



FY 2018 Follow-up of WPI Program

By Program Committee

February 2019

(This document reports on progress made under the WPI Program in FY 2017.)

A.	WPI Outline	2
B.	Highlights in FY 2018.....	2
C.	WPI Centers.....	3
D.	Follow-up	4
E.	Follow up on Kavli IPMU, Launched in 2007	6
F.	Follow up on I ² CNER, Launched in 2010.....	8
G.	Follow up on the 3 Centers Launched in 2012.	10
	G-1. IIIS	11
	G-2. ELSI	13
	G-3. ITbM	14
H.	Follow up on the 2 Centers Launched in 2017.....	15
	H-1. IRCN	15
	H-2. NanoLSI	17
I.	New WPI Centers Launched in 2018	19
J.	Follow-up of WPI Academy centers.....	20
K.	WPI Academy and Its Activities	21

In 2007, the Japanese government launched an ambitious initiative to create globally visible and internationally open research centers. This program, World Premier International Research Center Initiative (abbreviated WPI), successfully concluded its first 10 years of implementation in 2016. The second decade of the program started in 2017 with the launching of 2 centers, IRCN and NanoLSI. This year is the 2nd year of the Program's second decade of operation, or the 12th year when counted from its beginning. The 2018 follow-up report describes important areas of progress achieved in FY 2017 and new developments made in FY 2018, including the establishment of two more WPI centers, ICRoDD and ASHBI.

A. WPI Outline

In 2007, Ministry of Education, Culture, Sports, Science and Technology (MEXT) launched the WPI Program aimed at establishing internationally open and globally visible "World Premium Institutes" in Japan.

Four missions are given to WPI centers.

- Advancing to the highest pinnacle globally leading-edge research
- Creating interdisciplinary domains
- Establishing international research environments
- Reforming research organizations

MEXT supports the WPI centers within the following context.

- Up to ¥700 million a year per center in principle
(Up to about ¥1.3 billion a year for centers launched in and before 2010)
- Research money is not included.
- Support for 10 years (5-year extension is applicable for centers launched in or before 2012)

Many countries are now carrying out Research Excellence Initiatives (REI) against the following background. The WPI Program is regarded as an REI role model.

- Increasing worldwide competition in generating new research outcomes and in recruiting talented scientists.
- Strong need felt for more efficient forms of funding to advance fundamental and innovative sciences, which are essential to building knowledge-based societies.
- The advent of REIs designed to encourage outstanding research by providing large-scale and long-term funding.

B. Highlights in FY 2018

Selecting new centers

Responding to a recommendation made by the Program Committee in 2015 that the WPI Program should proceed forward by calling for new WPI centers, in 2016 MEXT laid out a long-term plan in which two new WPI centers would be launched in FY 2017, two more centers in FY 2018, and up to a total of 20 centers would possibly be established in the future. Through a rigorous screening process, the Program Committee selected the two new centers at its annual meeting in September 2018. They are the Institute for Chemical Reaction Design and Discovery (ICReDD) at Hokkaido University, and the Institute for the Advanced Study of Human Biology (ASHBi) at Kyoto University. These centers began their research activities in October 2018.

First year of WPI Academy

The WPI Academy was launched by MEXT in April of 2017. Its aim is to sustain the centers and advance the WPI brand established during the 10-year period supported by the WPI grant. The initial members of WPI Academy are the five WPI centers launched in 2007: AIMR, Kavli IPMU, iCeMS, IFReC, and MANA, which were certified to have reached “World Premier Status” by the WPI Program Committee. Although their total budgets were significantly reduced, these institutes have been well sustained through financial support provided by their host institutions, the government and JSPS in addition to the centers’ efforts to secure external budgets including through contract/collaboration with enterprises. Academy centers of universities are now situated within a new framework, which may be termed “Institute for Advanced Study,” within their host institutions. Their activities were reviewed by the visit of Academy Director (AD) and Academy Officer (AO) in the winter of 2017-2018.

C. WPI Centers

Nine WPI centers were launched during the first 10 years of the WPI Program.

The first five WPI centers launched in 2007 are now members of the WPI Academy.

- **AIMR** on materials science, Tohoku University.
- **Kavli IPMU** on the universe, The University of Tokyo.
- **iCeMS** on cell biology, Kyoto University
- **IFReC** on immunology, Osaka University
- **MANA** on nanotechnology, National Institute for Materials Science

The sixth WPI center was launched under the “green innovation program” in 2010.

- **I²CNER** on energy, Kyushu University

Three WPI centers were launched under the new “WPI Focus” program in focused research areas in 2012.

- **IIIS** on sleep, University of Tsukuba
- **ELSI** on Earth-life, Tokyo Institute of Technology
- **ITbM** on bio-molecules, Nagoya University

In 2017, the 11th year of the WPI Program, two WPI centers were added:

- **IRCN** on neurointelligence, The University of Tokyo
- **NanoLSI** on nano-probe life science, Kanazawa University

This year, two more centers were launched:

- **ICReDD** on chemical reaction design and discovery, Hokkaido University
- **ASHBi** on human biology, Kyoto University

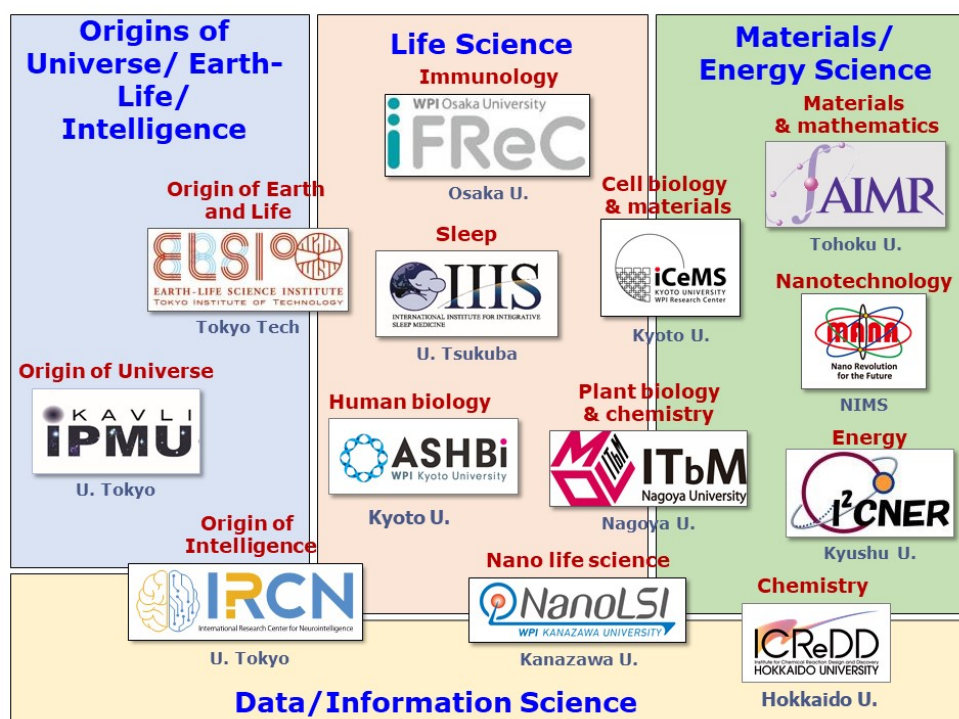


Figure: 13 WPI centers

As shown above, the 13 WPI centers cover four science areas: Origins of the Universe, Earth, Life, and Intelligence; Life Science; and Materials/Energy Science; Data/Information Science.

D. Follow-up

The WPI Program carries out a robust follow-up system comprising the international Program Committee, program directors (PDs), program officers (POs), and working groups (WGs). Since last year, an academy director (AD), academy officers (AOs), and Academy working groups (AWGs) have been put in place to oversee the follow-up activities of the WPI centers that are members of the WPI Academy.

Program Committee

The Committee membership changed slightly in FY 2018: Dr. Shinichiro Ohgaki resigned.

All the Committee members and their affiliations are listed in the following website:

https://www.jsps.go.jp/english/e-toplevel/data/07_committee/PC_member_list.htm

The FY 2018 Program Committee meeting was held on 19-20 September in Tokyo. Of its 17 members, 14 participated. The main items of business on the agenda were the selection of two new WPI centers to be launched this year, and progress evaluations of the seven WPI centers that are receiving ongoing funding, which were carried out based on presentations by the presidents of their host institutions and center directors as well as on site-visit reports and the centers' own progress reports.

PDs, POs and WGs

PDs: Dr. Akira Ukawa has been serving as Program Director since April 2017. Dr. Minoru Yoshida was appointed Deputy Director in December 2017.

POs: Experts in the research areas of each center. They chair site visits and prepare site-visit reports by compiling the comments of the site-visit team members.

WGs: Assembled for each WPI center, these groups principally consist of 3 domestic and 3 international experts in areas that cover the center's activities.

PDs, POs and WG members and their affiliations are listed in the following website:

http://www.jsps.go.jp/english/e-toplevel/08_followup.html

AD, AOs and AWDs

AD: Dr. Toshio Kuroki has been serving as Academy Director since April 2017.

AOs: Experts in the research area of the member centers. They chair site visits and prepare site-visit reports for the Program Committee.

AWGs: Assembled for each WPI center, these groups principally consist of 2 domestic and 1 international expert in areas that cover the center's activities. AWG members will be

appointed at a later date.

AD and AOs and their affiliations are listed in the following website:

https://www.jsps.go.jp/english/e-toplevel/18_academy.html

Site Visits

Site visits to the seven WPI centers receiving ongoing funding were conducted during the period of June-August 2018.

A full 2-day site visit was carried out on six centers, Kavli IPMU in its 12th year, IIS, ELSI and ITbM in their 7th year, and IRCN and NanoLSI in their 2nd year. The members of the site-visit team were the PDs, PO, WG, MEXT officials, and JSPS secretariat. The AD participated as an observer. Interested Program Committee members also participated. The visit schedule included briefings by the president of the host institution and center director and presentations by selected PIs. Poster presentations by young researchers spawned a free discussion between them and site-visit team members.

For I²CNER in its 9th year of operation, a half-day site visit without WG participation was conducted (following its 8th year extension application screening done last year). The schedule included a briefing by the president of host institution and by the center director, followed by discussions with them and the site-visit team members.

For all 7 centers, reports of the site visits were submitted to the Program Committee and disclosed to the respective centers.

WPI Academy Site Visit

For the four Academy-member centers (AIMR, iCeMS, IFRc and MANA), half-day visits were made by the AD and AOs between November 2017 and January 2018. The PD and DPD participated as observers. The center directors reported on progress made in FY 2017, the first year of their activity as WPI Academy centers, and also on activities for accelerating international brain circulation, with comments provided by (vice) presidents of the host institutions. These were followed by discussions between them and the visiting team.

E. Follow up on Kavli IPMU, Launched in 2007

Center director: Hitoshi MURAYAMA (till 14 October)

Hiroshi Ooguri (from 15 October)

Program officer: Ichiro SANDA, Nagoya University

1. Scientific achievements

The Program Committee (PC) congratulates Kavli IPMU on the impressive progress it has made since it was launched in 2007. In addition to many theoretical results, several experiments, some of which have taken as long as 10 years to prepare, are now yielding data.

2. Implementation as WPI center

Kavli IPMU continues to exert momentum as an exemplary WPI center. The Committee looks forward to it making further leaps ahead over the period of its five-year extension.

Interdisciplinary research: Kavli IPMU also continues to encourage and facilitate interdisciplinary interactions, sometimes in ways that were not planned but no less meaningful or impactful—this free flow and exchange of ideas is really critical as part of the milieu of a successful world leading research center.

It is the Committee's sincere hope that this interdisciplinary research will eventually result in some unexpected breakthroughs.

Internationalization: Kavli IPMU has become a global brand, an important career path, and a sought-after international destination for researchers.

However, it may take another 10 years for the world to acknowledge that Kavli IPMU is indeed a first-rate international research center. For this reason, careful nurturing of Kavli IPMU by the host institute will be essential.

System reforms: The system reforms initiated by Kavli IPMU have spread to other research centers and universities, and are reflected in the content of the system reform promoted by MEXT.

3. Efforts toward sustainability

In addition to the upgrades discussed last year, the new LiteBIRD experiment to study inflation was chosen as one of the projects to be included in MEXT Roadmap 2017.

Kavli IPMU is attracting and retaining the best broadly minded scientists from around the world in preparation for furthering its growth after the WPI grant ends.

4. Center's response to the follow-up results in last year

The PC acknowledges The University of Tokyo (UTokyo)'s exceptional efforts toward assuring the center's sustainability.

UTokyo fully supports Kavli IPMU to become a permanent center of the University. President Gonokami's new attempt for fund raising is impressive and may open new channels for fund raising at all other research institutions in Japan.

5. Actions required and recommendations

It is a sincere hope of the Program Committee that the efforts made by Kavli IPMU and by UTokyo towards their reforms will lead to a complete reform of the way research is being conducted in Japan. The value of setting up WPI at UTokyo will be judged by these reforms which lead to the goal of WPI.

One outstanding issue is that many faculty members at Kavli IPMU cannot supervise graduate students. This is because Kavli IPMU is not a school and hence cannot grant degrees, Kavli IPMU is completely at the mercy of traditional departments to have access to graduate students. On site Kavli IPMU faculty members, if interested, should be appointed as graduate advisors in the respective departments and have access to students. This model is common in US and UK e.g. the Broad Institute in Boston and the Francis Crick Institute in London. This would be an important system reform of the graduate education at UTokyo.

UTokyo should develop new opportunities such as research experience for undergraduates (REU) that will involve more students in the environment of this international research center. It is important to get to gifted undergraduates, so that they will have the courage to aim for graduate school and to be active in international environments.

On the Change of the director

- Kavli-IPMU under Director Murayama

Kavli IPMU has made great progress in regard to most of the WPI goals. The PC owe a great debt of gratitude to Director Murayama for his great efforts as well as his vision, which has continued to exercise positive influence on the host institute as well as on other institutes in Japan.

- Kavli IPMU under the new director

UTokyo has nominated an outstanding scientist and leader, Ooguri, to succeed Murayama. The PC supports UTokyo's proposal.

With high expectations for Kavli IPMU, the new director will be doing a lot more than "sustaining" the center. In particular, it is critically important for Kavli IPMU to make efforts to be visible (well-known) among the broader UTokyo community. It is only in this way that



Figure: Caltech Professor Hiroshi Ooguri appointed new director of Kavli IPMU

Kavli IPMU can have the transformative effect on UTokyo that WPI expects.

One concern is that Ooguri will put in only 50% effort to Kavli IPMU. PC and PD-PO must pay close attention to this issue.

F. Follow up on I²CNER, Launched in 2010

Center Director: Petros SOFRONIS

Program officer: Kazunari DOMEN, Shinshu University & The University of Tokyo

1. Scientific achievements

Clearly, I²CNER is producing cutting edge science. Impressive numbers of publications, citations, and h-index have been achieved. The number of patents is also impressive. I²CNER holds the international benchmarks in multiple areas, e.g. solid oxide electrolysis, optimizing post combustion CO₂ capture by membranes.

2. Feeding research outcomes back into society

The creation of an “Industrial Advisory Board” shows that the center focuses on external requests. 12 granted patents in 2017 and 49 technology transfers demonstrate the strong interactions with industry.

3. Implementation as a WPI Center

Interdisciplinary research: The Mathematics component driven and strengthened by bringing in Illinois professors based on Applied Math for Energy Initiative is outstanding. Kyusyu University Platform of Inter / Transdisciplinary Energy Research (Q-PIT) is engaging social and economic sciences and is expected to enhance the interdisciplinary research works.

Internationalization: International cooperation with the University of Illinois at Urbana-



Figure: Group photo of the participants of the Partnerships for International Research and Education (PIRE) program and their host researchers at I²CNER

Champaign (UIUC) will be a firm base of international activities for Kyushu University (Kyushu U). I²CNER has also established several new collaborations with foreign institutes: e.g. the University of Göttingen to establish an International Research Training Group to be co-funded by Deutsche Forschungsgemeinschaft

(DFG) and JSPS. Another example is the JSPS Core-to-Core Program carried out among I²CNER, Imperial College London, the Paul Scherrer Institut, and the Massachusetts Institute of Technology (MIT).

System reforms: There are examples where the center has had an impact on the university. The model how young people are treated has spread to the rest of the university. The center is emphasizing female researchers and is working towards increasing the number of female scientists.

4. Efforts toward sustainability

President Kubo's leadership is highly appreciated for his strong will to maintain this Center under a rather difficult financial situation of the University. The University has promised continuous economic support as well as providing the space of the second building for I²CNER.

5. Actions required and recommendations

It is necessary to have a detailed plan of budget, space, size and scope of I²CNER after the end of the WPI grant. One of the biggest concerns is how to maintain the excellent balance and other strengths of the program as I²CNER adapts to new sources of funding. It is the most important issue and would like to receive this plan by next year.

I²CNER has been able to attract international postdocs and enable them to launch and build their career to become tenured faculty of Kyushu U or to be attracted to overseas universities in similar positions, including UIUC. This is one of the most difficult aims of WPI and I²CNER should be commended for making this happen.

Interaction with other institutes outside of Kyushu U is highly recommended as the subject of energy research is so vast. This is needed for the brain circulation of young scientists as their careers grow.

G. Follow up on the 3 Centers Launched in 2012.

G-1. IIIS

Center director: Masashi YANAGISAWA

Program officer: Kozo KAIBUCHI, Nagoya University

1. Scientific achievements

Scientific output is very much impressive. Researches include the sleep regulating mechanism following up on the discovery of *Sleepy (Sik3)* and *Dreamless (Nalcn)*, the connection between motivational behavior and gating of sleep, memory consolidation, REM/non-REM switching mechanism, role of cortical/thalamus activities on sleep and



Figure: Prof. Yanagisawa and Prof. Funato were awarded the Erwin von Bälz's prize. (Photo : Katsumi Yanagiya)

wake, and the design and synthesis of OREXIN ligands etc. In addition, they are taking a new direction in human sleep research-the development of a new method for uncovering vigilance impairment from sleep loss. III's overall research output is of high quality and of high volume.

2. Implementation as a WPI center

Interdisciplinary research: While the scope (and funding) of IIIS are narrower than that of some other WPI centers, it has done an excellent job at catalyzing the fusion of fields. A good example of this is the substantial chemistry efforts of the Nagase lab, which support a

variety of the biological programs including Funato/Yanagisawa, Lazarus, Liu, Vogt, etc. The center's clinical studies and device development efforts also provide examples of fusion activities. While these are being done in collaboration or in part with S'UIMIN due to limitations in the overall IIIS budget, they nevertheless represent true fusion activities. Potential interaction with TOYOTA could be a tremendous opportunity for fusion.

Internationalization: IIIS has been further internationalized. The atmosphere has become more natural with regard to communicating in English. It is a good sign that the institute attracts many foreign students to it. We highly appreciate the leadership of the Director, Prof. Yanagisawa, for his effort to make the institute international in various ways. Seminars by distinguished foreign researchers are also a good indication of the international environment within the institute.

System reforms: The director's leadership, based on his experience in the US, continues to work well. A new PhD program in conjunction with a variety of research centers in University of Tsukuba and Tsukuba science city, international partner universities, and private companies is expected to develop the next generation of researchers with an interdisciplinary mindset. Two systems, IIIS research assistantship system and its mental care program, have been introduced to support students.

3. Actions required and recommendations

- (1) To strengthen the integrated sleep science, strategies for the next steps are required.
We would like to know what the next steps and goals are after identifying the sleep controlling circuits by optogenetic and pharmacogenetic methods.
- (2) Certain biochemical and cell biological approaches will be necessary after the genetic approaches. For an example, spatial and temporal monitoring of Sik3 activity is important for better understanding the roles of Sik3 in sleep control. Identifying Sik3 substrates is also important.
- (3) The next few years will be crucial for establishing IIIS as a sustainable institute. Ongoing effort to achieve this should be continued with tight collaboration with University of Tsukuba's top management.
- (4) Expected, but impressive, progress is seen not only in science but also in system reforms. The spirit of IIIS is to be extended to entire University of Tsukuba's administration, research, and education.

(5) Collaboration with TOYOTA will help to make the institute sustainable, but we wonder if this collaboration makes the institute research to be more applied one.

(6) It is important not to over-estimate the funding that can come in from S'UIMIN or other licensing revenues. University-wide licensing revenue typically only accounts for less than 3 or 4% of major university budgets in the US, which has a well-developed system.

G-2. ELSI

Center director: Kei HIROSE

Program officer: Shoken MIYAMA, Hiroshima University

1. Scientific achievements

A representative list of prominent results includes the cooling of magma ocean and hydrogen-rich atmosphere, a model of the ancient mantle structure and hydrothermal vents

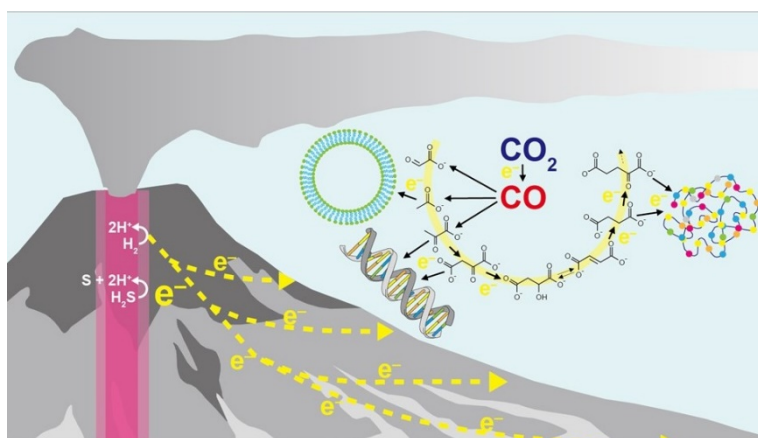


Figure: The hydrothermal vents in the oceans of early Earth are favorable locations for reducing CO_2 to CO via sulfide ions. This could be a promising process for the prebiotic CO_2 fixation and the subsequent evolution of primordial metabolism toward the origin of life (Kitadai et al., Sci. Adv. 2018).

as a site for CO_2 fixation. While the origin of life is a very difficult and complex problem, the construction of a narrative on the appearance of life on earth incorporating new findings at ELSI, perhaps termed “ELSI model,” will be a worthwhile goal.

2. Implementation as a WPI center

Interdisciplinary research: ELSI has truly remarkable and impressive achievements in fostering and producing deeply interdisciplinary research projects and publications. A diagram of the “topology” of connections among the researchers in the center would be so wide and valuable.

Internationalization: Around 50% of PI and researchers are from abroad suggesting that their internationalization is quite successful. A very healthy indicator of the level of the center’s internationalization is the fact that half of its papers’ coauthors are located in

overseas institutions.

System reform: It's great that President Masu called ELSI a model for Tokyo Institute of Technology (Tokyo Tech), but it is important to develop a systematic plan for translating this model to other programs and departments in the university. One example is ELSI's connection to graduate education of the host university.

3. Actions required and recommendations.

As for ELSI research it is now time to take stock of what the progress has achieved and set goals for the years ahead. This can best be done by revising and updating the ELSI's roadmap.

It is expected that the university's executive will support the educational relationship between ELSI and Tokyo Tech's departments.

Continued effort needs to be made toward increasing the number of women in senior research positions at ELSI.

G-3. ITbM

Center director: Kenichiro ITAMI

Program officer: Itaru HAMACHI, Kyoto University

1. Scientific achievements

ITbM continues to make impressive progress and has accomplished enormous scientific achievements. In fact, the number and quality of publication in high-impact-factor journals continue to be very high and the record of competitive research funds granted to ITbM's research members is also excellent. In term of a core ITbM project, the tackling of the parasitic plant Striga, advanced planning for a field study to test the efficacy of super- strigolactone (SPL7) in Kenya is currently underway, according to the roadmap toward its practical application in eradicating Striga in Africa. ITbM has also discovered other unique biomolecules, potential candidates of next flagship projects, such as stomata controlling

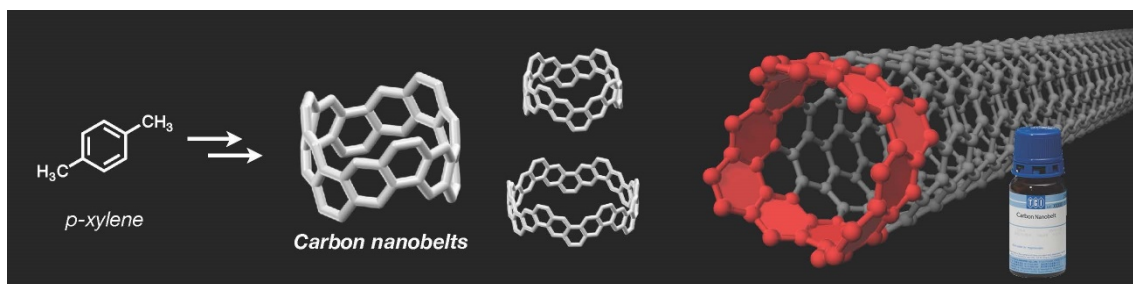


Figure: The first carbon nanobelt.

molecules, drug repositioning for jet lag and so on.

2. Implementation as a WPI center

Interdisciplinary research: The mixed-lab concept has become exceptionally successful in fusing (synthetic) chemistry and plant/chorono-biology with structural and computational research. The number of its joint papers and patents has dramatically increased.

Internationalization: Of the 13 PIs of ITbM, 5 are from abroad (38%) and 34% of researchers are from abroad overall. ITbM plans to organize the first EMBO workshop in Japan next year.

System Reform: It is welcome news that Nagoya University (NU) was appointed as “Designated National University” by MEXT in 2018. This should further strengthen the clear commitment of the NU administration to drive further systems change and facilitate dual bottom-up and top-down measures to increase research and education excellence. According to President Matsuo’s Initiatives for Reform, Autonomy and Innovation 2020 (NU MIRAI 2020), ITbM is positioned as a core research center, indicating that ITbM will continue to play a key role in the reform of the entire university.

3. Actions required and recommendations

ITbM should prepare a more strategic and concrete plan for maintaining its momentum for the long-term (10 years), including a plan after the support from the WPI program ends. ITbM needs thorough discussion about its future research direction including selection of transformative biomolecules next to SPL7, facilitation of target ID project and others.

NU and ITbM should cooperate to solve organization issues and make every effort for sustaining ITbM as a role model (institute) within the NU structure. The WISE Program (Doctoral Program for World-leading Innovative & Smart Education), a new MEXT program for which NU has now been selected, may be coupled with the system reform including ITbM.

H. Follow up on the 2 Centers Launched in 2017.

H-1. IRCN

Center director: Takao HENSCH

Program officer: Yo-ichi NABESHIMA, Foundation for Biomedical Research and Innovation at Kobe

1. Scientific achievements

By understanding the brain from a bottom-up approach, IRCN aims to elucidate the foundations of human intelligence at a deeper level. The three pillars of the center's research are establishing bottom-up principles of neural development, innovating AI technologies based on these principles, and unraveling mechanisms of neurodevelopmental and psychiatric disorders. The science is innovative and the center has a potential to be successful. However, IRCN needs to show a clear long-term plan, because the mile-stones and vision what they want to accomplish is vague. IRCN needs to make clear what advantages it has for tackling the last pillar since many laboratories and institutes are working on similar project.

2. Implementation as a WPI center

Interdisciplinary research: To understand human intelligence, IRCN has gathered excellent PIs. All PIs have made significant contributions to their respective fields. However, reported works in the site-visit meeting were quite diverse and appeared to be the extension of previous work. To overcome this situation, Dr. Hensch has developed several strategies to promote interdisciplinary collaboration and tight communication. Currently, many collaborations have started. However, it is not clear if the ongoing cross-collaboration will lead to the creation of a new field or merely result in the extension/expansion of the current work of each PI. The overall vision and goals of the center must be given and continually explained by the director.

Internationalization: IRCN has developed several strategies and various service systems for foreign researchers to establish an international research environment. Thus, work to establish an international research environment is proceeding well. However, the



Figure: Dr. Yokoyama in seminar

recruitment of foreign PIs is urgently needed. More foreign researchers, postdocs and female researchers are also needed.

System reforms:

Along with the internationalization

programs of UTokyo, UTokyo has promoted strategic investment of IRCN. In addition, Executive Director has proposed a “research ecosystem” that covers many aspects of research/education system. Working group expects that whole mindset of the Japanese research/education system can be changed by research ecosystem and reorganization program of UTokyo.

Effort to secure the center’s future development: President Gonokami promised to provide full support for IRCN. He explained three points, (1) an outline of IRCN at the end of WPI funding and (2) concrete strategies to secure enough research space and also explained (3) concrete plan to sustain IRCN after the WPI grant period ends. As for the sustainability of the center, ongoing support provided to IRCN by the UTokyo and President Gonokami’s statement are positive signs for the future of the center’s development.

3. Actions required and recommendations

- (1) Program committee has still concerns about Director Hensch’s effort and stay at IRCN. He has been making serious efforts to exert leadership and increase his stay at the UTokyo, but the effort and physical presence at IRCN are not yet at an adequate level. The program committee encourages him to keep the promised effort and to work towards the adequate level step by step.
- (2) With regard to the devotion to the IRCN project, IRCN has a big problem since all PIs and majority of researchers have substantial responsibilities to their host faculties and work at the WPI center only “part time”. IRCN is strongly encouraged to devote all PIs/research staffs to the IRCN project. System change is not easy to realize and cannot be done by IRCN alone without the support of the UTokyo headquarter. Breaking down the barriers between departments/faculties is one of the important goals of the WPI project and should be seriously considered.
- (3) The composition of the PIs in terms of their area of expertise may not be well-proportioned. This may need to be adjusted. The recruitment of young PIs and researchers is needed, particularly from the fields of psychiatric disorders and information science, to align the interests among researchers with the aim of the center.
- (4) IRCN seems to have made a good start. IRCN will be only successful if all researcher will be located at one site and the majority of PIs will work exclusively for IRCN. The program committee will carefully monitor on the scientific goals and strategy as well as the

leadership and progress as a WPI program.

H-2. NanoLSI

Center director: Takeshi FUKUMA

Program officer: Akihiko NAKANO, RIKEN

1. Scientific achievements

For the first year, NanoLSI appears to be on track and their research has performed reliable and good results. It is too early to see the success, but the scientific quality of PIs is judged very high. Bio-SPM technologies are already at the state of the art. Nanoendoscopy is an ambitious challenge, but their seriousness toward this effort is well understood. Under the excellent leadership of Dr. Fukuma, NanoLSI seems to be able to achieve fruitful results in the near future.

2. Implementation as a WPI center

Interdisciplinary research: NanoLSI has good plans for promotion of interdisciplinary research. Fusion of 4 areas, nanometrology, supramolecular chemistry, computational science and life science, is ongoing and the synergy has been established in a convincing

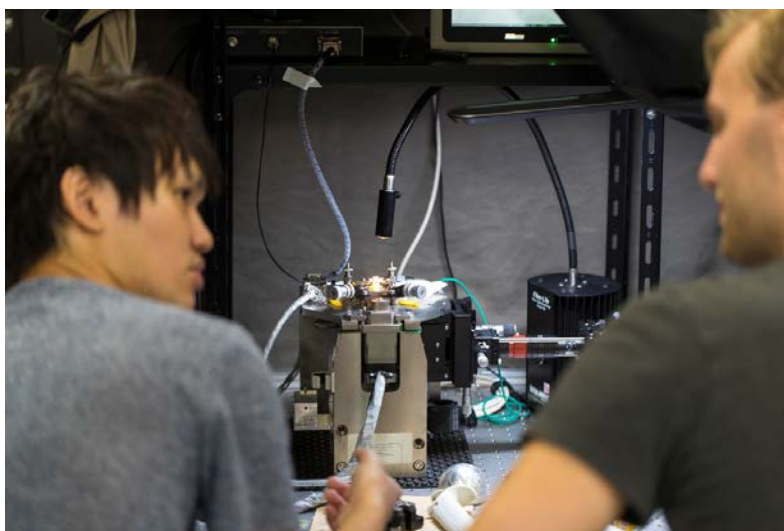


Figure: Snap- shot in Bio-AFM Summer School

way. They have moved together into two buildings and have a further plan to gather under a single roof, which will be helpful.

Internationalization:

They already have good activities for international cooperation. Their science has a high international visibility. The amount of

international researchers is increasing, but can increase further. NanoLSI should demonstrate some progress for the future, for example, exchange of postdocs and scientists as well as joint projects.

System reform: NanoLSI has already been regarded as an independent institution of

Kanazawa University. President Yamazaki is fully supportive and has provided much help on budget, tenured positions and space commitment.

3. Actions required and recommendations.

- Program Committee members mostly agree that NanoLSI has made a good start.
- The leadership of the center director is highly appreciated. Program Committee, however, felt a concern that the discretionary decision-making power of the director may be not sufficient. NanoLSI should be open to new strategic opportunities over the course of a 10-year grant.
- It is not too early to plan of sustainability after the end of the WPI financial support. NanoLSI should define the missions and milestones during the 10-year period. They will need to include industry beyond academics. At the same time, NanoLSI should stay as a top research institute, the key for which would be the balance between maintaining their own research to push the frontier of the science and technology versus providing services in order to attract revenue contribution. Collaboration with domestic and international institutes, which pursue more or less similar target, is also recommended.

I. New WPI Centers Launched in 2018

In FY 2018, the WPI program has expanded its activity by adding two new centers, following the addition of two centers, **IRCN** and **NanoLSI**, in FY 2017. As with previous calls for WPI centers, the focus was placed on basic research in the natural sciences and the fusion of research areas, while the creation of new domains was encouraged. Internationalization and system reform continue to be project pillars. In addition, it is explicitly requested that host institutions carry out reform of their own organization in parallel with the establishment of their WPI center. Funding in the amount of ¥700 million a year per center at most is provided over 10 years.

Thirteen applications were received for the screening in April and the following two centers were selected.

Institute for Chemical Reaction Design and Discovery (ICReDD), Hokkaido University.

Headed by Director Satoshi Maeda, ICReDD aims to develop a novel approach to design and discovery of chemical reactions through combination of computational, information and

experimental sciences, thereby establishing the new academic field “Chemical Reaction Design and Discovery (CReDD)”.

Institute for the Advanced Study of Human Biology (ASHBi), Kyoto University.

Headed by Director Mitinori Saitou, ASHBi aims to elucidate the core principles of human traits, including disease states, using multidisciplinary integrative strategies, creating a basis for developing innovative therapeutic opportunities.

These two WPI centers launched their research in October 2018.

J. Follow-up of WPI Academy centers

Follow up on the WPI Academy centers is conducted by the WPI Program Committee. In addition to the WPI centers’ four mission objectives (i.e., top quality science, fusion study, internationalization, and system reform), the following points are evaluated: (i) top-down management and swift decision making by the centers, (ii) proactive and sufficient effort made to enhance the WPI brand, (iii) international brain circulation, (iv) center support by the host institution, and (v) full cooperation by the centers in activities to disseminate WPI Program achievements.

For the purpose of carrying out the follow-up activities, the Academy Director (AD) and an Academy Officer (AO) for each center are appointed. The AD and AO visit the WPI Academy Center once every year to confirm the state of its operation. In addition to the AD/AO visit, the site visit will be organized once every three or four years to assess the center’s research level and operation. A site-visit working group will be assigned to each center, comprising the AO and about 3 Japanese and overseas experts. The PD and DPD may participate in these Academy site visits as observers. Based on a summary of the site visits reported by the AD, the Program Committee carries out a follow-up on the state of effort made by the Academy centers.

Follow up reports on WPI centers were reported in the program committee for evaluation. The committee appreciated for the efforts paid by the host institutions to sustain these centers.

In FY 2017, half-day visits were conducted of four centers, AIMR, iCeMS, IFRcC and MANA, from November 2017 to January 2018. The findings of the visits are as follows.

AIMR

AIMR is continuously led by the strong leadership of Director Kotani, challenging to create a

new field, mathematics oriented materials science. Their activities are at a high level in terms of publications and awards as well as in international and domestic collaborations. In spite of the termination of the WPI grant, AIMR has still kept about three-fourth of its personnel (180 in 2017 compared to 237 in 2016) thanks to the support of the host institution, Government, and the efforts of staff members. AIMR is now housed under a new framework, Organization for Advanced Studies (OAS) of Tohoku University.

iCeMS

Kyoto University supports iCeMS by providing positions for 8 PIs, 5 overseas researchers, 10 postdocs and 8 administrators under the framework of Kyoto University Institute for Advanced Study (KUIAS). Two young executive board members, vice-director Dr. Suzuki and PI board chair Dr. Furukawa, lead the research of iCeMS under the leadership of Director Kitagawa, which is identified as "Fundamental Cell-Materials Science". iCeMS is now actively collaborating with seven outside institutes; Japan (G-CHAIN), China (CLS), Thailand (VISTEC), India (NCBS, JNCASR, inStem) and US (CNIS). Although the size of researcher staff was reduced from 152 in 2016 to 84 in 2017, their scientific activity remains high.

IFReC

IFReC restarted smoothly after termination of the WPI grant. Their successful transition is due to the following three major factors. First, support of the host institution; second, the strong leadership of Director Akira; and third, long-term financial support by two pharmaceutical companies, Chugai and Otsuka. The support of these companies is unique in that they support basic research, rather than application, at IFReC, and their contract deals with a priority to know research outcomes of IFReC, rather than their collaboration. Total support will continue for 10 years with a budget comparable to the WPI grant.

MANA

After termination of the WPI grant, MANA has been maintained as an internal organization of NIMS (National Institute of Materials Science), its host institution, and now is responsible for basic research at NIMS using bottom-up approaches as one of NIMS' seven research centers. MANA used to study five research fields but is now focused on the three basic fields, i.e. Nano-materials, Nano-systems and Nano-theory. Although postdocs were reduced by 35% after the WPI grant ended, MANA still keeps 213 researchers, of which 45% come from abroad. The center director has changed from Aono to Sasaki.

K. WPI Academy and Its Activities

The WPI Academy was launched by MEXT in April of 2017. Its aim is to enhance and amplify the WPI brand and to play a vanguard role in internationalizing and reforming Japan's research environment by leveraging the WPI achievements attained so far. For this purpose, the Academy promotes networking among the various WPI centers' activities.

Membership

The WPI Academy centers are those certified to have reached "World Premier Status" by the WPI Program Committee and have promised to actively participate and collaborate in the activities for promoting the overall WPI Program and amplifying its achievements. The initial members of the Academy are the five WPI centers launched in 2007: AIMR, Kavli IPMU, iCeMS, IFRcC, and MANA.

Institute for Advanced Study

Most universities are structurally composed of departments, institutes, hospital, library and administration office etc. In addition to this traditional structure, the host institutions have created a new framework for housing the WPI Academy centers in their organizations, which is a sort of "Institute for Advanced Study," following a role model of the well-known institute in Princeton, USA.

These are

AIMR: Organization for Advanced Studies (OAS), Tohoku University

Kavli IPMU: The University of Tokyo Institutes for Advanced Studies (UTIAS), The University of Tokyo.

iCeMS: Kyoto University Institute for Advanced Study (KUIAS), Kyoto University.

IFRcC: International Advanced Research Institute (IARI), Osaka University.

(MANA: MANA is integrated within the National Institute for Materials Science (NIMS) as a center for basic research)

International brain circulation and related activities

The circulation of top researchers is an essential function of the WPI Academy centers as they work to advance research excellence. The WPI Academy centers carry out activities such as the operation of overseas satellites, invitation of PIs and researchers from abroad, programs for sending Japanese researchers overseas, and holding of international workshops and conferences. WPI Program Center in JSPS supports these activities carried out by the

WPI Academy centers.

Dissemination and application of WPI program achievements

WPI centers have accumulated considerable experience and know-how regarding the internationalization of research systems in Japan. This includes international researcher employment (e.g. advertisement, selection procedures, cross appointments), research environment and support to funding applications (MEXT-Kakenhi grant, etc.), daily life, emergency response (medical, natural disasters such as earthquakes), legal regulations, and many others. Their dissemination and sharing among research institutions is an important activity of the WPI Academy.

The WPI Program Center in JSPS opened an internet portal site for this purpose on October 2018 (<https://wpi-forum.jsps.go.jp/j-index>) and organized a workshop in collaboration with Research University Consortium on October 2018 in Tokyo. Ms. Maki Kubo, the former vice-president of OIST (Okinawa Institute of Science and Technology Graduate University) presented a key-note lecture on OIST's experiences of internationalization.

These activities were reported in the program committee. The committee appreciated for the efforts paid for dissemination and application of WPI program achievement.

Financial support to sustain WPI Academy centers

WPI funding provides support for basically for 10 years but can be extended for another 5 years for centers with exceptionally outstanding achievements. To date, only Kavli IPMU has been selected for the 5-year extension. The host institutions promise, when they apply for the program, to sustain their WPI centers after the termination of the WPI funding, but in reality it is very hard to sustain such large institutes using their own budget under the present severe financial situation confronting universities in Japan. Nevertheless, the host institutions of the four WPI centers have made every effort to sustain them.

MEXT provided three sources of funding to the activity of WPI Academy centers in FY2017: Support for global brain circulation through the JSPS budget, "The Program for Promoting the Enhancement of Research Universities" of MEXT, and subsidy on request of the host institutions, amount varying by institution.

In total, 100 to 200 million ¥ (approximately 0.9 to 1.8 million US \$) of funding is provided to the WPI Academy centers from the Government.

Further, each WPI Academy center has made considerable effort in obtaining the support via various sources:

- External research funding
- Collaboration with industries and research organizations.
- Fundraising through donations from public or private sources.

The most successful case of funding is that of IFReC which received a large amount of support from two pharmaceutical companies that exceeds the WPI grant. AIMR has started a close collaboration with RIKEN and AIST including personnel support.

In spite of these efforts, the annual budget of the WPI Academy centers has been reduced by about 50 % and research personnel by about 24% compared to what was fully supported by the WPI grant.

Branding and outreach

The WPI Academy is promoting the WPI brand through various channels. The WPI's continued participation in the annual conferences of the American Association for the Advancement of Science (AAAS) provides another platform for heightening international visibility of the WPI centers including the WPI Academy centers.

In previous years, WPI centers took turns in holding joint symposia oriented to the general public and young generation. A fresh title, "WPI Science Symposiums," has been adopted. This fiscal year's event was held in December 2018 in Nagoya under the title of "Transformative Science -Connecting research to change the world-", in which more than four hundred of high school students eagerly participated.

This activities were reported in the program committee. The committee appreciated for the efforts paid for dissemination and application of WPI program achievement.