

7. 点検評価と課題

2017年度より Hrvoje Petek 教授（ピッツバーグ大学）と中嶋 敦教授（慶應義塾大学）を研究顧問としてお招きし、所全体の研究評価、研究体制についての提言をいただいた。

2020年度は、文部科学省が新たな機関評価の方式を設定したのに基づき、8月に「自己検証報告書」を提出し、それをもとに外部有識者による「外部検証」が実施され、その結果が2021年1月に公表された。

2019年に実施された国際諮問委員会による点検評価結果は、海外からの委員を含めた検証結果として上述の「自己検証報告書」に反映された。これらの経緯を踏まえ、国際諮問委員会からいただいた提言やご指摘に対して、2021年6月に分子研としての回答を提出した。ここでは、自己検証報告書および外部検証結果の概要とともに、国際諮問委員会への回答書を掲載した。

2019年12月の国際諮問委員会から始まった研究所に対する一連の点検評価結果は、2022年4月からの次期計画へ反映すべく、自然科学研究機構における次期研究目標及び計画の策定への反映に取り組んでいる。

(川合真紀)

7-1 大学共同利用機関の教育研究等の検証

2020年3月に文部科学省では、第4期中期目標期間における大学共同利用機関のあり方に関する議論に基づき、中長期的な構想に基づく学術研究推進の観点から、大学共同利用機関が学術研究の動向に対応しているか、学術の発展に寄与しているか、我が国の研究力向上に資するものとなっているかを検証することとしている（6年ごとの実施を想定）。この方針に基づき、2020年8月に各機構からの自己検証報告書の提出を求め、それに対して9月から12月にかけて外部検証を行い報告書を提出することとなった。外部検証は、「研究環境基盤部会大学共同利用機関改革に関する作業部会の委員を中心に、専門性や分野融合等に配慮し所要の有識者を加える体制」で、特定の大学共同利用機関に直接の利害関係を有しない者で構成する「委員会で行うこととされた。

検証にあたっては、「大学共同利用機関として備えるべき要件」が7点設定され、それぞれに対して「主な観点」と「指標例」がいくつか示されている。指標は定量的なものとは限らない。「備えるべき要件」は以下のとおりである：<運営面><中核拠点性><国際性><研究資源><新分野の創出><人材育成><社会との関わり>。それぞれの「備えるべき要件」に対して3～6項目の「主な観点」が示されており、その中には自己検証に際して必ず評価すべき項目と、選択して評価する項目がある。

これらの検証におけるガイドラインの詳細は、以下のwebページに掲載されている。

https://www.mext.go.jp/b_menu/shingi/gijyutu/gijyutu4/010/toushin/mext_01137.html

https://www.mext.go.jp/b_menu/shingi/gijyutu/gijyutu4/010/toushin/1382719_00001.htm

以下では、上記のガイドラインに沿って作成した自己検証結果報告書、及びそれに対する外部検証結果の、分子研部分の要点（自己検証結果報告書の「全体概要」、及び外部検証結果の「総合所見」）を示す。全文は参考資料として第9章に添付する。

自己検証結果報告書

全体概要

分子科学研究所は、分子科学分野の中核研究機関として(1)学術研究の推進、(2)若手研究者の育成、そして(3)共同利用・共同研究の推進を、研究所が果たすべき3つの柱と位置付けて国内外の分子科学研究を牽引してきた。

研究組織は、4研究領域（理論・計算分子科学、光分子科学、物質分子科学、生命・錯体分子科学）と領域を繋ぐ2つの研究センター（協奏分子システム研究センターとメゾスコピック計測研究センター）からなり、分子科学の研究基盤を構成している。加えて、自然科学研究機構に設置されている生命創成探究センター（ExCELLS）に人員を供出して、分子科学の観点から同センターの運営に寄与している。研究を支援する施設としては、極端紫外光研究施設（UVSOR）、計算科学研究センター、機器センター、装置開発室を擁し、各施設の運営は、技術部門に所属する技術職員と研究者との協力で成り立っている。

I. 運営面

分子科学研究所の運営は、研究所の現状の評価及び将来計画への提言を旨とする顧問（運営顧問、研究顧問、外国人運営顧問）、研究教育職員の人事、共同利用・共同研究等研究所の運営に関する重要事項について、所内外の委員で構成される運営会議、そして所内の教授及び准教授（客員を含む）から構成される教授会議が所長の諮問に

応じる会議体を構成する。さらに、中期計画中期には、運営顧問を中心に現況の評価及び将来計画に対する意見聴取を行う。今期については、2019年12月に分子科学研究所 国際諮問委員会を開催し、本自己検証に関係する評価及び提言をいただいた。

顧問は全て外部の者で構成される（総計8名）。評価結果は、研究所の運営に反映すると同時に、研究者に対しては所長裁量経費としての毎年の配分額に反映される。運営会議（外部10名、内部11名）は、分子科学及びその関連分野の学術研究者から構成される。顧問及び運営会議の委員は所内外比11:18の構成である。

研究不正・会計不正等防止のための措置として、岡崎3機関等不正使用防止計画推進室会議による自己点検を実施しているほか、自然科学研究機構に設置されている機構不正行為防止委員会の活動により、適切なコンプライアンス確保に向けた体制は整備されている。

II. 中核拠点性

分子科学分野を牽引する教職員で構成され、当該分野を牽引する研究所として十分な実績を挙げている。分子科学分野及び関連する科学分野の優れた成果を顕彰する学会賞を多く受賞している。特に若手の研究水準の高さは当該分野で国内随一である。

分子科学分野の中核的研究所として、研究所創設以来多くの中核研究者を大学や研究所に輩出し、人的基盤の拡充に寄与してきた。分子科学分野の旗艦研究所として、卓越教授制度を設け先鋭的な分子科学研究を支援すると同時に、分子科学分野の中堅人材の育成を目指すために、大学などに所属する教員に対してクロスアポイントメント制度により一定期間研究に専念する時間と環境を提供するなど、分野の総合的な発展に寄与している。また、我が国の大型プロジェクトの代表機関として、全国の大学教員の活動の取りまとめを支援している。

共同利用・共同研究の実施件数はいずれも研究施設規模に見合う数字である。共同研究の成果は査読付きの論文として公表されており、実施状況は良好である。施設利用については、公表される論文中に分子科学研究所の果たした役割への記載が十分ではないケースがあり、今後は利用成果についても把握に努める必要がある。

III. 国際性

所外の研究者の申請を可能とする様々な国際研究集会を支援している。毎年1～2件開催される「岡崎コンファレンス」は分子科学分野のトップレベル研究者を国内外から招聘し、分子科学分野の重要課題について国内研究者との交流を促進している。さらに海外機関と国際交流協定を結び、インターンシップなども含めた幅広い世代の人材交流を推進している。研究顧問（国内機関1名、海外機関1名）、外国人運営顧問2名、外国人客員教授等による毎年の研究者評価・運営に対するアドバイスが適切に実施されているほか、今中期計画中期にあたる2019年度は国際諮問委員会による研究所の評価と将来計画へのアドバイスをいただいた。

研究所の各部署には、英語で職務遂行が可能な職員を配置し、所内文書は全て日英併記である。共同利用・共同研究に参加する外国人研究者に対し、来所前後いずれも技術面・生活面で必要な支援が得られるように体制が整えられている。2016年以降、所内人事は全て国際公募である。

IV. 研究資源

先端的な計測機器や加工装置群に加えて、放射光施設である極端紫外光研究施設（UVSOR）、岡崎3機関共通施設の大型計算機施設である計算科学研究センター等を擁し、これらを全国の共同利用や国を超えた国際共同研究に

開放して、コミュニティの研究展開に寄与している。年間 600 件近い共同研究・施設利用が実施されており、2,000 名以上にのぼる所外の研究者が来所し、その成果として、年間あたり 300 報を超える研究論文が発表されている。

大学連携研究設備ネットワークによる設備相互利用の促進事業、ナノテクノロジープラットフォーム事業「分子・物質合成プラットフォーム」、ポスト京の重点課題「エネルギーの高効率な創出、変換・貯蔵、利用の新規基盤技術の開発」などの代表機関・責任機関として他機関と連携しながら、施設、設備等の整備・共同運用を行っている。

各共同利用施設に適切に教員、技術職員、事務職員が配置されているほか、共同利用・共同研究を全体的に支援するための事務部署が設置されており、共同利用・共同研究を支援する体制が十分に整備されている。

V. 新分野の創出

学際的・融合的領域における研究実績は、分子科学分野及び周辺研究分野を対象とした学術・技術賞を多くの職員が受賞している事に現れている (II. 中核拠点性の項目を参照)。また、外部機関所属の研究者による共同利用・共同研究の研究実績は高く評価されている (IV. 研究資源の項目を参照)。研究所は創設以来、次世代の分子科学分野を創出することを重要なミッションとしてきた。研究室主宰者(教授、助教授あるいは准教授)の選考にあたっては、独創的な研究提案を重視して人事選考を実施してきた。また、内部昇格を禁止して、研究所における研究領域の固定化を回避し、研究分野の流動化を促すとともに、転出した研究者が在籍時に創出した研究を大学等で更に発展・展開させることに寄与している。

研究組織を適切に見直し、研究分野の流動化に対応させている。2000年に設置した岡崎統合バイオサイエンスセンター、それを発展的に廃止して2018年に新設した生命創成探究センターに参画した。2019年度からはクロスアポイントメント制度を活用し、他大学の研究者が所内研究者と連携して新たな研究展開を目指す研究活動を行っている。この他、分子科学研究所が主体となり、国内の5つの物性科学関連研究拠点が共同して新たな研究領域の発展を目指す「物性科学連携研究体」の構築を目指した活動を開始している(学術会議マスタープラン2020に重点大型研究計画 No. 22として記載:<http://www.scj.go.jp/ja/info/kohyo/pdf/kohyo-24-t286-1-p1.pdf>, 自然科学研究機構概算要求事項)。

VI. 人材育成

総合研究大学院大学の基盤機関として大学院教育を実施すると同時に、関連する大学の要請に応じて特別共同利用研究員として大学院生を受け入れ、次世代の分子科学を担う研究者の育成に取り組んでいる。修士課程を含む全ての大学院生に対してリサーチアシスタント(RA)として経済支援を行っている。また、共同利用研究の申請事項の一つとして「若手研究活動支援」を設置するなど、主体的かつ積極的に分子科学分野の後継者の育成に取り組んでいる。

分子科学研究所では、創設時から内部昇格を禁止することで高い流動性を保ち、コミュニティに多くの人材を輩出してきた。今中期計画期間中にすでに准教授8名、助教23名とおおよそ半数の教員が転出している。独立した研究グループを主宰する准教授の採用は、28歳から38歳の若手研究者を登用し、現在、本務教員の66%が44歳以下である。また、外国人研究者14名(助教2名、特任助教1名、博士研究員11名)が在籍しており、海外研究者を含む若手研究者の採用や育成に積極的に取り組んでいる。

女性研究者は現在11名(所長1、准教授2、助教2、特任助教1、研究員5)が在籍しており、全教員・研究員数の10%に相当する。男女共同参画推進への取り組み、特に子育て・介護中の研究者に対する支援として、構内に保育園を設置しているほか、ライフステージに合わせた柔軟な就労制度の更なる拡充を進めている。

VII. 社会との関わり

ホームページやプレスリリースによる研究成果の広報活動を進めている。さらに、市民公開講座や研究所一般公開、希望団体への研究施設の見学対応、岡崎市観光協会と連携した各種市民向けイベントへの協力を通じて、市民への広報活動を強化している。スーパーサイエンスハイスクール事業への協力、小・中学校の理科教員を対象としたセミナーの開催、職場体験学習の生徒受け入れ、国際化学オリンピックへの協力など、岡崎市内及び近隣の小学校から高等学校までの様々なレベルでの理科教育に協力して地域社会と連携している。

岡崎商工会議所と連携して隔年開催されるイベントで展示ブースを設置し、地域の民間企業による施設利用促進を図っている。2019年度からは複数の民間企業など外部機関と連携し運営するオープンイノベーション拠点「社会連携研究部門」を新設した。社会実装が求められる先端的な小型固体レーザーの研究開発を強力的に推進し、社会人を含めた研究者育成及び産学を交えた人材流動化の促進に取り組んでいる。また、文部科学省ナノテクノロジープラットフォーム事業及び大学連携研究設備ネットワークによる設備相互利用の促進事業の拠点として、民間企業の施設・機器利用を積極的に受け入れている。

自由記述

【概要】

研究者が研究と教育に専念できるよう、事務の効率化及び事務作業の分業化を推進している。研究力強化戦略室を設け、研究所の運営に係る事務作業を担っている。評価・将来計画、共同研究、国際、施設、広報に担当教員を配置すると同時に、人事管理、評価・研究支援、国際、情報発信を担当する URA 職員を雇用して関係する作業を実施している。

会議の効率化の一例として、毎月開催することが規定されている対面で行う教授会議を原則年4回の季節開催とし、審議を必要としない報告事項はホームページに掲載あるいは、メールなどで通知することとした。所内会議及び、岡崎3機関に共通の委員会を大幅に整理し、職員の時間効率の改善を図っている。

外部検証結果

総合所見

分子科学分野の中核的研究拠点として質・量ともに顕著な研究成果を上げているほか、人材育成の面でもコミュニティの活性化に大きく貢献しており、自己検証のとおり、大学共同利用機関として備えるべき要件に照らして十分な活動を行っていると思われる。

多くの海外研究機関が予算や人員を拡充している中、国際的研究競争力を維持するためにも、安定的な財源はもとより、関係する研究機関との一層の連携強化を図り体制の充実が求められる。

(優れた点等)

○分子科学分野の中核拠点として、質・量とも十分な研究成果を上げ、分野をけん引している。また、学際的・融合的領域においても高い研究水準にある。ナノテクノロジープラットフォーム事業の実施機関としても研究コミュニティの活性化に寄与している。

○研究者の内部昇格を禁止していることにより、准教授・助教が全国の国公立大学の物理化学教員などとして転出して中核研究者となっており、分野への人材輩出においても貢献している。

○学位取得後3年以内の若手研究者に研究室を主宰する機会を与える若手独立フェロー制度等の様々な施策により、優れた若手研究者が育成されていることは特筆に値する。

○外部有識者から構成される運営顧問、研究顧問、外国人運営顧問からの助言・評価の他、学会等連絡会議からの意見を適切に運営に反映させている。

(課題、改善を要する点等)

○共同利用課題の審査における所外委員の割合について早急に改善が必要である。

○国際共著率は40%程度と高いが、国際的な中核研究拠点として、更なる向上を目指してほしい。また、同様の国際拠点との比較のためベンチマークの資料を自己検証で示すべきではないか。

○今後の日本の成長分野である新材料分野(化学・素材分野)では産業界との連携が不可欠であり、今後、取組を更に強化、発展させることが求められる。

○海外の研究機関の予算や研究者が増える中で、専任教員数が減少していることから、現在の国際競争力を維持することができるよう財源強化が必要である。

○大学共同利用機関はコミュニティが一体となって運営に当たる組織であり、各種会議の議事録、規則などは適切に公開されるべきである。

(その他)

○国内では関連分野の大学の共同利用・共同研究拠点や理化学研究所などとの連携強化の具体策を検討し、その遂行により日本の分子科学を含む、物質・材料・物性科学等マテリアル分野の発展を更に推し進めることを期待したい。東京大学物性研究所、京都大学化学研究所、東北大学金属材料研究所、SPring-8、KEK物構研、物質・材料研究機構等と物質科学研究をネットワーク化することで関連研究分野の発展と国際的な存在感の大幅な改善があり得るのではないか。

○分子研の優れた取組と活動をクロスアポイントメント制度等も活用して更に全国的に展開し、今後も促進してもらいたい。

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 4th 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 1st, 2021

Maki Kawai

Director General,

Institute for Molecular Science

Response to the Advisory Report of IMSAC 2019

Institute for Molecular Science Advisory Council (IMSAC) was conducted between 10th and 11th 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 13th 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 Advisory Report of IMSAC 2019
[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.

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.