ph.D. Glycotechnology	80%	10%		10%	Oct. 1, 2007	Joins a video conference from Gifu University once a month. Usually stays at Gifu University satellite.	
Saitou, Mitinori (44)	Professor, Graduate School of Medicine, Kyoto University	M.D. Ph.D. Germ Cell Biology	15%	5%	70%	10%	Jan. 16, 2013	Participates at the 20% effort level. 80% devoted to the Graduate School of Medicine.	
Sugiyama, Hiroshi (58)	Professor, Graduate School of Science, Kyoto University	Ph.D. Chemical Biology	15%	5%	70%	10%	Apr. 1, 2008	Participates at the 20% effort level. 80% devoted to the Graduate School of Science.	
Tanaka, Motomu (44)	Professor, Institute for Integrated Cell-Material Sciences, Kyoto University	M.D. Ph.D. Biological Physics	40%		50%	10%	Apr. 1, 2013	Participates at the 40% effort level. (Frequency of visits to Japan: 11 times and 171 days in FY2014)	

Harada, Yoshie (55)	Professor, Institute for Integrated Cell-Material Sciences, Kyoto University	Ph.D. Single- Molecule Physiology	90%	10%			Mar. 1, 2008	Usually stays at the institution.
<u>Heuser, John</u> (72)	Professor, Institute for Integrated Cell-Material Sciences, Kyoto University Professor, Washington University School of Medicine	M.D. Biophysics	50%		40%	10%	Nov. 16, 2009	Participates in the institution at the 50% effort level. (Frequency of visits to Japan: 5 times and 168 days in FY2014)
Kusumi, Akihiro (62)	Professor, Institute for Integrated Cell-Material Sciences, Kyoto University	Ph.D. Single-Molecul e Cell Biophysics	80%	10%		10%	Oct. 1, 2007	Usually stays at the institution.
Tanaka, Koichiro (52)	Professor, Graduate School of Science, Kyoto University	Ph.D. Terahertz Optical Science	15%	5%	70%	10%	Apr. 1, 2008	Participates at the 20% effort level. 80% devoted to the Graduate School of Science.
<u>Yamanaka, Shinya</u> (52)	Professor, iPS Cell Research and Application (CiRA), Kyoto University Senior Investigator, Gradstone Institutes	M.D. Stem Cell Biology	4%	1%	75%	20%	Oct. 1, 2007	Participates at the 5% effort level. 95% devoted to the CiRA.
Kato, Kazuto* (54)	Professor, Graduate School of Medicine, Osaka University)	Ph.D., Bioethics, Science Communicatio n	4%	1%	50%	45%	Nov. 1, 2008	Usually attend meetings at the center once or twice in a month, and/or give supervision to the group members through video conference from the main affiliation (Osaka University) once or twice a month.
Carlton, Peter* (41)	Program-Specific Research Center Associate Professor, Institute for Integrated Cell-Material Sciences, Kyoto University	Ph. D. Molecular and Cell Biology	90%	10%			Mar. 1, 2010	Usually stays at the institution.

Murakami, Tatsuya (45)	Program-Specific Research Center Associate Professor, Institute for Integrated Cell-Material Sciences, Kyoto University	Ph.D. (Eng.), Nanobio-science	90%	10%			Jan. 1, 2009	Usually stays at the institution.
Sivaniah, Easan (43)	Associate Professor, Institute for Integrated Cell-Material Sciences, Kyoto University	Ph. D. Physics	90%	10%			July 1, 2013	Usually stays at the institution.
Suzuki, Kenichi (46)	Program-Specific Research Center Associate Professor, Institute for Integrated Cell-Material Sciences, Kyoto University	Doctor of Engineering, Cell Biophysics	75%	5%	15%	5%	Apr 17, 2011	Stays at National Centre for Biological Sciences(NCBS) / Institute for Stem Cell Biology and Regenerative Medicine (inStem) satellite 5-6 times a year, and at center during other periods
Kim, Franklin (37)	iCeMS Kyoto Fellow, Institute for Integrated Cell-Material Sciences, Kyoto University	Ph.D. Chemistry	90%	10%			Dec. 16, 2010	Usually stays at the institution.
Wang, Dan Ohtan (39)	iCeMS Kyoto Fellow, Institute for Integrated Cell-Material Sciences, Kyoto University	Ph.D. Neuroscience	90%	10%			May 1, 2011	Usually stays at the institution.

Biographical Sketch of a New Principal Investigator

Name (Age)	Kazuto Kato (54)
Affiliation (Position title, department, organization)	Project Professor, iCeMS, Kyoto University (Professor, Graduate School of Medicine, Osaka University)
Academic degree, specialty	Ph.D., Bioethics, Biomedical Ethics, Science Communication
<p>Research and education history</p> <p>November 1993, Researcher, JTBiohistory Research Hall (October 1998, Senior researcher) October 2001, Associate Professor, Institute for Research in Humanities, Kyoto University April 2004, Adjunct Associate Professor, Graduate School of Biostudies, Kyoto University November 2008, Adjunct Associate Professor, iCeMS, Kyoto University April 2012, Professor, Graduate School of Medicine, Osaka University April 2012, Project Professor, iCeMS, Kyoto University</p>	
<p>Achievements and highlights of past research activities <i>(Describe qualifications as a top-caliber researcher if he/she is considered to be ranked among the world's top researchers.)</i></p> <p>Professor Kato started to work on science communication after conducting research on molecular developmental biology in Kyoto University, Japan (supervisors: Tokindo Okada, Masatoshi Takeichi and Hisato Kondo) and University of Cambridge, UK (Sir John Gurdon). In 1990s the importance of the field of science communication was not recognized in Japan, therefore Dr. Kato became a pioneer in the field and played a key role to expand the field. After moving to Kyoto University in 2001, he started to work on ethics and policy of life sciences in addition to science communication. He contributed to the large international human genome research projects such as International HapMap Project and International Cancer Genome Consortium as an expert on ethics. He is internationally known as one of the top experts who have strong background of science and work on ethical and social aspects of life sciences, particularly in human genome research and stem cell research.</p>	
<p>Achievements</p> <p>(1) International influence <i>a) Guest speaker, chair, director, or honorary member of a major international academic society in the subject field, b) Holder of a prestigious lectureship, c) Member of a scholarly academy in a major country, d) Recipient of an international award(s), e) Editor of an influential journal etc.</i></p> <p>In addition to the role Professor Kato played in the international human genome research projects, he has been invited to serve as a member of the new international organization for genomic and health data sharing: the Global Alliance for Genomics and Health (GA4GH). Currently he is only one member from Asia. He also serves as a member of the ethics and policy committee of the leading academic society on stem cell research, the International Society for Stem Cell Research (ISSCR). In 2009, he was invited to be a guest speaker and panelist in the ethics session of the prestigious meeting, "the Biology of Genome," organized at the Cold Spring Harbor Laboratory.</p>	
<p>(2) Receipt of large-scale competitive fundings <i>(over past 5 years)</i></p> <p>Research on ethical, legal and social implications of genome research by Professor Kato's group has been supported by the Grant in Aid for Scientific Research on Innovative Areas "Genome Science" from Ministry of Education, Culture, Sports, Science and Technology of Japan. The leader of the project is Professor Yuji Kohara of the National Institute of Genetics, and as one of the main PI for the project, Professor Kato has been receiving about 30 million yen/year since 2010 (up to 2015).</p>	
<p>(3) Article citations <i>(Titles of major publications, and number of citations.)</i></p> <p>Kato, K. and Gurdon, J.B. <i>Proc. Natl. Acad. Sci. USA</i>, 90, 1310-1314, 1993. (65) Gurdon, J.B., Lemaire, P., and Kato, K. <i>Cell</i>, 75, 831-834, 1993. (177) The International HapMap Consortium (incl. Kato, K.), <i>Nature</i>, 437, 1299 -1320, 2005. (3298) International Cancer Genome Consortium (including Kato, K.), <i>Nature</i>, vol.464, pp.993-998, 2010. (632) Zarzeczny A, Scott C, Hyun I, et al. (including Kato, K.) <i>Cell</i>, 139, 1032-1037, 2009. (38)</p>	
<p>(4) Others <i>(Other achievements that indicate qualification as a top-caliber researcher, if any.)</i></p>	

Biographical Sketch of a New Principal Investigator

Name (Age)	Peter Carlton (41)
Affiliation (Position title, department, organization)	Associate Professor, iCeMS, Kyoto University
Academic degree, specialty	Ph.D., Molecular and Cell Biology
<p>Research and education history</p> <p>1991-1995 Bachelor of Science Degree, University of Southern California, USA</p> <p>1995-2001 Doctoral Degree, University of California, Berkeley, USA</p> <p>2001-2005 Postdoctoral Fellow, Lawrence Berkeley National Laboratory, Berkeley, USA</p> <p>2005-2010 Associate Specialist, University of California, San Francisco, USA</p> <p>2010-2014 Program-specific research center assistant professor, iCeMS, Kyoto University</p> <p>2014-present Program-specific associate professor, iCeMS, Kyoto University</p>	
<p>Achievements and highlights of past research activities <i>(Describe qualifications as a top-caliber researcher if he/she is considered to be ranked among the world's top researchers.)</i></p> <p>— among the first researchers to apply superresolution microscopy to biological problems</p> <p>— elucidated the roles of the conserved protein phosphatase PP4 in meiosis, and showed its requirement increases with advancing maternal age</p>	
<p>Achievements</p> <hr/> <p>(1) International influence <i>a) Guest speaker, chair, director, or honorary member of a major international academic society in the subject field, b) Holder of a prestigious lectureship, c) Member of a scholarly academy in a major country, d) Recipient of an international award(s), e) Editor of an influential journal etc.</i></p> <hr/> <p>(2) Receipt of large-scale competitive fundings <i>(over past 5 years)</i></p> <p>Inamori Foundation Grant (2012)</p> <p>Sumitomo Foundation Grant (2011)</p> <p>JST CREST fund "Development of Fundamental Technologies for Diagnosis and Therapy Based upon Epigenome Analysis", 2011-2016 (Collaborator)</p> <p>JSPS Kakenhi Fund "Wakate A", 2012-2013</p> <p>JSPS Kakenhi Fund "Kiban B", 2015-2017</p> <p>JSPS Kakenhi Fund "Houga", 2015-2016</p>	

(3) Article citations (*Titles of major publications, and number of citations.*)

Subdiffraction multicolor imaging of the nuclear periphery with 3D structured illumination microscopy *Science* 320 (5881), 2008 **522 citations**

Three-dimensional resolution doubling in wide-field fluorescence microscopy by structured illumination *Biophysical journal* 94 (12), 2008 **398 citations**

HIM-8 binds to the X chromosome pairing center and mediates chromosome-specific meiotic synapsis *Cell* 123 (6), 2005 **124 citations**

Cytoskeletal forces span the nuclear envelope to coordinate meiotic chromosome pairing and synapsis *Cell* 139 (5), 2009 **104 citations**

Sequence-dependent sorting of recycling proteins by actin-stabilized endosomal microdomains *Cell* 143 (5), 2010 **102 citations**

N-terminal processing of proteins exported by malaria parasites *Molecular and biochemical parasitology* 160 (2), 2008 **97 citations**

A presynaptic giant ankyrin stabilizes the NMJ through regulation of presynaptic microtubules and transsynaptic cell adhesion *Neuron* 58 (2), 2008 **71 citations**

Fast live simultaneous multiwavelength four-dimensional optical microscopy *Proceedings of the National Academy of Sciences* 107 (37), 2010 **57 citations**

Polarity reveals intrinsic cell chirality *Proceedings of the National Academy of Sciences* 104 (22), 2007 **57 citations**

(4) Others (*Other achievements that indicate qualification as a top-caliber researcher, if any.*)

Biographical Sketch of a New Principal Investigator

Name (Age)	Tatsuya Murakami (45)
Affiliation (Position title, department, organization)	Associate Professor, iCeMS, Kyoto University
Academic degree, specialty	Ph.D., Nanobioscience
<p>Research and education history</p> <p>1989.04–1993.03 Undergraduate, Department of Applied Chemistry, Faculty of Engineering, Osaka University</p> <p>1993.04–1995.03 Graduate student, Department of Molecular Engineering, Graduate School of Engineering, Kyoto University</p> <p>1995.04–1998.03 Ph.D. student, Department of Molecular Engineering, Graduate School of Engineering, Kyoto University</p> <p>1998.04–2003.03 Researcher, Kyowa Hakko Kogyo Co., Ltd.</p> <p>2003.04–2005.05 Postdoc, JST-SORST (Iijima team)</p> <p>2005.06–2008.12 Assistant Professor, Institute for Comprehensive Medical Science, Fujita-Health University</p> <p>2007.10–2011.03 Researcher, JST-PRESTO (holding two posts concurrently)</p> <p>2009.01–2009.03 Assistant Professor, Imahori Group, WPI-iCeMS, Kyoto University</p> <p>2009.04–2013.09 iCeMS Kyoto Fellow/Independent Assistant Professor, WPI-iCeMS, Kyoto University</p> <p>2013.10–Present Associate Professor, WPI-iCeMS, Kyoto University</p>	
<p>Achievements and highlights of past research activities</p> <p>2009.01–present</p> <p>6 original papers, 1 review on drug delivery systems with genetically and chemically engineered natural nanomaterials</p> <p>7 original papers on drug delivery systems and cell engineering with external stimuli-responsive nanomaterials</p> <p>9 original papers based on collaborations with researchers outside Kyoto University</p> <p>2 original papers in preparation based on collaboration with Prof. Jean-Christophe Leroux at ETH Zürich</p> <p>2 patents for engineered natural nanomaterials (preclinical test in progress under collaboration with Prof. Nagahisa Yoshimura, an ophthalmologist at Kyoto University on the basis of one of them)</p> <p>First development and in vitro/in vivo analyses of genetically engineered high-density lipoprotein for drug delivery systems</p> <p>Discovery of a novel near-infrared photoresponsiveness of single-walled carbon nanotubes and press release on it (19/19/2012)</p> <p>Publication in a newspaper (Nikkan Kogyo Shinbun) on a collaborative research achievement with Tohoku University (12/09/2012)</p> <p>Publication in a newspaper (Nikkan Kogyo Shinbun) on the contents of a patent submitted from Kyoto University (23/06/2009)</p>	

Achievements

(1) International influence

5 Guest speakers

(2) Receipt of large-scale competitive fundings (*over past 5 years*)

2007.12–2011.03 JST-PRESTO

(3) Article citations (*Titles of major publications, and number of citations.*)

Numata, T.[†]; Murakami, T.[†]; Kawashima, F.; Morone, N.; Heuser, J. E.; Takano, Y.; Ohkubo, K.; Fukuzumi, S.; Mori, Y.*; Imahori, H.* , Utilization of photoinduced charge-separated state of donor-acceptor-linked molecules for regulation of cell membrane potential and ion transport. *J. Am. Chem. Soc.* **134**, 6092–6095 (2012). [†]These authors contributed equally.

8 citations

Murakami, T.*; Nakatsuji, H.; Inada, M.; Matoba, Y.; Umeyama, T.; Tsujimoto, M.; Isoda, S.; Hashida, M.; Imahori, H.* , Photodynamic and photothermal effects of semiconducting and metallic-enriched single-walled carbon nanotubes. *J. Am. Chem. Soc.* **134**, 17862–17865 (2012).

20 citations

Zhang, M.*; Murakami, T.; Ajima, K.; Tsuchida, K.; Sandanayaka, A. S. D.; Ito, O.; Iijima, S.; Yudasaka, M.* , Fabrication of ZnPc/protein nanohorns for double photodynamic and hyperthermic cancer phototherapy. *Proc. Natl. Acad. Sci. U.S.A.* **105**, 14773–14778 (2008).

120 citations

Ajima, K.*; Yudasaka, M.*; Murakami, T.; Maigné, A.; Shiba, K.; Iijima, S.* , Carbon nanohorns as anticancer drug carriers. *Mol. Pharmaceutics* **2**, 475–480 (2005).

205 citations

Murakami, T.; Ajima, K.; Miyawaki, J.; Yudasaka, M.; Iijima, S.; Shiba, K.* , Drug-loaded carbon nanohorns: adsorption and release of dexamethasone in vitro. *Mol. Pharmaceutics* **1**, 399–405 (2004).

176 citations

(4) Others (*Other achievements that indicate qualification as a top-caliber researcher, if any.*)

2nd(2014) Kyoto SMI Nakatsuji Award

Biographical Sketch of a New Principal Investigator

Name (Age)	Easan Sivaniah (43)																
Affiliation (Position title, department, organization)	Associate Professor, iCeMS, Kyoto University																
Academic degree, specialty	Ph.D., Polymer Physics, Chemical Engineering.																
<p>Research and education history</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 15%;">2013-present</td> <td>Associate Professor, Kyoto University</td> </tr> <tr> <td>2008-2013</td> <td>Research Group Leader, Cambridge University</td> </tr> <tr> <td>2006-2008</td> <td>Lecturer, Leeds University</td> </tr> <tr> <td>2004-2006</td> <td>Asst. Professor, Texas University</td> </tr> <tr> <td>1999-2004</td> <td>JSPS Research Fellow, Kyoto University</td> </tr> <tr> <td>1997-1999</td> <td>PDRA, UC Santa Barbara</td> </tr> <tr> <td>1993-1997</td> <td>PhD, Cambridge University</td> </tr> <tr> <td>1989-1993</td> <td>MEng, Chemical Engineering, Imperial College</td> </tr> </table>		2013-present	Associate Professor, Kyoto University	2008-2013	Research Group Leader, Cambridge University	2006-2008	Lecturer, Leeds University	2004-2006	Asst. Professor, Texas University	1999-2004	JSPS Research Fellow, Kyoto University	1997-1999	PDRA, UC Santa Barbara	1993-1997	PhD, Cambridge University	1989-1993	MEng, Chemical Engineering, Imperial College
2013-present	Associate Professor, Kyoto University																
2008-2013	Research Group Leader, Cambridge University																
2006-2008	Lecturer, Leeds University																
2004-2006	Asst. Professor, Texas University																
1999-2004	JSPS Research Fellow, Kyoto University																
1997-1999	PDRA, UC Santa Barbara																
1993-1997	PhD, Cambridge University																
1989-1993	MEng, Chemical Engineering, Imperial College																
<p>Achievements and highlights of past research activities <i>(Describe qualifications as a top-caliber researcher if he/she is considered to be ranked among the world's top researchers.)</i></p> <p>The Sivaniah group manipulates materials with synthetic and biological approaches whilst seeking to establish a viable interface between the two.</p> <p>In recent years we have delivered notable biomaterials research papers on intelligent scaffolds to interrogate the factors that influence cell migration. One example is well-defined scaffolds to determine the role of 3-D architectures on cell migration (<i>Biomaterials</i> 2010). Another example is the controlled generation of spatially variant stiffness in 2D gels to interrogate cell mechanotaxis (<i>Advanced Materials</i>, 2012). Moreover our group studies the generation of bioplastics using bacterial and enzymatic tools (<i>Advanced Materials</i> 2013). Through such works, we will channel our experiences to develop practical principles that can support our vision of a grand challenge of generating industrially relevant processes via bionanotechnology.</p> <p>Although soft-matter bionanotechnology forms one key part of our research, our approach is to mix both synthetic and biosynthetic methods of materials development (with a current primary focus in achieving energy efficiency and environmental targets in separation technology). Examples include the report of a transformative platform technology for generating nanoporous materials (<i>Nature Materials</i> 2012) and high performance microporous membranes for the separation of important environmental gases (<i>Nature Comms</i> 2013, <i>Nature Comms</i>. 2014).</p>																	
<p>Achievements</p> <p>(1) International influence <i>a) Guest speaker, chair, director, or honorary member of a major international academic society in the subject field, b) Holder of a prestigious lectureship, c) Member of a scholarly academy in a major country, d) Recipient of an international award(s), e) Editor of an influential journal etc.</i></p>																	
<p>(2) Receipt of large-scale competitive fundings <i>(over past 5 years)</i></p> <p style="margin-left: 20px;">JST Sakigake 'Presto' grant</p> <p style="margin-left: 20px;">Title : The virtual surface - the use of internal structure to alter external material properties.</p> <p style="margin-left: 20px;">Period : 2014.12.0-2018.3.31</p> <p style="margin-left: 20px;">Funding Amount : JPY40,000,000</p>																	

JST START

Title: Practical development of low fouling, high flux and rejection liquid separation membranes using a novel Collective Osmotic Shock technique.

Period : 2014.11.20-2017.3.31

Funding Amount : JPY135,962,000

Eneos Foundation Grant

Title : Creation of composite polymer-Metal Organic Frameworks for gas separation membranes.

Period : 2014.10.1-2015.9.30

funding amount:JPY7,000,000

(3) Article citations (*Titles of major publications, and number of citations.*)

Impact Factor >10 articles listed for last 3 years

- Song, Q., Cao, S., Pritchard R., Terentjev, E., Al-Muhtaseb S.A., Cheetham A.K., **Sivaniah E.***. Controlled thermal oxidative crosslinking of polymers of intrinsic microporosity for tunable molecular sieve membranes, *Nature Communications*. 5, Article number: 4813 (2014): Citations :- 0
- Song, Q., Cao, C., Lu, L., Zavala-Rivera, P., Li, W., Shuai, Z., Cheetham A.K., Al-Muhtaseb S.A., Sivaniah E.*. Photo-oxidative enhancement of polymeric molecular sieve membranes. *Nature Communications*. 4, Article number: 1918 (2013). Citations :- 5
- Sangiambut, S, Channon, K., Thomson, N., Sato, S., Tsuge, T., Doi, Y., **Sivaniah, E.*** 'A robust route to enzymatically functional, hierarchically self-assembled peptide frameworks' *Advanced Materials*. 25, 2661-2665 (2013). Citations :- 2
- Kuo C.R.K, Xian, J., Brenton J.D., Franze, K., **Sivaniah, E.*** . Complex stiffness gradient substrates for studying mechanotactic cell migration. *Advanced Materials*. 24, p. 6059 (2012). Citations :- 14
- Song, Q., Nataraj, S.K., Roussenova, M.V., Tan, J.C., Hughes, D.J., Li, W., Bourgoin, P., Alam, A., Cheetham A.K., Al-Muhtaseb S.A., Sivaniah E.*. 'Zeolitic imidazolate framework (ZIF-8) based polymer nanocomposite membranes for gas separation.' *Energy and Environmental Science* 5, p.8359 (2012). Citations :-71
- P. Zavala-Rivera, K. Channon, V. Nyugen, Nataraj S.K., Kabra D., Friend R.H. and Al-Muhtaseb S.A., Hexemer, A., Calvo, M.E., Miguez, M., Sivaniah, E.*, 'Collective osmotic shock in ordered materials', *Nature Materials* 11, p.53 (2012). Citations :- 28

(4) Others (*Other achievements that indicate qualification as a top-caliber researcher, if any.*)

15th International PI to be awarded JST Sakigake in its 3 decade history.

2nd International PI to be awarded JST START program award.

1st International PI to be awarded the Eneos Foundation Grant in 9-year history

Biographical Sketch of a New Principal Investigator

Name (Age)	Kenichi Suzuki (46)
Affiliation (Position title, department, organization)	Associate Professor, iCeMS, Kyoto University,
Academic degree, specialty	Ph.D., Cell Biophysics
<p>Research and education history</p> <p>Apr. 1987 – Mar. 1991: Department of Polymer Chemistry, School of Engineering, Kyoto University, <i>Bachelor of Engineering</i>, Mar., 1991</p> <p>Apr. 1991 – Mar. 1993: Department of Polymer Chemistry, Graduate School of Engineering, Kyoto University, <i>Master of Engineering</i>, Mar., 1993</p> <p>Apr. 1993 – Nov. 1996: Department of Synthetic and Biological Chemistry, Graduate School of Engineering, Kyoto University, <i>Doctor of Engineering</i>, Jan., 1997</p> <p>Nov. 1996 – Jan. 1999: Duke University Medical Center, Department of Cell Biology Research Associate in Michael P. Sheetz Laboratory</p> <p>Feb. 1999 – Sep. 2003: Researcher in ERATO Kusumi Membrane Organizer Project</p> <p>Oct. 2003 – Mar. 2005: Researcher in SORST Kusumi Team</p> <p>Apr. 2005 – Sep. 2007: Research Assistant Professor, Kyoto University, Institute for Frontier Medical Sciences</p> <p>Oct. 2007 – Feb. 2010: Research Assistant Professor, Kyoto University, Institute for Integrated Cell-Material Sciences</p> <p>Oct. 2008 – Mar. 2012: JST, PRESTO Researcher</p> <p>Mar. 2010 – Apr. 2011: Research Senior Lecturer, Kyoto University, Institute for Integrated Cell-Material Sciences</p> <p>Apr. 2011 – Present: Associate Professor, Kyoto University, Institute for Integrated Cell-Material Sciences</p> <p>Apr. 2011 – Present: Visiting Associate Professor, National Centre for Biological Sciences (NCBS)/Institute for Stem Cell Biology and Regenerative Medicine (inStem)</p>	
<p>Achievements and highlights of past research activities <i>(Describe qualifications as a top-caliber researcher if he/she is considered to be ranked among the world's top researchers.)</i></p> <p>We succeeded to simultaneously observe two different kinds of single molecules in living cell plasma membranes for the first time ever (back-to-back two companion papers in Suzuki et al., <i>J. Cell Biol.</i>, 2007). This achievement allowed us to examine molecular motions and interactions which transiently and/or rarely occur in plasma membranes. More recently, we largely improved the microscopy system and the methods of fluorescent labeling of proteins and lipids. We aim to elucidate membrane domain structures and basic principles of signal transduction in plasma membranes.</p> <p><u>Unraveling of raft structure in the steady-state cell plasma membranes</u></p> <p>Lipid rafts have been drawing extensive attention as a signaling platform in cell plasma membranes, but their structures and functions have been enigma for these 20 years. We solved this issue by performing simultaneous two-color single-molecule tracking of a representative raft molecule, glycosylphosphatidylinositol (GPI)-anchored protein (Tanaka and Suzuki et al., <i>Nature Methods</i>, 2010; Suzuki et al., <i>Nature Chem. Biol.</i>, 2012). We found that GPI-anchored proteins formed homodimers and homooligomers with short lifetimes (100~200 ms) in the steady-state cell plasma membranes, and protein-protein interactions are essential to the formation of these homodimers which are then stabilized by raft-lipid interactions. Furthermore, we found that raft size is less than several nanometers in the steady-state cell membranes, and contradicted the prevailing notion that large and stable rafts exist before stimulation.</p>	

Elucidation of mechanisms of signal transduction of GPI-anchored proteins in lipid rafts

We found that transient homodimers of GPI-anchored proteins are essential to the efficient formation of stabilized rafts upon stimulation (Suzuki et al., *Nature Chem. Biol.*, 2012). The stabilized rafts further recruit transmembrane proteins by specific protein interactions, which induces recruitment of downstream signaling molecules such as G α 2 and Lyn by both protein interactions and raft-lipid interactions. We further found that the signaling cluster rafts transiently bound to cytoskeletal actin filaments, which induced phosphorylation of a scaffold protein, recruitment of PLC γ and eventually led to intracellular calcium response. We proposed a new concept of signaling platform on membrane cytoskeletal proteins (back-to-back companion papers in Suzuki et al., *J. Cell Biol.*, 2007).

Achievements

(1) International influence *a) Guest speaker, chair, director, or honorary member of a major international academic society in the subject field, b) Holder of a prestigious lectureship, c) Member of a scholarly academy in a major country, d) Recipient of an international award(s), e) Editor of an influential journal etc.*

Invited Talks

1. Gordon Research Conference on Glycolipid & Sphingolipid Biology, Ventura, USA (2014, Jan)
2. The 5th Leukocyte Signal Transduction Workshop, Crete, Greece (2009, Jun)
3. Frontier in Microscopy II. Imaging from single molecule to whole organisms and its application, Bar Harbor, USA (2007, Jun)
4. Gordon Research Conference on Glycolipid & Sphingolipid Biology, Spring-8, Japan (2004, Jul)
5. The 42nd Annual Meeting of American Society for Cell Biology, Washington D.C. USA (2002, Dec)

(2) Receipt of large-scale competitive fundings *(over past 5 years)*

1. JSPS, Scientific Research B (general), 2015, Apr. – 2018, Mar.
2. JSPS, Scientific Research B (general), 2012, Apr. – 2015, Mar.
3. JST, PRESTO, 2008, Oct. – 2012, Mar.

(3) Article citations *(Titles of major publications, and number of citations.)*

Total citation: 2299 times (ISI Thomson Reuter Web of Science)

1. Suzuki K. G. N. et al. Transient GPI-anchored protein homodimers are units for raft organization and function. *Nature Chem. Biol.*, 8, 774-783 (2012) 42 times
2. Tanaka, K. A. K.*, Suzuki, K. G. N.* et al. (*equal), Membrane molecules mobile even after chemical fixation. *Nature Methods*, 7, 865-866 (2010) 51 times
3. Suzuki, K. G. N. et al., GPI-anchored receptor clusters transiently recruit Lyn and G alpha for temporary cluster immobilization and Lyn activation: single molecule tracking study 1. *J. Cell Biol.*, 177, 717-730 (2007) 174 times
4. Suzuki, K. G. N. et al., Dynamic recruitment of phospholipase C gamma at transiently immobilized GPI-anchored receptor clusters induces IP₃-Ca²⁺ signaling: single molecule study 2. *J. Cell Biol.*, 177, 731-742 (2007) 113 times
5. Suzuki, K. et al., Rapid hop diffusion of a G-protein-coupled receptor in the plasma membrane as revealed by single-molecule techniques. *Biophys. J.*, 88, 3659-3680 (2005) 130 times
6. Kusumi, A., and Suzuki, K. Toward undergoing the dynamics of membrane-raft based molecular interactions. *Biochim. Biophys. Acta* 1746, 234-251 (2005) 136 times
7. Kusumi, A., Koyama, I. and Suzuki, K. Molecular dynamics and interactions for creation of stimulation-induced stabilized rafts from small unstable steady-state rafts. *Traffic* 5, 213-230 (2004) 254 times

(4) Others *(Other achievements that indicate qualification as a top-caliber researcher, if any.)*

Biographical Sketch of a New Principal Investigator

Name (Age)	Franklin Jongmyung Kim (37)
Affiliation (Position title, department, organization)	Assistant Professor, iCeMS, Kyoto University
Academic degree, specialty	Ph.D., Chemistry
<p>Research and education history</p> <p>2011 ~ Kyoto University, Institute for Integrated Cell-Material Sciences (iCeMS) iCeMS Kyoto Fellow / Independent assistant professor Assembly of nanomaterials into functional three-dimensional architectures</p> <p>2007 ~ 2010 Northwestern University, Dept. of Materials Science and Engineering Postdoctoral research with Prof. Jiaying Huang Chemical synthesis and assembly of graphene-based materials</p> <p>2005 ~ 2007 UC Berkeley, Dept. of Bioengineering Postdoctoral research with Prof. Luke P. Lee Integration of metal nanostructures in optical biosensors and drug delivery vessels</p> <p>1999 ~ 2005 UC Berkeley, Dept. of Chemistry Ph. D. research with Prof. Peidong Yang Shape-controlled synthesis and assembly of metal nanoparticles</p>	
<p>Achievements and highlights of past research activities <i>(Describe qualifications as a top-caliber researcher if he/she is considered to be ranked among the world's top researchers.)</i></p> <p>1. Developing new methods for shape controlled synthesis of metal nanoparticles</p> <p>The material properties of nanoparticles are highly sensitive to its morphology. Therefore, precise control of the size and shape of the nanoparticles is an important issue. This has been achieved by methods such as selection of appropriate surface passivating agents and overgrowth on seed particles. Several highly cited reports in this direction include <i>Angew. Chem., Int. Ed.</i> 2004 (citation 671) and <i>J. Am. Chem. Soc.</i> 2002 (citation 728).</p> <p>2. Assembly of nanomaterial at liquid-liquid and air-liquid interfaces</p> <p>When a large number of nanomaterials are put together, its overall material properties are not only influenced by the properties of the individual building blocks but also by the structure of the assembly. Kim utilized Langmuir-Blodgett technique to investigate the two-dimensional self-assembly of nanoparticles on liquid surfaces. This lead to highly cited reports such as <i>J. Am. Chem. Soc.</i> 2001. (citation 411), <i>Nano Lett.</i> 2003 (citation 784), and <i>J. Am. Chem. Soc.</i> 2009. (citation 535). Such research has recently evolved into construction of three-dimensional macroscopic structures, as demonstrated in <i>ACS Nano</i> 2012 and <i>Nat. Commun.</i> 2014.</p>	

Achievements

(1) International influence *a) Guest speaker, chair, director, or honorary member of a major international academic society in the subject field, b) Holder of a prestigious lectureship, c) Member of a scholarly academy in a major country, d) Recipient of an international award(s), e) Editor of an influential journal etc.*

(2) Receipt of large-scale competitive fundings *(over past 5 years)*

2012~2013 Grants-in-Aid for Young Scientists (A) (PI)

Project title: ラングミュア-プロジェクト法を用いたDNA折り紙二次元集積体の構築
(Langmuir-Blodgett assembly of DNA origami into two-dimensional structures)

2013~2017 Specially promoted research (co-investigator)

Principle Investigator: Prof. Susumu Kitagawa (iCeMS)

Project title: Chemistry of Hierarchical Coordination Space

(3) Article citations *(Titles of major publications, and number of citations.)*

"Diffusion driven layer-by-layer assembly of graphene oxide nanosheets into porous three-dimensional macrostructures", J. Zou, F. Kim, Nature Communications, 2014, DOI: 10.1038/ncomms6254. (citation: 0)

"Self-assembly of two-dimensional nanosheets induced by interfacial polyionic complexation", J. Zou, F. Kim, ACS Nano 2012, 6, 10606. (citation: 8)

"Energetic graphene oxide: challenges and opportunities", D. Krishnan, F. Kim, J. Luo, R. Cruz-Silva, L. J. Cote, H. D. Jang, J. Huang, Nano Today 2012, 7, 137. (citation 47)

"Surfactant-free water-processable photoconductive all-carbon composite", V. C. Tung, J.-H. Huang, I. Tevis, F. Kim, J. Kim, C.-W. Chu, S. I. Stupp, J. Huang, J. Am. Chem. Soc. 2011, 133, 4940. (citation 95)

"Hydration-responsive folding and unfolding in graphene oxide liquid crystal phases", F. Guo, F. Kim, T.-H. Han, V. B. Shenoy, J.-X. Huang, R. H. Hurt, ACS Nano 2011, 5, 8019. (citation 51)

"Graphene oxide as surfactant sheets", L. J. Cote, J. Kim, V. C. Tung, J. Luo, F. Kim, J. Huang, Pure Appl. Chem. 2011, 83, 95. (citation 101)

"Seeing graphene-based sheets", J. Kim, F. Kim, J. Huang, Mater. Today 2010, 13, 28. (citation 67)

"Graphene oxide sheets at interfaces", J. Kim, L. J. Cote, F. Kim, W. Yuan, K. R. Shull, J. Huang, J. Am. Chem. Soc. 2010, 132, 8180. (citation 422)

"Visualizing graphene based sheets by fluorescence quenching microscopy", J. Kim, L. J. Cote, F. Kim, J. Huang, J. Am. Chem. Soc. 2010, 132, 260. (citation 172)

"Self-propagating domino-like reactions in oxidized graphite", F. Kim, J. Luo, R. Cruz-Silva, L. J. Cote, K. Sohn, J. Huang, Adv. Funct. Mater. 2010, 20, 2867. (citation 96)

"Graphene oxide: Surface activity and two-dimensional assembly", F. Kim, L. J. Cote, J. Huang, Adv. Mater. 2010, 22, 1954. (citation 185)

"Construction of evolutionary tree for morphological engineering of nanoparticles", K. Sohn, F. Kim, K. C. Pradel, J. Wu, Y. Peng, F. Zhou, J. Huang, ACS Nano 2009, 3, 2191. (citation 53)

"Remote optical switch for localized and selective control of gene interference", S. E. Lee, G. L. Liu, F. Kim, L. P. Lee, Nano Lett. 2009, 9, 562. (citation 99)

"Langmuir-Blodgett assembly of graphite oxide single layers", L. J. Cote, F. Kim, J. Huang, J. Am. Chem. Soc. 2009, 131, 1043. (citation 535)

"Chemical synthesis of gold nanowires in acidic solutions", F. Kim, K. Sohn, J. Wu, J. Huang, J. Am. Chem.

Soc. 2008, 130, 14442. (citation 83)

"Crystal overgrowth on gold nanorods: Tuning the shape, facet, aspect ratio, and composition of the nanorods", J. H. Song, F. Kim, D. Kim, P. Yang, Chem. Eur. J. 2005, 11, 910. (citation 129)

"Pt nanocrystals: Shape control and langmuir-blodgett monolayer formation", H. Song, F. Kim, S. Connor, G. A. Somorjai, P. Yang, J. Phys. Chem. B 2005, 109, 188. (citation 334)

"Spontaneous formation of nanoparticle stripe patterns through dewetting", J. Huang, F. Kim, A. R. Tao, S. Connor, P. Yang, Nat. Mater. 2005, 4, 896. (citation 239)

"Solution-phase synthesis of single-crystalline iron phosphide nanorods/nanowires", C. Qian, F. Kim, L. Ma, F. Tsui, P. Yang, J. Liu, J. Am. Chem. Soc. 2004, 126, 1195. (citation 154)

"Platonic gold nanocrystals", F. Kim, S. Connor, H. Song, T. Kuykendall, P. Yang, Angew. Chem., Int. Ed. 2004, 43, 3673. (citation 671)

"One-dimensional nanostructures: Synthesis, characterization, and applications", Y. Xia, P. Yang, Y. Sun, Y. Wu, B. Mayers, B. Gates, Y. Yin, F. Kim, H. Yan, Adv. Mater. 2003, 15, 353. (citation 5867)

"Langmuir-blodgett silver nanowire monolayers for molecular sensing using surface-enhanced raman spectroscopy", A. Tao, F. Kim, C. Hess, J. Goldberger, R. He, Y. Sun, Y. Xia, P. Yang, Nano Lett. 2003, 3, 1229. (citation 784)

"Low-temperature wafer-scale production of ZnO nanowire arrays", L. E. Greene, M. Law, J. Goldberger, F. Kim, J. C. Johnson, Y. Zhang, R. J. Saykally, P. Yang, Angew. Chem., Int. Ed. 2003, 42, 3031. (citation 1114)

"Self-organized GaN quantum wire UV lasers", H.-J. Choi, J. C. Johnson, R. He, S.-K. Lee, F. Kim, P. Pauzauskie, J. Goldberger, R. J. Saykally, P. Yang, J. Phys. Chem. B 2003, 107, 8721. (citation 198)

"Langmuir - blodgett assembly of one-dimensional nanostructures", P. Yang, F. Kim, ChemPhysChem 2002, 3, 503. (citation 93)

"Photochemical sensing of NO₂ with SnO₂ nanoribbon nanosensors at room temperature", M. Law, H. Kind, B. Messer, F. Kim, P. Yang, Angew. Chem., Int. Ed. 2002, 41, 2405. (citation 626)

"Photochemical synthesis of gold nanorods", F. Kim, J. H. Song, P. Yang, J. Am. Chem. Soc. 2002, 124, 14316. (citation 728)

"Functional bimorph composite nanotapes", R. He, M. Law, R. Fan, F. Kim, P. Yang, Nano Lett. 2002, 2, 1109. (citation 92)

"Synthesis and assembly of BaWO₄ nanorods", S. Kwan, F. Kim, J. Akana, P. Yang, Chem. Commun. 2001, 447. (citation 124)

"Langmuir-blodgett nanorod assembly", F. Kim, S. Kwan, J. Akana, P. Yang, J. Am. Chem. Soc. 2001, 123, 4360. (citation 411)

"Surfactant-induced mesoscopic assemblies of inorganic molecular chains", B. Messer, J. H. Song, M. Huang, Y. Wu, F. Kim, P. Yang, Adv. Mater. 2000, 12, 1526. (citation 48)

(4) Others (*Other achievements that indicate qualification as a top-caliber researcher, if any.*)

Biographical Sketch of a New Principal Investigator

Name (Age)	Dan Ohtan Wang (39)
Affiliation (Position title, department, organization)	Assistant Professor, iCeMS, Kyoto University
Academic degree, specialty	Ph.D., Neurosciences
<p>Research and education history</p> <p>2005-2010 Postdoc Researcher, Molecular and Cell Biological Mechanisms of Memory, UCLA, USA</p> <p>2010-2011 JSPS Foreign Postdoc Researcher, Visualization of Gene Expression in Learning Circuits, RIKEN, Japan</p> <p>2011-2012 Assistant Professor, 4D Gene Analysis in a Learning Circuit</p> <p>2012-present Kyoto Fellow (Principal Investigator) , From RNA to Memory: post-transcriptional regulation in Long-term plasticity and memory</p>	
<p>Achievements and highlights of past research activities <i>(Describe qualifications as a top-caliber researcher if he/she is considered to be ranked among the world's top researchers.)</i></p> <p>Dan Ohtan Wang has pioneered the use of real-time fluorescence reporters to study local translation in the functional learning circuits. She and her colleagues successfully visualized translation of a critical neuropeptide for formation of long-term synaptic plasticity and memory at synapses and identified RNA structures required for its synaptic localization. A series of reports was not only published in academia scientific journals but also digested in Fortune, Yahoo news, BBC focus, etc.</p>	
<p>Achievements</p> <p>(1) International influence <i>a) Guest speaker, chair, director, or honorary member of a major international academic society in the subject field, b) Holder of a prestigious lectureship, c) Member of a scholarly academy in a major country, d) Recipient of an international award(s), e) Editor of an influential journal etc.</i></p> <p>a) Workshop organizer at the 35th Annual Meeting of the Molecular Biology Society of Japan</p> <p>b) Oral presentation at 2014 RNA localization and local translation international conference (Canada)</p>	
<p>(2) Receipt of large-scale competitive fundings <i>(over past 5 years)</i></p> <p>From JSPS: Grant-in-aid for Young Scientist (Start-up), Grant-in-aid for young scientist (A), Challenging Exploratory Research, Grant-in-aid for Scientific Research on Innovative Areas</p> <p>From Cabinet Office: Impulsing Paradigm Change through disruptive Technologies as a team leader</p> <p>From International Funding Agency: Human Frontier Science Program Research Grant</p>	
<p>(3) Article citations <i>(Titles of major publications, and number of citations.)</i></p> <p>Wang DO, Martin KC, and Zukin RS. Spatially restricting gene expression by local translation at synapses. <i>Trends Neurosci.</i> (2010) 33(4):173-82 Citation: 110</p> <p>Wang DO, Kim SM, Zhao Y, Hwang HG, Miura SK, Sossin WS, and Martin KC. Synapse- and stimulus-specific local translation during long-term neuronal plasticity. <i>Science.</i> (2009) 324(5934): 1536-40. Citation: 102</p>	
<p>(4) Others <i>(Other achievements that indicate qualification as a top-caliber researcher, if any.)</i></p>	

Records of FY2014 Center Activities

1. Researchers and center staffs, satellites, partner institutions

1-1. Number of researchers in the "core" established within the host institution

- Enter the total number of people in the columns below. In the "Researchers" column, put the number and percentage of overseas researchers in the < > brackets and the number and percentage of female researchers in the [] brackets.
- In the "Administrative staffs" column, put the number and percentage of bilingual staffs in the () brackets.
- In the "Final Goal" column, enter the currently projected goal at [OO month, OO year (next year of the end of WPI grant)].

	Goal set in the "Post-interim evaluation revised center project"	Results at end of FY2014	Final goal (Date: month, year)
Researchers	185 <64, 35%> [55, 30%]	190 <59, 31%> [42, 22%]	200 <73, 37%> [52, 26%]
Principal investigators	18 <3, 17%> [2, 12%]	25 <6, 24%> [3, 12%]	20 <3, 15%> [2, 10%]
Other researchers	167 <61, 37%> [53, 32%]	165 <53, 32%> [39, 24%]	180 <70, 39%> [50, 28%]
Research support staffs	81	124	100
Administrative staffs	34	30 (27, 90%)	30 (27, 90%)
Total	300	344	330

Other matters of special mention

- Enter matters warranting special mention, such as concrete plans for achieving the Center's goals, established schedules for employing main researchers, particularly principal investigators.
- As background to how the Center is working to mobilize/circulate the world's best brains, give good examples, if any, of how career paths are being established for the Center's researchers; that is, from which top-world research institutions do researchers come to the Center and to which research institutions do the Center's researchers go, and how long are their stays at those institutions.

1-2. Satellites and partner institutions

- List the satellite and partner institutions in the table below.
- Indicate newly added and deleted institutions in the "Notes" column.
- If satellite institutions have been established, describe by satellite the Center's achievements in coauthored papers and researcher exchanges in Appendix 4.

<Satellite institutions>

Institution name	Principal Investigator(s), if any	Notes
iCeMS Satellite at Gifu University, Japan	Makoto Kiso	

<Partner institutions>

Institution name	Principal Investigator(s), if any	Notes
California NanoSystems Institute, UCLA (CNSI), USA		

National Centre for Biological Science, Tata Institute of Fundamental Research (NCBS), India		
Medical Bioconvergence Research Center, Seoul National University (Biocon), South Korea		
Center for Regenerative Medicine, University of Edinburgh (MRC CRM), UK		
Moscow Institute of Physics and Technology(MIPT), Russia		
Jawaharlal Nehru Center for Advanced Scientific Research (JNCASR), India		
Division of Advanced Materials Science, Pohang University of Science and Technology (POSTECH AMS), South Korea		
NIH Center for Regenerative Medicine, National Institute of Health (NIH CRM), USA		
Tsinghua University-Peking University Center for Life Sciences (CLS), China		
Welcome Trust Centre for Stem Cell Research, University of Cambridge (CSCR), UK		
Heidelberg University, Germany		
Max Planck Institute of Molecular Cell Biology and Genetics (MPI CGI), Germany		
Center for Basic and Applied Membrane Sciences, Purdue University (PUBAMS), USA		
Stem Cells Australia, the University of Melbourne(SCA), Australia		

2. Securing competitive research funding

- Competitive and other research funding secured in FY2014:

Total: 1834 JPY million

- Describe external funding warranting special mention. Include the name and total amount of each grant.

(Unit: JPY millions)

Grants-in-Aid for Scientific Research	599
Sponsored Research Funding (including NEDO)	971
Collaborative Research funding	181
Donations	83
Total	1,834

*The Yamanaka Lab budget is calculated separately as part of the CiRA, and is not included above.

3. International research conferences or symposiums held to bring world's leading researchers together

- Indicate the number of international research conferences or symposiums held in FY2014 and give up to three examples of the most representative ones using the table below.

FY 2014: 3 meetings	
Major examples (meeting title and place held)	Number of participants

Meeting Title : The 16 th iCeMS International Symposium "Light Control in Cell Biology" Place : iCeMS Main building	From domestic institutions: 109 From overseas institutions: 6
Meeting Title : The 17 th iCeMS International Symposium "MOF2014: 4th International Conference on Metal Organic Frameworks and Open Framework Compounds" Place : Kobe International Conference Center	From domestic institutions: 320 From overseas institutions: 385
Meeting Title : The 18 th iCeMS International Symposium "The 15th International Membrane Research Forum" Place : iCeMS Main building	From domestic institutions: 150 From overseas institutions: 13

4. Center's management system

- Please diagram management system in an easily understood manner.
- If any changes have been made in the management system from that in the "Post-interim evaluation revised center project," please describe them. Please describe any changes made in the administrative director, head of host institution, and officer(s) in charge at the host institution (e.g., executive vice president for research)

1. Top down decision making by Executive Board

The board consists of the Director, two Deputy Directors, Chair of PI Meeting and Admin Director. Meetings are held twice a month, and the Director makes top-down decisions on matters related to personnel affairs, budget and other management issues.

2. Board of PIs

The board consists of PIs, Associate Professors and iCeMS Kyoto fellows. PI meetings are held monthly to share important management information and to set up job seminars and make recommendations of candidates for faculty and other positions.

3. Management support by various committees

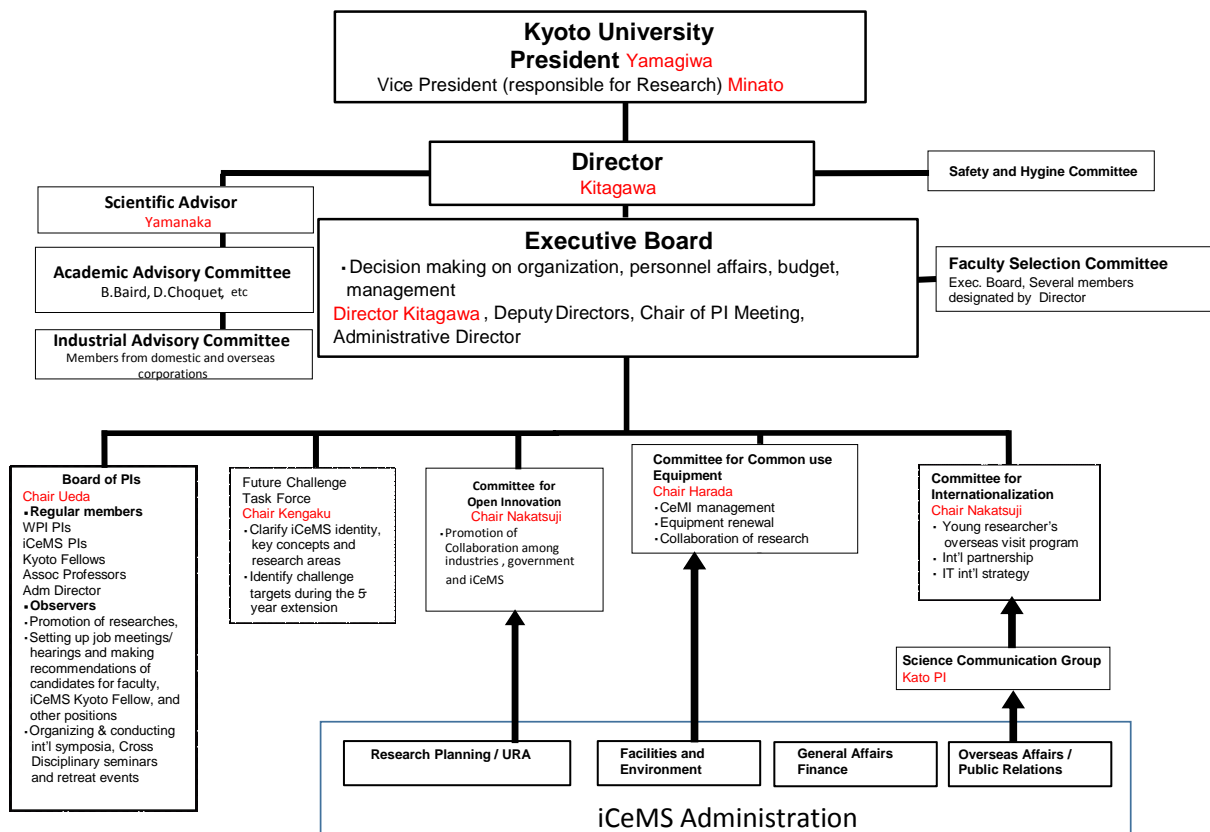
Committees include Future Challenge Task Force, Open innovation, Facilities Management, CeMI Management and Internationalization.

4. Scientific Advisor

Nobel Prize winner Prof Yamanaka contributes valuable suggestions from a broader point of view.

5. Academic and Industrial Advisory Boards

The Academic Board consists of world renowned professors (researchers from 8 overseas and 2 domestic institutions). The board meetings, held three times to date, contribute valuable comments on research activities conducted at iCeMS. The Industrial Advisory Board (managers from 3 overseas and 3 domestic industries) was established in 2013 to promote further collaboration with industries.

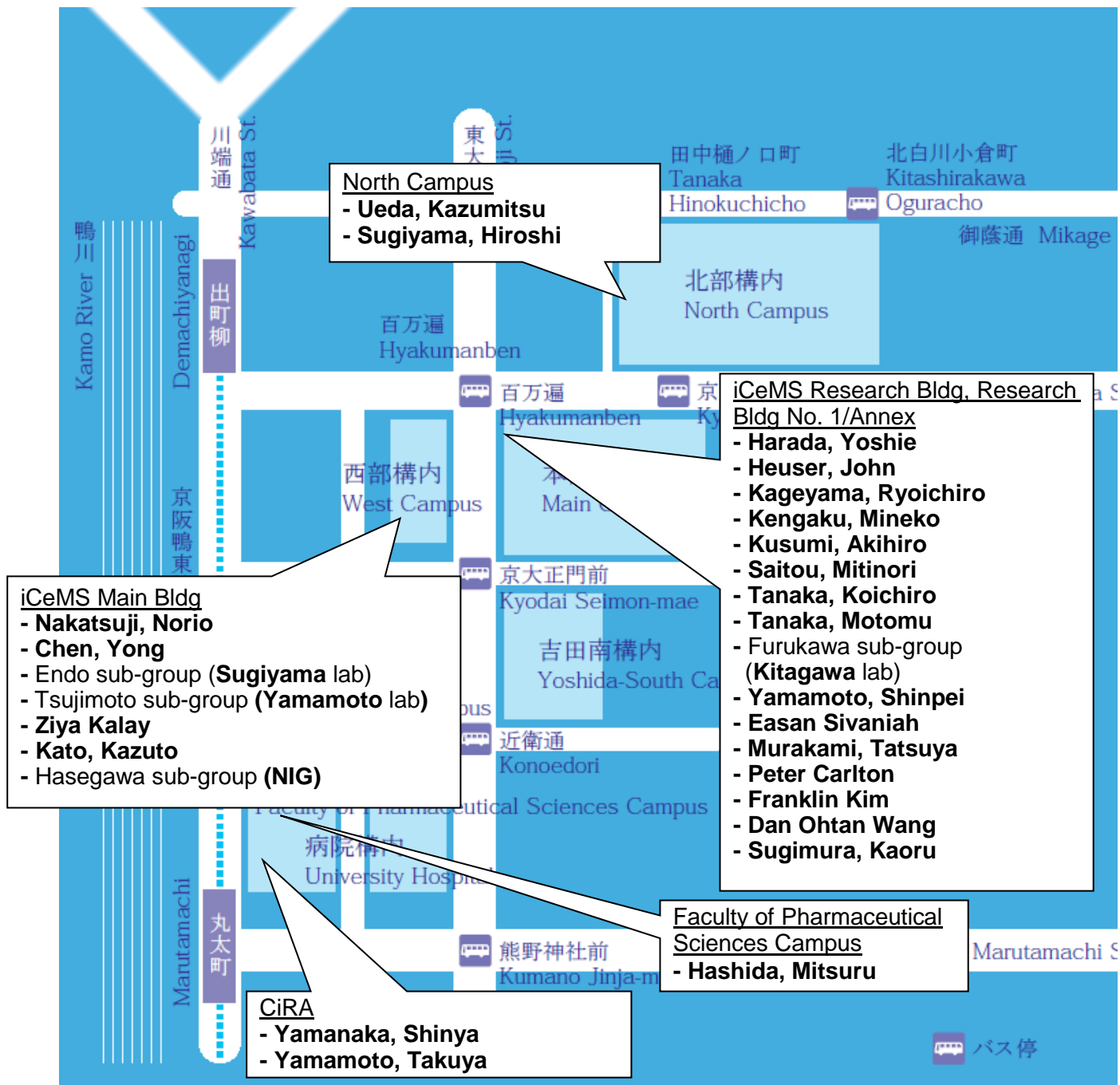


5. Campus Map

- Please draw a simple map of the campus showing where the main office and principle investigator(s) are located.



Yoshida Campus



i) Overall project funding

Ten thousand dollars

Cost Items	Details	Costs (10,000 dollars)		
			WPI grant	1,310
Personnel	Center director and Administrative director	35		
	Principal investigators (no. of persons): 22	216	Costs of establishing and maintaining facilities	22
	Other researchers (no. of persons): 98	454	Others	22
	Research support staffs (no. of persons): 94	149		
	Administrative staffs (no. of persons): 44	155		
	Total	1009		
Project activities	Gratuities and honoraria paid to invited principal investigators (no. of persons): 0	0	Cost of equipment procured	95
	Cost of dispatching scientists (no. of persons): 20	36	Others	95
	Research startup cost (no. of persons): 25	243		
	Cost of satellite organizations (no. of satellite organizations): 1	50		
	Cost of international symposiums (no. of symposiums): 3	2		
	Rental fees for facilities	20		
	Cost of consumables	26		
	Cost of utilities	64		
	Other costs	159		
	Total	600		
Travel	Domestic travel costs	10		
	Overseas travel costs	22		
	Travel and accommodations cost for invited scientists (no. of domestic scientists): 49 (no. of overseas scientists): 31	8		
	Travel cost for scientists on secondment (no. of domestic scientists): 5 (no. of overseas scientists): 6	3		
	Total	43		
Equipment	Depreciation of buildings	119		
	Depreciation of equipment	603		
	Total	722		
Other research projects	Projects supported by other government subsidies, etc.	64		
	Commissioned research projects, etc.	585		
	Grants-in-Aid for Scientific Research, etc.	341		
	Total	990		
Total		3364		

ii) Costs of Satellites and Partner institutions

Cost Items	Details	Costs (10,000 dollars)
Personnel	Principal investigators (no. of persons): 1	/
	Other researchers (no. of persons): 2	
	Research support staffs (no. of persons): 8	
	Administrative staffs (no. of persons):	
	Total	
Project activities		6
Travel		1
Equipment		1
Other research projects		26
Total		76

Status of Collaboration with Overseas Satellites

1. Coauthored Papers

- List the refereed papers published in FY2014 that were coauthored between the center's researcher(s) in domestic institution(s) and overseas satellite institution(s). List them by overseas satellite institution in the below blocks.
- Transcribe data in same format as in Appendix 1. Italicize the names of authors affiliated with overseas satellite institutions.
- For reference write the Appendix 1 item number in parentheses after the item number in the blocks below. Let it free, if the paper is published in between Jan.-Mar. 2015 and not described in Appendix 1.

Overseas Satellite 1 (Total: OO papers)

No.	Author names and details
1-	
1-	
1-	

Overseas Satellite 2 (Total: OO papers)

No.	Author names and details
2-	
2-	
2-	

2. Status of Researcher Exchanges

- Using the below tables, indicate the number and length of researcher exchanges in FY2014. Enter by institution and length of exchange.
- Write the number of principal investigator visits in the top of each space and the number of other researchers in the bottom.

Overseas Satellite 1:

<To satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2014					

<From satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2014					

Overseas Satellite 2:

<To satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2014					

<From satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2014					

FY2014 Visit Records of World Top-caliber Researchers from Abroad

Researchers Total: 10

Name (Age)	Affiliation (Position title, department, organization)	Academic degree, specialty	Record of research activities (Awards record, etc.)	Time, duration	Summary of activities during stay at center (e.g., participation as principal investigator; short-term stay for joint research; participation in symposium)
Schwartz Martin	Yale School of Medicine	Ph.D.		2014/04/18~ 2014/04/18	Discussion/Conference
Krishnaswamy Vijay	Ministry of Science & Technology	Ph.D.	the Padma Shri award in 2013, the Infosys Prize in the life science s category in 2009	2014/05/16~ 2014/05/16	Visit iCeMS
Chadaram Sivaji	Embassy of India	Ph.D.		2014/05/16~ 2014/05/16	Visit iCeMS
Wang Ming-Wei	Chinese Academy of Sciences	Ph.D.	The Shanghai 2002 First Prize in Science and Technology Advancement (2003),The National 2003 Second Prize in Science and Technology Advancement(2004)	2014/05/02~ 2014/05/02	Discussion/Conference
Vortkamp Andrea	University of Duisburg-Es sen	Ph.D.		2014/06/23~ 2014/06/23	Seminar talk
Blanpied Thomas	University of Maryland School of Medicine	Ph.D.		2014/09/14~ 2014/09/17	Seminar talk
Tomas Torres	Autonoma University of Madrid	Ph.D.	Research Prize and the Gold Medal of the Spanish Royal Society of Chemistry (2013)	2014/10/06~ 2014/10/06	Seminar talk
Bassani Dario	Université de Bordeaux	Ph.D.	Swiss Chemical Society Grammaticakis-Neumann Prize (2005)	2014/11/25~ 2014/11/25	Seminar talk
Hammarström Leif	Uppsala University	Ph.D.	Nominated as No 1 and offered two open Chair Professorships: Chemical Physics (Uppsala Univ) and Molecular Electronics (Royal Inst. Techn., Stockholm) (20 04)	2014/11/28~ 2014/11/29	Seminar talk
Mann Stephen	University of Bristol	Ph.D.		2014/11/04~ 2014/11/06	Seminar talk

State of Outreach Activities

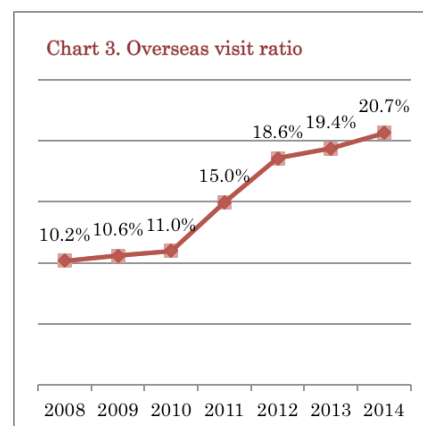
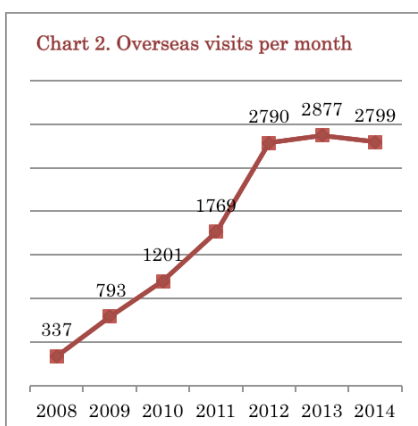
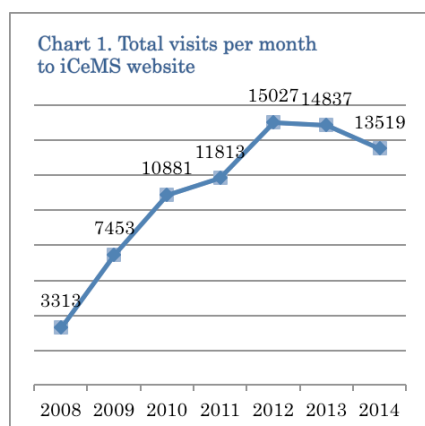
- Using the table below, show the achievements of the Center's outreach activities in FY2014 (number of activities, times held).
- Describe those activities that have yielded novel results or that warrant special mention in the "Special Achievements" space below.
- In appendix 7, list and describe media coverage (e.g., articles published, programs aired) in FY2014 resulting from press releases and reporting.

Activities	FY2014 (number of activities, times held)
PR brochure, pamphlet	4
Lectures, seminars for general public	34
Teaching, experiments, training for elementary and secondary school students	25
Science cafe	1
Open houses	1
Participating, exhibiting in events	26
Press releases	20

Special Achievements: International visibility

a) Web traffic analysis

Number of visitors to the iCeMS website dramatically increased immediately after Professor Shinya Yamanaka's receipt of the Nobel Prize in 2012. Although the total access rate has slowly declined since the spike, it remains higher than before 2012 (Chart 1). The proportion of access from overseas is also on a continued rise, retaining a monthly average of 2,800 visits, indicating an enhanced visibility of iCeMS in the international community since the Nobel Prize win (Chart 2, 3).



b) Social media utilization

To engage with a wider audience across the globe — younger generations of scientists in particular — iCeMS is also committed to utilizing social media, such as Twitter (from March 2011), YouTube (December 2011), and Facebook (March 2012). In particular Facebook has aided in raising iCeMS' visibility: the iCeMS Facebook page drove 2,158 visits to the iCeMS website in 2014. The page also garnered 6,979 views (the number of times iCeMS updates are seen by Facebook users) per month in 2014; 52% of the fan base were from overseas.

c) World Stem Cell Summit

For the third consecutive year, iCeMS co-organized and participated in the 2014 World Stem Cell Summit, an event held in San Antonio, USA, that attracted 1,000 visitors from industry, academia, and government


of 40 countries. Prof. Nakatsuji gave a welcome speech at the opening ceremony, well as a lecture at the Japan Symposium to an international audience, which included 170 experts in the stem cell and regenerative medicine fields. An iCeMS booth showcased stem cell mass culture technology developed through joint research with iCeMS and Nissan Chemicals, and attracted industry leaders interested in forging potential partnerships. Other iCeMS' members gave poster presentations and were part of the awards evaluation committee.

d) WPI-iCeMS showcased at San Jose AAAS annual meeting

A team consisting of WPI centers' outreach officers (incl. iCeMS PR) and MEXT officers hosted a booth to present the WPI program, with a particular focus on its international, interdisciplinary nature, at the American Association for the Advancement of Science (AAAS) annual meeting in San Jose, USA in February 2014. The WPI team engaged with over 350 booth visitors to publicize the program and state-of-the-art research conducted in each center.

Future Plans:

Date	Title	Activity	Target Audience	Objectives
July 2015	iCeMS Café	Science Café	General public	2, 3
August 2015	NHK TV program "Thinking Crow (<i>Kangaeru-Karasu</i>)" workshop 'Brainstorming together'	Hands-on workshop	Elementary school students and guardians	2, 4
October 2015	Kyoto University Academic Day 2015	Science dialogue	General public	2, 3
October 2015	SSH Visit	Lecture and laboratory tour	High school students	1, 2
October 2015	iCeMS/CiRA Classroom for high school students	Hands-on laboratory exercises on stem cells	High school students	1, 4
November 2015	NHK TV program "Thinking Crow (<i>Kangaeru-Karasu</i>)" workshop 'Brainstorming together'	Hands-on workshop	Elementary school students and guardians	2, 4
December 2015	iCeMS Café	Science Café	General public	2, 3
February 2016	iCeMS Café	Science Café	General public	2, 3
March 2016	NHK TV program "Thinking Crow (<i>Kangaeru-Karasu</i>)" workshop 'Brainstorming together'	Hands-on workshop	Elementary school students and guardians	2, 4

- 
1. Raise middle and high school students' scientific literacy
 2. Have productive interaction with communities outside of the institute
 3. Have scientists engage in outreach activities
 4. Educate society on activities within the institute through mass media outlets

FY2014 List of Project's Media Coverage

- Select main items of coverage, and list them within these 2 pages.

Domestic media coverage

No.	Date	Type media (e.g., newspaper, television)	Description
1	Apr 25, 2014	Yomiuri TV [TV]	(Nakatsuji) New method allows mass cultivation of stem cells
2	Jun 03, 2014	The Kyoto Shimbun [newspaper]	(Kitagawa) Industry, Academia and Government collaborate to generate next-generation energy using Kyoto's nanotechnology
3	Jul 01, 2014	The Nikkei [newspaper]	(Higuchi, Kitagawa) Kyoto University develops novel material to purify gas and collect CO2
4	Jul 08, 2014	The Nikkei Evening Edition [newspaper]	(Uesugi) Kyoto University invites six top-performing students from online course
5	Aug 04, 2014	Nikkei Biotech [magazine]	(Nakatsuji) Kyoto U Prof Nakatsuji starts stem cell venture capital
6	Sep 11, 2014	The Nikkan Kogyo Shimbun [newspaper]	(Sivaniah) Kyoto U creates cross-link structure for gas separation membranes, gas permeability increased 100 times fold, selectivity doubled
7	Sep 29, 2014	The Yakuji Nippou [newspaper]	(iCeMS) iCeMS and CiRA classroom for High School students
8	Oct 17, 2014	The Nikkan Kogyo Shimbun [newspaper]	(Kim, Zhou) Kyoto U develops simple and versatile way to build three-dimensional porous graphene nanosheets
9	Nov 19, 2014	Nikkei Biotech [web]	(Sugi) Japan Science and Technology Agency uncovers mechanism of desensitization to stress
10	Feb 08, 2015	The Yomiuri Shimbun [newspaper]	(Kageyama) Controlling the DNA with blue light: "light sensor switch" made of protein
11	Mar 17, 2015	The Nikkei Sangyo Shimbun [newspaper]	(H. Kitagawa) Hiroshi Kitagawa develops unique materials with nanotechnology to promote hydrogen society

Overseas media coverage

No.	Date	Type media (e.g., newspaper, television)	Description
1	Sep 04, 2014	Engineering (Canada)	(Sivaniah) To clean air and beyond: Catching greenhouse gases with advanced membranes
2	Sep 04, 2014	Nature World News [web]	(Sivaniah) Japanese Researchers Create Membrane that Traps Greenhouse Gases
3	Sep 05, 2014	Azo Materials [web]	(Higuchi, Kitagawa) Researchers Develop Water-Resistant Porous Coordination Polymers
4	Sep 08, 2014	Design and Trend (USA) [web]	(Sivaniah) Japanese Researchers Create Membrane that 'Catches' Greenhouse Gases
5	Oct 16, 2014	World Industrial Reporter (USA) [web]	(Kim, Zhou) Kyoto Devises Versatile Way to Build 3D Materials of the Future
6	Oct 17, 2014	Science and Enterprise	(Kim, Zhou) Simple 3-D Graphene Construction Process Devised
7	Oct 21, 2014	Le Scienze (Italy) [web]	(Kim, Zhou) How to produce 3-dimensional graphene
8	Oct 22, 2014	Materials Today (UK)	(Kim, Zhou) Building 3D graphene structures layer by layer
9	Oct 23, 2014	Big News Network (USA)	(Carlton, Sato) Single protein behind successful fertilisation
10	Oct 27, 2014	Tnews (Iran) [web]	(Carlton, Sato) Role of protein in reproductive success
11	Nov 18, 2014	e Science News [web]	(Sugi) State-of-the-art integrated imaging system allows mapping of brain cells responsible for memory
12	Nov 19, 2014	Medical News Today [web]	(Sugi) Brain cells responsible for memory mapped by state-of-the-art integrated imaging system