

## 7-2 国際諮問委員会の答申レポート

### Response to the Advisory Report of IMSAC2019

July 01, 2021

Institute for Molecular Science

Institute for Molecular Science Advisory Council 2019 was conducted during the 4<sup>th</sup> year of the term of DG Maki Kawai. Along with the terms of references given as guidelines, IMSAC reported their findings and suggestions to DG in February 2020.

DG and all the members of the Institute are very proud to receive the approved comment from IMSAC that IMS is recognized as the research core of the molecular science community. We are grateful for the suggestions made in the Advisory Report and will sincerely work to improve IMS.

In 2020, the Japanese government conducted an inspection for the Inter-University Research Institutes, where IMS was asked to deliver a report of “Self-Inspection” along with the guide-line which was delivered during the IMSAC. We were asked to include the voice from the international community in our “Self-Inspection” and the corresponding part of the Advisory Report of IMSAC 2019 was delivered to our “Self-Inspection.” Our document of “Self-Inspection” was examined by the committee and IMS has received the response, which is called “External-Inspection” in January 2021. This response is also attached to the respective part of the document.

This document “Response to the Advisory Report of IMSAC 2019” is to clarify how IMS will work forward to reflect the suggestion from IMSAC. Some have already been overcome, while others may still need time to realize. We believe our response satisfies the member of IMSAC2019.

July 1<sup>st</sup>, 2021

Maki Kawai

Director General,

Institute for Molecular Science

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### Response to the Advisory Report of IMSAC 2019

Institute for Molecular Science Advisory Council (IMSAC) was conducted between 10<sup>th</sup> and 11<sup>th</sup> December 2019 at the Institute for Molecular Science in Okazaki, Japan. All the AC members and our Science Advisors, Prof. Hrvoje Petek and Prof. Atsushi Nakajima met in Okazaki. It was fortunate that we were able to conduct the AC on-site before the worldwide trapping of COVID-19 pandemic. Director General of IMS has received the report from IMSAC on 13<sup>th</sup> February 2020. The corresponding part of the report was reflected in the “Self-Inspection” of IMS delivered to MEXT in August 2020, followed by the examination by MEXT. The response of which was delivered in so-called “External-Inspection” in January 2021. “Response to the Advisory Report of IMSAC 2019” is meant to inclusively report the reflection as above and to how IMS makes use of the Advisory Report in our planning towards the future.

IMS appreciates IMSAC for their tremendous effort in carefully examining to understand the present status of the Institute and discovering our strength and weakness. The advice and suggestions given by IMSAC are valuable for us to settle the future direction of the Institute.

Four important findings of IMSAC were summarized in “5. Summary and Suggestions.” They are: 1) Concerning the importance of the UVSOR facility to IMS, a concrete mid- or long-term vision on the facility is indispensable, 2) Plan for the reform of the department structure, beforehand of the retirement of several full professors, 3) Accepting foreign researchers is a vital issue for increasing the presence of the Institute, <Hire non-Japanese professors>, and 4) IMS should change the management system for separating administrative work from the scientific activities of full professors.

IMS seriously understands the importance and will reflect the advice to our plan for the coming next mid-term. Since the sections in “4. IMS as the Inter-University Research Institute” cover all the points mentioned in the Advisory Report of IMSAC 2019 and correspond to the “External-Inspection,” according to the order of this Chapter 4., the details of our response to each point are described in [1] to [7] as follows.

In this Response	In <a href="#">Advisory Report of IMSAC 2019</a>
[1] Administration	4-1. Administration 5. Summary and Suggestions- 4)
[2] Core Institute to lead the community for Molecular Sciences	4-2. Core Institute to lead the community for Molecular Sciences
[3] Institute as an International Core	4-3. Institute as an International Core 5. Summary and Suggestions- 3)
[4] Research Resources	2-1. UVSOR Synchrotron Facility 2-2. Instrument Center 4-4. Research Resources 5. Summary and Suggestions- 1)
[5] Commitment to innovate new area of science	1. Science Activity of IMS 4-5. Commitment to innovate new area of science 5. Summary and Suggestions- 2)
[6] Cultivating personnel	4-6. Cultivating personnel
[7] Relation to Society	4-7. Relation to Society

IMSAC’s advice on “3. Revitalization Strategy Measured” is inevitable. AC advised to invite more distinguished professors to raise the IMS profile even higher, specifically to hire scholars from abroad in line with the good successful practice model of OIST. IMS acknowledges the practical suggestions given here. Although OIST is operated with a high standard of budget from the Japanese government which is one order of magnitude large compared to the domestic universities under the control of MEXT, IMS will learn their strategy of hiring scholars from abroad and will consider reflecting our management.

Hereafter our “Response to the Advisory Report of IMSAC 2019” quotes the section number of Chapter 4. of the Advisory Report. Following the Response, the brief English-translated summary from the “External-Inspection” originally written in Japanese by MEXT is attached.

## [1] Administration

AC appreciates the transparency of the administration and operation of IMS including the process of recruitment of researchers and faculties. In the meanwhile, AC noted the importance of IMS to set mid- to long-term strategic plans for future initiatives along with new directions and make priorities in the use of its resources, in order to enhance cooperative researches in IMS with outside scientists. They also suggested having an informal board of people to give thoughts on research areas to focus on.

We consider it is worth hearing the thoughts of an informal board on the strategic plans for future initiatives and steering the Institute along the line. We will discuss the possibility of planning such kind of informal board meeting on the mid- to long-term future perspectives of research strategies. On the other hand, we consider that another function of IMS is also important, to hire promising young scientists and provide a research environment to promote their talent, and to produce influential scientists back to universities and research institutes. To achieve that, it may be essential to open the personnel recruitment with the research areas as wide as possible. We consider that the balance between the two should be carefully managed.

AC pointed out that it is necessary to add one or more URAs who collect information and analyze statistics of the research fields and communicate with the science communities or funding agencies.

In the Research Enhancement Strategy Office and some other sections of IMS, a few URAs (or equivalent) are assigned. Some of them have Ph.D. degrees. They actually conduct collection of information and analysis, but further addition of URA staff is preferable. Basically, we may expect a URA to function as a professional person who not only collects information and analyzes statistics of the research fields but also takes charge of various activities such as negotiations with external organizations and budget acquisition, based on the information. To achieve that, we need to hire talented personnel and offer reasonable status and treatment commensurate with it. We need to discuss it, along with the issue of the personnel cost.

## [2] Core Institute to lead the community for Molecular Sciences

Recognizing the importance of IMS to continue to be the core institute to lead the community for molecular sciences, four points were noted by the AC.

Owing to the reduction of the budget in the national university, AC suggests supporting the shared use of standard equipment. Also, cutting-edge equipment and facility, which a university cannot manage, are essential to promote novel molecular science. We realize the situation of universities and thus the importance of upgrading the standard equipment for the purpose. IMS will continue to introduce large facilities for shared use, for example, we have installed an electron-beam lithography system in 2018 and a probe microscopy system in 2019.

AC points out the importance to discuss the benefit of UVSOR for cutting-edge research in addition to the common usage in the scientific field of chemistry by comparing it to other worldwide SR facilities. A momentum microscope recently installed in UVSOR will become one of the key instruments to lead the cutting-edge research of this facility.

AC concerns about the small number of scientists allocated in the Institute and strongly suggests the need for IMS to make a strategy to involve external scientists in the activities in IMS. Calling collaboration with universities and institutes is the most important activities with the community and we will keep encouraging. IMS started inviting external scientists as visiting professors to IMS by cross-appointment of three months per year for five years term from universities and institutes. We have one visiting Full Professor and one Associate Professor working in UVSOR in April 2021 and are planning to expand to other departments increasing the number in the coming years.

AC also points out to continue the discussion about the direction of IMS as the core research institute in the field of molecular science towards the success of the Institute for the next 50 years. A similar suggestion was made in [1] and thus the response is given in the respective section.

### [3] Institute as an International Core

IMS is delighted to know that its activities as an international core institute are highly recognized both by AC and by the External-Inspection committee. Since its foundation, the IMS system has enabled a lot of Japanese researchers both inside and outside IMS to make collaboration with foreign researchers as well as to hold international conferences. International joint research program, global use of facilities program, and international internship program have facilitated exchanges of human resources and ideas in a worldwide molecular science community. IMS also provides visiting professor positions to foreign researchers, typically for three to six months. However, this visiting scholar system is not actively utilized at the moment. Hence a suggestion has been made both by AC and by the External-Inspection committee that one or two regular faculty positions can be intentionally assigned to non-Japanese scholars. This is quite an important message in terms of both the diversity and international visibility of IMS. Although IMS has already started to make regular announcements of open positions to the international community, such proactive communication suggested by AC is needed in the next step. Therefore, IMS will take measures in the next term recruitment both for regular and visiting positions regarding the international laboratory operation. Probably this should be designed in combination with the recruitment for several full professor positions which will be available within the forthcoming five to six years. AC has also suggested implementing a sabbatical system in IMS, which is not at all active now, although an internal regulation has been already set up. This situation is connected with the heavy burden of full professors in IMS which has been pointed out in another part of the AC advice. IMS will start to discuss how to organize a queue for sabbatical leave in order to make the system real and to facilitate mutual human resource exchange with foreign institutes and universities

### [4] Research Resources

IMS will keep our four facilities and contribute to promoting molecular science worldwide. We realize the increasing demand for open-use facilities from the local universities. IMS will carefully observe the opinion of the community and tune the operation of our facility.

AC appreciates that IMS is operating large facilities such as the Research Center for Computational Science and the UVSOR light sources, that are not suitable for each university could maintain. As for the future perspective, AC suggests we discuss the future status of UVSOR.

#### **On UVSOR Synchrotron Facility:**

UVSOR Synchrotron Facility is a unique facility for low-energy synchrotron radiation (SR) light sources. The facility is quite old and is facing time to revitalize. Along with the advice from the AC and Prof. Umbach's assessment report, the UVSOR team has drafted their plan through the discussion with the user community.

Since 2017, the future direction of UVSOR has been discussed in multiple committees and working groups consisting of related domestic and foreign researchers. We are promoting the use of high-brilliance SR, UVSOR-III, which is rare internationally in vacuum-ultraviolet (VUV) photon range, by domestic and foreign researchers, and doing development and utilization of novel quantum-beam sources by accelerator researchers. In particular, the development of a photoelectron momentum

microscope, which is expected as next-generation spectroscopy, started in 2020. The strengthening of such “only one character” of UVSOR is positioned as the most important issue in mid-term plans.

Besides, as planned in the Master plan 2020 “Network of academic infrastructures in SR science,” three facilities (Photon Factory, Institute of Materials Structure Science High Energy Accelerator Research Organization, KEK; Hiroshima Synchrotron Radiation Center, Hiroshima University; UVSOR) will cooperate to advance the SR-related technology, working on joint research, and human resource development for the continuous development of SR science in Japan. The mid-term goal of UVSOR-III is to continue these activities over the next 10 years to harvest cutting-edge results. At the same time as maintaining the activity of advanced research, it is important to expand and strengthen the user community in the future, in particular, the SR-used research should expand to chemical and bio-related systems where the use of VUV radiation has not been widespread historically. Due to the COVID-19 pandemic, technological development of automation and remoteization, as well as standardization of equipment, is being promoted in various places, and UVSOR has also started R&D of related techniques as a short-term plan. This work is also an effective link to the proposition of expanding the SR-user community.

In the long term, now it is time to consider how to deal with the deterioration of the UVSOR against the sustainability of the unique activities. UVSOR could take a leading position in Japan which is required to support academic research using the low-energy VUV photons that the large-scale facility SPring-8 and the medium-sized facility Tohoku Ring (tentative) cannot cover. Through internal discussions at IMS, it was concluded that the construction proposal of the next UVSOR is important for satisfying such demands. Yet, the achievement done by the mid-term plan must be essential to realize the construction plan. From 2020, the examination of the concrete SR facility design and usage concept was started mainly by the in-house committee members. In the next, we will shift to the work of embodying the construction plan by hearing the opinions of SR users and disseminating it to the community.

#### **On Instrument Center:**

IMS will continue listening to the user’s voice and will pay attention to renew instruments that are necessary. Recent demand from local universities should be reflected in the arrangement. IMS performs a call for the renewal and demand for new instruments, annually that will be the base of the action.

#### **[5] Commitment to innovate new area of science**

AC appreciated the commitment of IMS to cultivate new fields in molecular science, and the validity of the IMS system to provide independent groups for young talented researchers. AC noted that IMS and its community should survey the activities of the research areas to plan future directions to cultivate.

With the retirements of several senior professors in another several years in mind, we will extensively discuss, in the Institute and with the community, the future plans of the research areas in molecular science, and accelerate planning the recruitment of PIs. All the recruitment will be opened internationally, and we will not hesitate to hire non-Japanese scientists if the candidate is excellent and meets the conditions.

#### **Science Activity of IMS**

IMS appreciates the careful examination and the cordial advice given by AC. We are planning to restructure the departments in the near future, where your advice to each of the present departments is precious and we will seriously take those into account.

**On Department of Theoretical and Computational Molecular Sciences:**

IMS acknowledges the AC's suggestions that the department does not miss the current wave of participation in the AI/Data Science world and that theoretical scientists are effectively embedded within topical experimental research groups.

IMS will reflect the idea of such integration of theory and experiments in consultation with project leaders and principal investigators. This is valuable for the interpretation of data in cutting-edge areas.

**On Department of Photo-Molecular Science:**

As pointed out by AC, the department has a limited number of groups at present. IMS will start planning to restructure the departments in the coming years and accordingly the recruitment of group leaders will follow.

**On Department of Materials Molecular Science:**

We appreciate the precious advice from AC to strengthen IMS from the materials science point of view. The way how to integrate the activity of IMS with our community outside the Institute is the key. We will seriously take the point into account upon the restructuring of the department.

**On Department of Life and Coordination-Complex Molecular Science:**

It has been advised in the past as well to reconsider the name of this department. We will take this seriously during the restructuring process.

**On Research Center of Integrative Molecular Systems (CIMoS):**

The Center represents one of the two research directions of IMS at present, together with CMS (below), appealing our thought by structuring the organization to MEXT that was necessary in the past. Our foci are to realize new molecular systems and to create or investigate new methodology to measure and understand the molecular systems with new functions.

**On Center for Mesoscopic Sciences (CMS):**

CMS represents another focus of IMS as described above. We set a second Research group starting from April 2021, accordingly to gradually strengthening the activity.

Upon our restructuring, IMS will consider an appropriate structure for the Institute.

**[6] Cultivating personnel**

AC appreciates the successful role of IMS in growing young researchers, specifically associate professors many of whom have been promoted to be full professors in decent universities and institutional labs. As was pointed out by AC, however, IMS has been struggling to have graduate students, and the decrease in the number of students in Japan would make the situation even worse.

AC encouraged improved flexibility of career paths for young scientists.

We will continue the discussion on further enhancement of the framework and the system that meet requirements for the establishment of a flexible career path, particularly for young researchers.

For the advertisement of the Institute, IMS has been providing multiple opportunities that students can experience research environments and facilities of IMS, *e.g.*, open campus, hands-on research activities, and so forth. In the past few years, we have been trying to reconstruct the programs so as to be more effective for recruiting highly motivated and talented graduate students. We will continue the efforts.

In terms of attracting international students, IMS has been developing networks with overseas institutions through the use of international internship programs, international joint research programs, and global use of facilities programs. Currently, a quarter of the students working at IMS are international. To recruit more international students who are motivated to do doctoral research at IMS, we will consider the further enhancement and substantive use of the networks. In addition, we have just started to re-examine the scholarships that are sufficient for international students to live in Okazaki.

AC recommends keeping high ability of technical staff, in the description on Equipment Development Center. We take the advice seriously and have recently revitalized the system for our technical staff. IMS will continue to facilitate to give them incentives.

#### [7] Relation to Society

We think it is significant to share our research topics with the general public to obtain their support for the institution, and AC appreciates our efforts through the public forum, “Molecular Science Forum” and the acceptance of group tours to show the research environment and facilities of IMS. We will analyze the effects of the current public relations activities and thereby develop new types of activities, *e.g.*, online events.

To contribute to society through solving practical issues by applying results of fundamental research at IMS, we established Division of Research Innovation and Collaboration and launched the TILA Consortium under the support from private sectors. To further the effort to connect the fundamental research to actual industry for open innovation, AC suggests IMS develop some industry incubator programs so that researchers can venture into making start-up companies. Related to the TILA Consortium, a venture company, LAcubed has been already established in 2019. As a future subject, however, we need further consideration to build a solid framework for making start-up companies.

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#### External-Inspection by MEXT

Opinion from MEXT received on January 2021

*Translated from Japanese to English by IMS*

#### General remarks

##### Excellent points

IMS appropriately reflects voices from the community to their management. Councilors, Senior Scientific Advisors, and Foreign Councilors are directly giving advice to the Director General, and the Liaison Committee of Scientific Societies to select external members of Councilors are considered as some of the good practice.

By prohibiting the internal promotion of researchers, associate professors and assistant professors have been transferred to universities and national institutes and have become core researchers in physics and chemistry faculty at national, public, and private universities nationwide. IMS has contributed to the cultivation of human resources in the field.

It is worth noting that excellent young researchers are being cultivated through various measures such as the Young Independent Fellow System, which gives young researchers within three years of obtaining an opportunity to preside over the laboratory.

### **Points that need to be improved**

IMS is a member of the Inter-University Research Institute Corporation that has to be operated with the corresponding science community and thus the Institute has to be managed in an open mind. Minutes of the Advisory Committee, which is the highest decision-making body of the Institute, and other conferences and committee meetings should be published properly. The same is true for the rules of the Institute.

In the field of materials science (chemical/materials field), which is considered as the growing field of Japan in the future, cooperation with the industrial sector is indispensable, and it is worth required to further strengthen and develop the efforts.

#### **[1] Administration**

The committee highly acknowledges the principle of IMS in prohibiting the internal promotion of researchers, with which IMS has been successful in contributing to the cultivation of human resources in the field by transferring associate professors and assistant professors as core researchers in physics and chemistry faculty of national, public and private universities nationwide.

#### **[2] Core Institute to lead the community for Molecular Sciences**

Within four years during the third term, 100 researchers have been transferred from the Institute, which is great. Since the foundation of the Institute, 46% of the people transferred from IMS became to be Professors, 28% became Associate Professors. Counting those transferred from Associate Professor of IMS, 81% are promoted to professors, a number of which is the proof that IMS greatly contributes to the circulation of human resources, and is the core base in this field in Japan.

In the third term, an average of more than 700 joint researches are conducted annually, and more than 300 papers are reported annually as a result of utilizing facilities, which is proof that IMS is the core base. It is also commendable that IMS has been in charge of coordinating important measures that lead the field of molecular science as the nanotechnology platform etc. as a core institute.

#### **[3] Institute as an International Core**

##### **Points that need to be improved**

It is commendable that international joint research is increasing, with international co-authored papers exceeding 37% from 2016 to 2019, and would like to expect IMS for further improvement as an international core research institute. Since 2016, IMS has been promoting international joint research and supporting internships and internationalization is in progress. IMS is considered to be a research institution with a high degree of internationality when viewed comprehensively. In order to clarify its internationality, IMS should make a benchmark to compare the activities with other international institutions. Also, it is necessary for IMS to work on increasing the number of laboratories presided over by foreigners.

#### **[4] Research Resources**

UVSOR, computational resources, and general-purpose measuring equipment are shared. UVSOR is a light source that covers long-wavelength regions, and in the third term, a total of 4,949 people contributed to 873 programs, reaching a shared usage rate of 87.5%. Of these, the international shared utilization rate of the facility's beamline BL4U (STXM) is 28%. Shared use



at the Research Center for Computational Science and Instrument Center is also operated to meet the needs of users. What is noteworthy about the number of the shared use of general-purpose equipment is that the national universities with priority support group 1 (community contribution type) are becoming the major users, and it can be seen that IMS is making a great contribution to local universities nationwide.

IMS allocates 37 technical staff to maintain the facility, and 34 staff to provide technical and administrative support related to joint use and joint research. Improving the treatment of technical staff and their career paths is an issue for Japan as a whole, but the expectation that IMS takes the initiative is high.

Nowadays the SR light source is considered as an infrastructure for academic research and industrial use. UVSOR was built many years ago and its facilities are aging. Discussions have been held on the future direction of the SR facility both domestically and internationally, and upgrade of the facility and nurture human resource are being promoted. While further accelerating these efforts, the expectation of UVSOR to develop as a facility with unique strengths is high.

#### [5] Commitment to innovate new area of science

IMS has contributed to creating many new research fields by its researchers and also through joint research, and is considered to be an institute that delivers a high level of research in interdisciplinary and integrated fields.

Since IMS prohibits internal promotion, 66% of faculty members are young researchers, and the opportunity to preside over the laboratory to young researchers within three years after obtaining a Ph.D. degree under the Young Independent Fellow System is appreciated.

#### [6] Cultivating personnel

##### **Excellent points**

Associate professors and assistant professors have been transferred to universities and national institutes and have become core researchers in physics and chemistry faculty at national, public, and private universities nationwide. IMS has contributed to cultivating human resources in the field.

In particular, the fact that many young researchers have received awards from related academic societies is proof that young researchers are well nurtured in the Institute. This is also clear from the fact that the number of projects to be implemented in the PRESTO Strategic Creative Research Promotion Project of the Japan Science and Technology Agency (JST) has been steadily increasing from four to five, six and ten cases in the four years of the third term.

It is noteworthy that IMS is conducting the research at a high level and succeeding in developing human resources.

##### **Points that need to be improved**

The number of foreign students is about a quarter at present, it would be nice if IMS could increase it a little more.

#### [7] Relation to Society

##### **Excellent points**

Through websites, press releases, public lectures, and research institutes, IMS is actively making efforts to disclose research content to the general public, and it can be said that the number of participants and viewers is also high.

LAcubed Co., Ltd. was established as a venture company, and sales in FY2019 were 14.72 million yen, delivering the application

of laser technology. As for IMS as a whole, the number of patents acquired in the four years of the third term was 36 (including 17 overseas), and the number of patents held in FY2019 was 87 (including 32 overseas). Patent fee income is 8.21 million yen, which exceeds the patent acquisition and maintenance cost of 5.68 million yen.

IMS has newly established the “Division of Research Innovation and Collaboration,” an open innovation base that operates collaboration with external organizations including private companies and local cities. It is working to foster researchers, including those in the private sectors, and promotes the mobilization of human resources through industry and academia. In addition, it is commendable that IMS is actively promoting the use of facilities by the private sector. Collaboration with industry should be further promoted.