World Premier International Research Center Initiative (WPI)
Activities Report of the WPI Academy Center
(FY 2021 – FY 2024)

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Research Center	Institute of Transformative Bio-Molecules		
Center Director	Takashi Yoshimura	Administrative Director	Tsuyoshi Matsumoto

Common Instructions:
* Unless otherwise specified, prepare this report based on the current (31 March 2025) situation of your Center.
* Use yen (¥) when writing monetary amounts in the report. If an exchange rate is used to calculate the yen amount, give the rate.
* Prepare this report within 10 pages (excluding the appendices, and including "Summary of State of WPI Academy Center Progress" (within 2 pages)).

Summary of WPI Academy Center's Activities (write within **2 pages**)

ITbM's mission is to conduct "needs-inspired" basic research and develop transformative biomolecules that will significantly impact the field of biological science and technology. By marrying state-of-the-art synthetic chemistry, catalytic chemistry, plant biology, animal biology, live imaging, theoretical science, and data science, ITbM has advanced new research areas.
ITbM has been exploring the research fields of (1) Chemistry-enabled plant adaptation, (2) Parasitic plants, (3) Chemistry-enabled bioimaging, (4) Nanocarbon chemistry and biology, (5) Clock-disease. In 2022, ITbM added (6) Climate change resilience to expand its scope.

The achievements of 2021.4-2025.3 (papers: 2021.1-2024.12)
- Journal publications: 556 papers (172 papers = IF>10; 246 papers = IF>7; 14 highly cited papers (Top 1%); 6 hot papers (Top 0.1%), 177 international collaborative papers)
- Patent application: 58 (incl. 31 cases co-filed among several research groups)
- Patent license agreement: 20
- Collaborative research with industries: 69
- Commercialization of molecules/catalysts for research: 5
- Sum of external research funds (4 years): 3.5 billion JPY

As of the end of FY2024, ITbM has 54 researchers including 17 PIs (12 NU PIs, 5 overseas PIs). The 5 overseas PIs have Co-Principal Investigators (Co-PIs) who are based at NU and practically manage the overseas PI groups in ITbM. Non-Japanese and female researchers accounted for 30% and 31%, respectively. Recent academic promotion of ITbM's faculty members has brought about ITbM's natural generational shift.

The 5 world-leading overseas PIs and postdoctoral researchers from abroad have contributed greatly to ITbM's research activities and internationalization. In 2022, the overseas PI groups were officially allowed to have PhD students of Graduate School of Science, and their research activities has been accelerated. Whereas ITbM has Florence Tama as a non-Japanese PI full-time at NU, ITbM newly set non-Japanese Junior PI positions in 2022 via financial support of NU, and appointed Anuphon Laohavisit and Quan Phung in 2022.

From 2021 to 2024, ITbM published 556 papers and collected research funds of 3.5 billion JPY. Two or three PIs have been selected as "Highly Cited Researchers" by Clarivate Analytics every year, and two overseas PIs, Torii and Frommer, have been elected as members of the National Academy of Science in 2024. These achievements represent the high profile of ITbM research outcomes.

To encourage interdisciplinary research, ITbM's installed Mix Labs and Mix Offices as places where new unique ideas in research are being generated based on daily communications among researchers from different fields working side-by-side. In addition, various initiatives have been implemented. ITbM

Research Award fosters interdisciplinary collaboration among young researchers and students. ITbM Workshop is held regularly to share research progress and to provide an opportunity for new collaboration in ITbM. ITbM Tea Break Meeting provides an opportunity for casual discussions and has been slightly modified to include seminars by young researchers, especially those who have recently joined ITbM, which helps them devise new research plans and launch collaborative research. ITbM has 4 centers (Live Imaging Center, Chemical Library Center, Molecular Structure Center, and Peptide Protein Center) to provide research platforms, which have been making remarkable contributions as hubs for the promotion of ITbM's interdisciplinary collaborative research.

In 2018, a new graduate program "Graduate Program of Transformative Chem-Bio Research (GTR)" was established as a MEXT "Doctoral Program for World-leading Innovative & Smart Education (WISE)" with ITbM at its core. The GTR program received high evaluations, and received the highest score of "S" in its final evaluation in March 2025. Although the seven-year program support ended in March 2025, NU continues the program.

ITbM actively engages in societal implementation of research results. As represented by the development of parasitic plant striga eradication molecules, a number of socially implementable results have emerged regarding such as environmental adaptation in plants. To accelerate the collaboration with industries, ITbM has been organizing a membership discussion forum ITbM/GTR Consortium.

ITbM has been functioning as a global talent pool. Since 2012, ITbM has hired 149 postdoctoral researchers from over the world, in which 88 (60%) are non-Japanese. Among them, 91 found faculty positions in academia in Japan and overseas.

ITbM's Administrative Department consists of 3 divisions: Management Division, Research Promotion Division (RPD), and Strategic Planning Division (SPD). The RPD & SPD have individuals with specialized skills, such as a science designer and a patent attorney. The Department consists of staff who are proficient in both English and Japanese, enabling non-Japanese researchers to begin their research immediately. ITbM has been hosting annual international symposia (ISTbM) and international awards (Tsuneko & Reiji Okazaki Award, Hirata Award, Nagoya Medal of Organic Chemistry). ITbM faculty members have also organized various international symposia/workshops/summer school, which have contributed to increasing ITbM's international visibility and extending international network.

NU has provided full support for the development of ITbM. ITbM is positioned as a flagship research institute in NU, and NU increased its financial support to secure almost all the faculty members and staff. Consequently, the number of publications and research funding has remained at the same level as during the WPI grant period.

In the process of perpetuating ITbM, NU established Nagoya University Institute for Advanced Study (NAIAS) as an organization to strengthen the Nagoya University's advanced basic research further, and positioned ITbM under this umbrella. NU's Institute for Advanced Research (IAR), which implements next-generation research support programs of NU such as WPI-next, was also placed under the NAIAS, and the know-how accumulated at ITbM is horizontally deployed.

ITbM is aware of researchers' responsibility to avoid any research misconduct. ITbM examined the recent case of the research misconduct, and took measures to ensure to prevent any research misconduct. In cooperation with NU, ITbM made organizational reforms in 2022 under the leadership of the director Yoshimura with the slogan of "openness, transparency, and inclusion" to ensure that research misconduct would never occur. ITbM seized this opportunity to further develop the organization by expanding interdisciplinary research and enhancing its research capabilities.

* Describe clearly and concisely the progress being made by the Center from the viewpoints below.
- In addressing the below-listed 1-8 viewpoints, place emphasis on the following:
  (1) Whether research standards and operation of the Center is maintaining a "world premier" status.
  (2) Whether the Center participate and cooperate to the activities to advance the overall development of the WPI Program and to promulgate its achievements.

1. Overall Image of Your Center

・Describe the Center's current identity and overall image.
・ List the Principal Investigators in Appendix 2, diagram the Center's management system in Appendix 3-1, enter the number of center personnel in Appendix 3-1a, and enter center funding in Appendix 3-2.

ITbM is an international research institute established at Nagoya University (NU) to develop "transformative bio-molecules" that make a marked change in the form and nature of biological science and technology. ITbM gathers world-leading researchers in the fields of synthetic chemistry, biology, theoretical science, and data science, and they work together to conduct interdisciplinary research. As of the end of FY2024, ITbM has 54 researchers including 17 PIs (12 NU PIs, 5 overseas PIs) and 4 center chiefs. Non-Japanese and female researchers accounted for 30% and 31%, respectively. The 5 overseas PIs have Co-Principal Investigators (Co-PIs) who are based at NU and practically manage the overseas PI groups in ITbM, and implement the overseas PIs' research at ITbM. In addition, 7 Co-PIs have been allocated to the NU PIs through NU's financial support, which enables the NU PIs to focus on their research. Recently, academic promotion of ITbM's faculty members including the Co-PIs has been increasing, bringing about ITbM's natural generational shift.

The ITbM has 4 centers (Live Imaging Center, Chemical Library Center, Molecular Structure Center, and Peptide Protein Center) to provide research platforms, which have been making remarkable contributions as hubs for the promotion of ITbM's interdisciplinary collaborative research.

To further encourage interdisciplinary research, ITbM established the Mix Lab and Mix Office where researchers and students from different fields are sitting side-by-side and naturally have discussions based on a flat relationship irrespective of their titles. ITbM implements measures to promote bottom-up collaboration, such as ITbM Research Award, ITbM Workshops, and ITbM Tea Break Meetings (Section 3).

ITbM extends its global network to further advance its interdisciplinary research through extensive collaboration. With the cutting-edge research outcomes, ITbM is now widely recognized as an international research hub of chem-bio research. ITbM is positioned as a flagship research institute in NU, and has induced system reforms at NU.

ITbM proactively nurtures PhD students who can pioneer new science at the interface of multiple disciplines. In 2018, a new graduate program "Graduate Program of Transformative Chem-Bio Research (GTR)" was established as a MEXT "Doctoral Program for World-leading Innovative & Smart Education (WISE)" having ITbM as its core. Concurrently, the Graduate School of Science of NU made a system reform and officially allocates PhD students also to ITbM's overseas PI groups from FY2022. The GTR program received high evaluations, and received the highest score of "S" in its final evaluation in March 2025. Although the seven-year program support ended in March 2025, NU continues the program.

NU has provided full support for the development of ITbM. After the WPI grant support was completed, NU increased its financial support, thus securing researchers and staff for ITbM (see Section 7). NU also provided additional support to hire new and junior PIs in fiscal year 2022, including a young non-Japanese researcher. Consequently, the number of publications and research funding has remained at the same level as during the WPI grant period.

ITbM actively engage in societal implementation of research outcomes. As represented by the development of parasitic plant striga eradication molecules, a number of socially implementable results have emerged regarding environmental adaptation in plants. ITbM will continue and accelerate these researches. ITbM has been organizing a membership discussion forum "ITbM Consortium" since 2017 to provide matching opportunities with industries, which was revamped in 2020 as "ITbM/GTR Consortium" and incorporated a wider range of researchers who engage in the GTR program.

ITbM has become an exciting and internationally visible institute where new interdisciplinary research fields emerge and new molecules are discovered daily. Meanwhile, we sincerely examined the recent case of the research misconduct, and took measures to ensure to prevent any research misconduct. ITbM took this as an opportunity to further develop our research, and have been expanding ITbM's unique "Mix" by integrating a wider range of disciplines. ITbM's unique "Mix" culture encouraged researchers from various research fields to collaborate across disciplines, discover unique problems and solutions, and provide innovative solutions to key global problems.

2. Advancing Research of the Highest Global Level

・Describe what's been accomplished in the Center's research objectives and plans.
・In Appendix 1, list the papers underscoring those research achievement and list the Center's research papers published in 2021-2024 in a manner prescribed in Appendix A.

Yoshimura assumed the ITbM director's post in April 2022. Under the leadership of the new director, ITbM made organizational reforms in cooperation with NU with the slogan of "openness, transparency, and inclusion" to ensure that research misconduct would never occur. ITbM seized this opportunity to further develop the organization by expanding interdisciplinary research and enhancing its research capabilities.

ITbM's mission is to conduct "needs-inspired" basic research and develop transformative biomolecules that will significantly impact the field of biological science and technology. By marrying state-of-the-art synthetic chemistry, catalytic chemistry, plant biology, animal biology, live imaging, theoretical science, and data science, ITbM has advanced new research areas.

From 2021 to 2024, ITbM published 556 papers. Because of the high research profile of ITbM, two or three PIs have been selected as "Highly Cited Researchers" by Clarivate Analytics every year. ITbM's remarkable achievements are also evident in the records of competitive funds, prestigious awards, and invited lectures. During the four years, research funds has amounted to 3.5 billion JPY. Considering the relatively small number of PIs and the nature of ITbM's science focusing on basic research, this number is remarkably high as an institute in Japan. Overseas PIs has constantly obtained KAKENHI grants. Among the awards/honors, it is notable that two overseas PIs, Torii and Frommer, have been elected as members of the National Academy of Science in 2024.

Through an extensive collaboration, ITbM has been exploring the research fields of (1) Chemistry-enabled plant adaptation, (2) Parasitic plants, (3) Chemistry-enabled bioimaging, (4) Nanocarbon chemistry and biology, (5) Clock-disease. In 2022, ITbM added (6) Climate change resilience to expand its scope. Their representative results published during the period 2021-2024 are summarized below. Other topical research results, especially of synthetic chemistry, an essential base of ITbM, are denoted in (7).

(1) Chemistry-enabled plant adaptation

Stomatal opening and closing is a key physiological response to environmental conditions. Combining biological and chemical perspectives, Kinoshita Group has discovered a protease inhibitor (Front. Plant Sci., 2021) and innovative molecules having 2,6-dihalopurines (ACS Chem. Biol., 2023) that induce stomatal closing. They have also identified benzyl isothiocyanate (BITC) as a potent molecule for stomatal closing, and further developed a more efficient molecule "Super ITC" via collaboration with Murakami (Kwansei Gakuin U, a former Co-PI of Itami group) and the Chemical Library Center (Nat. Commun., 2023). In collaboration with the Molecular Structure Center, they have also identified an uncharacterized protein that responds to abscisic acid through phosphorylation (Front. Plant Sci., 2021). Collaboration with U of Minnesota revealed that the Mg^{2+}- and Mn^{2+}-dependent membrane-localized type 2C protein phosphatase clade D (PP2C.D) plays a crucial role in dephosphorylating the cell membrane proton pump in guard cells (Plant Physiol., 2022). While the phosphorylation of the penultimate threonine residue is essential for stomatal opening, they found that another threonine residue Thr881 also plays a significant role in response to blue and red light (Nat. Commun., 2024).

In 2021, they found a genetically modified rice featuring enhanced stomatal opening has achieved over a 30% increase in yield in China via collaboration with Nanjing Agricultural U (Nat. Commun., 2021), which underscores the potential of their work addressing global food security.

Torii group has been working on unraveling the molecular mechanisms that drive stomatal development. Stomatal differentiation unfolds in three essential stages – initiation/proliferation, fate determination, and terminal differentiation – each meticulously regulated by lineage-specific transcription factors: SPEECHLESS, MUTE, and FAMA. Remarkably, the SCREAM (SCRM) protein showcases a unique ability to form heterodimers with these key transcription factors, a selectivity governed by its C-terminal ACT-like domain, which is vital for defining heterodimerization pathways (Proc. Natl. Acad. Sci., 2022). They have also delved deep into the intricate changes in chromatin architecture that occur as stomatal stem cells transition from an undifferentiated to a differentiated state (Nat. Plants, 2022). Their research further highlights the mechanisms behind the activation and degradation of the receptor-like kinase ERECTA (Nat. Plants, 2023). Collaborating with Uchida (NU, a former Co-PI of Torii group), Itami, Hagihara (RIKEN, a former Co-PI of Itami group), and the Chemical Library Center, they have also discovered compounds that promote the elongation and thickening of hypocotyls (HYGIC, Plant Cell Physiol., 2023). Further collaboration with Itami, Kurihara, and Kinoshita has led to the identification of Stomidazolone, a

remarkable molecule capable of reducing stomatal density (Nat. Commun., 2024).

(2) Parasitic plants

The parasitic plant Striga has been causing huge damage on crop production in Africa. ITbM has been tackling to provide molecular solutions to this issue, and succeeded in identification of strigolactone receptors and development of sphynolactone-7 (SPL7) that induces a Striga's suicidal germination. Collaborating with Itami, Ooi, Crudden-Nambo, the Live Imaging Center, the Molecular Structure Center, and the Chemical Library Center, Tsuchiya Group launched the field trials of SPL7 in 2019. Irrespective to formidable challenges, including locust infestations, harmful plant virus infections like maize lethal necrosis, and the disruptive impact of the COVID-19 pandemic, they swiftly resumed field and pot trials in early 2021, yielding promising results: the application of SPL7 notably reduced Striga parasitism by nearly fifty percent in the field. In late 2023, they have embarked on a pivotal joint research initiative with a global trading company, paving the way for large-scale field trials to implement SPL7 in the fight against Striga.

The insights gained from Striga research are being harnessed to tackle Orobanche, a parasitic plant that is wreaking havoc across North Africa, Southern Europe, and Southwest Asia. This finding is a testament to their commitment to innovation, as research and development efforts progress in partnership with Itami and the Chemical Library Center.

(3) Chemistry-enabled bioimaging

By integrating main group elements into molecular design, Yamaguchi has been developing groundbreaking fluorescent molecules like phospha-xanthene, thiophene-S,S-dioxide, and boron-doped heteroacenes. These new dyes, capable of absorbing light in the near-infrared region, are ideal for deep imaging (ChemSci., 2021; ACS Mat. Sci., 2021; Angew. Chem. Int. Ed., 2021). Collaboration with Yanai and Tama Groups accelerated molecular design and synthesis. This not only merged quantum chemical calculations with predictions of optical properties but also provided information of vivo behaviors, such as membrane permeability (J. Am. Chem. Soc., 2024; Angew. Chem. Int. Ed., 2024).

Frommer-Nakamura Group has made a notable progress in visualizing substance transport, including the intricate dynamics of plant hormones. By integrating their innovative sucrose sensor, SWEETs, with bioimaging techniques, they have provided new methodologies (Plant J, 2021; Proc. Natl. Acad. Sci., 2022).

The Live Imaging Center has conducted studies on the structure-physicochemical property relationships of N-aryl pyrido cyanine, a novel DNA staining reagent, and developed "Kakshine" as an exceptional fluorescent dye that distinguishes between mitochondrial, chloroplast, and nuclear DNA (Nat. Commun., 2021).

(4) Nanocarbon chemistry and biology

Itami Group has been actively engaged in creating a wide range of structurally and functionally diverse molecular nanocarbons. They synthesized zigzag-type carbon nanobelts (CNBs), which were previously considered to be the most challenging of the shortest carbon nanotube (CNT). Combined with earlier synthesis of armchair and chiral CNBs, they established a comprehensive strategy to synthesize all three types of CNBs, and also marked a significant step towards the precise and structure-selective synthesis of CNTs (Nat. Chem., 2021). They have also achieved the chemical synthesis of a various structures of molecular nanocarbons through innovative synthetic strategies, such as a diversity-oriented synthesis of nanographenes using small polycyclic aromatic hydrocarbons (PAHs) as starting materials and employing dearomative annulative π-extension (DAPEX) reactions (Nat. Commun., 2021). They have synthesized unsubstituted aromatic polymers, such as polythiophenes, by utilizing dendrimers as solubilizing supports (Nat. Commun., 2022) and created perfluorocycloparaphenylenes (PFCPPs), a new class of highly strained, electron-accepting, ring-shaped perfluoroarenes (Nat. Commun., 2022).

Meanwhile, they have interested in applying molecular nanocarbons to biological research. In addition to the previous water-soluble warped nanographene (Angew. Chem. Int. Ed., 2018), they have synthesized highly soluble PAH–sulfonium salts (Chem. Sci., 2025) and water-soluble nanobelts (Angew. Chem. Int. Ed., 2025). In collaboration with Frommer–Nakamura Group, they have been exploring the use of molecular nanocarbons for nucleic acid delivery, and filed a patent (WO2023153504A1).

(5) Clock-disease

Disturbances in the biological clock system have a profound impact on health, and they have been linked to several pathologies. Yoshimura Group is advancing research on biological rhythms. As well as the circadian clock, they are focusing on the circannual clock, which governs yearly (seasonal) rhythms, and the circalunar clock, which is influenced by the lunar cycle. Through transcriptome analysis of the

hypothalamus and pituitary gland in medaka fish, they identified 518 genes that exhibit approximately annual rhythmic expression, indicating the existence of circannual genes (Proc. Natl. Acad. Sci., 2023). They also explored the mechanism behind the synchronized spawning of grass pufferfish, which occurs on the nights of new and full moons. Comprehensive gene analysis of the pufferfish identified "spring tide genes," activated during spring tides (new and full moons), and "neap tide genes," activated during neap tides. They found that prostaglandin E2 derived from spring tide genes is secreted during spawning, synchronizing the reproductive behavior of neighboring individuals (Curr. Biol., 2022).

They demonstrated in a mouse model that dopamine signaling is regulated in a photoperiod-dependent manner. Pharmacological intervention was shown to restore retinal photosensitivity that had been suppressed under short-day conditions, providing insights into the molecular basis of seasonal affective disorder (Sci. Rep., 2021). In collaboration with Hirota Group and the Chemical Library Center, they found circadian clock modulators derived from Kampo medicine (Sci. Rep., 2021).

Kay-Hirota Group is conducting structural biology research to elucidate the interactions of circadian clock proteins, aiming to drive rational drug design. Together with Tama Group, they determined the crystal structures of essential circadian clock proteins CRY1 and CRY2. Structural analysis of their binding pockets revealed that specific interactions arise from differences in the interaction between the gatekeeper tryptophan residues (W399 in CRY1 and W417 in CRY2) and a neighboring structural element known as the lid loop (Proc. Natl. Acad. Sci., 2021). Based on the co-crystal structure of CRY2 with SHP656, a small molecule identified by Kay-Hirota Group as a circadian modulator, they elucidated the mechanism of action and demonstrated the potential of CRY2 as a therapeutic target for glioblastoma (Proc. Natl. Acad. Sci., 2022).

(6) Climate change resilience

The impact of the global climatic and environmental changes is also causing serious problems to animals, including humans. Kamikouchi Group is at the forefront of exploring the intricate biological and biophysical mechanisms underlying courtship communication of mosquitoes, they demonstrated that the use of a serotonin biosynthesis inhibitor dramatically lessens male mosquitoes' attraction to the distinctive wingbeat sounds produced by females (Front. Physiol., 2022). They have also identified notable divergences in both the auditory traits of male mosquitoes and their behavioral reactions to female wingbeat sounds across closely related species (iScience, 2024).

(7) Other topical results

Molecular synthesis is an essential platform to advance ITbM's interdisciplinary research. Ooi Group is actively developing novel reactions through insightful catalyst design and cutting-edge applications of light. They have taken significant leaps in the field by pioneering the acceptorless dehydrogenative cross-coupling reaction using photoinduced hydrogen-atom transfer catalysis (Nat. Synth., 2023). Their explorations into C–H functionalization combined with carbon-carbon double bond formation utilizing phosphonium ylides (Nat. Synth. 2024) advances synthetic methodologies.

Bode Group advanced the efficient protein chemical synthesis with their innovative KAHA and KAT ligation reactions (RSC Chem. Biol., 2022). Their development of the optoproteomic technology "LUX-MS" opens new avenues for understanding transient protein interactions within living cells, providing unprecedented insights into cellular processes (Nat. Commun., 2021).

Crudden Group is pushing the boundaries of catalysis by developing cutting-edge reactions (Nat. Chem., 2024). Their gold nanoclusters stabilized by N-heterocyclic carbenes demonstrates their proficiency in catalysis (Nat. Commun., 2021). They have shown that these nanoclusters efficiently catalyzed the reduction of CO_2 to CO (J. Am. Chem. Soc., 2022; Chem. Mat., 2024).

3. Facilitating Interdisciplinary Research Activities

- Describe the content of measures taken by the Center to facilitate interdisciplinary research activities. For example, measures that create an environment that will facilitate doing joint research by researchers in differing fields.
- Describe the contents and results of interdisciplinary research activities yielded by the measures described above.

ITbM's Mix concept has facilitated bottom-up interdisciplinary researches among young researchers. Particularly, Mix Labs and Mix Offices function as places where new unique ideas in research are being generated based on daily communications among researchers from different fields working side-by-side.

ITbM Research Award, established to foster interdisciplinary collaboration among young researchers and students. Three proposals were awarded during 2023-2024, which has motivated young researchers and students to apply for external grants, and provides them practice with writing grants and defending their

ideas. ITbM Workshop is held regularly to share research progress and to provide an opportunity for new collaboration in ITbM. ITbM Tea Break Meeting provides an opportunity for casual discussions and has been slightly modified to include seminars by young researchers, especially those who have newly joined ITbM, which helps them devise new research plans and launch collaborative research.

Research Promotion Division (RPD) of ITbM's Administrative Department has been playing a critical role as a catalyst to initiate collaboration. The RPD can assist in strategic planning at an early stage of the research, including early feedback on research that should be covered under intellectual property and developing industrial collaborations with the help of the SPD (see below).

Strategic Planning Division (SPD) was separated from RPD in 2016 to focus on promotion of societal implementation of the research outcomes. The SPD has strong ties with the Academic Research & Industry–Academia–Government Collaboration Department of NU, and promotes, expands and strengthens collaborations with industry.

Whereas ITbM has collaborated with over 1,000 users inside and outside of ITbM and has been a part of nearly 150 publications on interdisciplinary research, the four supporting centers (Molecular Structure Center, Live Imaging Center, Chemical Library Center, and Peptide Protein Center) have also been making remarkable contributions to the promotion of ITbM's interdisciplinary research. The Live Imaging Center has collaborated with over 50 research institutions, contributing to more than 100 publications. Its achievements have been recognized with major awards, including the "Outstanding Support for Research Award from MEXT (2023)", the "Hirase Award" from JSPM (2021), and the "Technical Special Award" from BSJ (2019). The Chemical Library Center has distributed over two million compounds for 350 collaborators inside and outside Japan, and expanding its activities such as on drug discovery including in silico and development in vivo, and metabolomics. From FY2022, the center led a large-scale Academia-Industry collaboration. The Molecular Structure Center performs comprehensive analyses for researchers at ITbM and beyond. Specializing in quantitative proteomics, the center provides precise compound analyses and cutting-edge measurement systems for metabolomics and lipidomics, addressing a wide range of research needs. The Peptide Protein Center has participated in MEXT's Data Creation and Utilization-type Material R&D Project (DX Poly) since FY2021 and the Grant-in-Aid for Transformative Research Areas (B) since FY2024. The center is expanding its research network to industry through two collaborations: one focused on peptide-based biomaterials and another on agricultural solutions.

The ITbM's concrete interdisciplinary research outcomes are denoted in Section 2.

4. Maintaining an International Research Environment

- Describe what's been accomplished in the efforts to raise the Center's recognition as a genuine globally visible research institute, along with innovative efforts proactively being taken, including the following points, for example:
  - Efforts being developed to maintain an international research environment based on the analysis of number and state of world-leading, frontline researchers; exchanges with overseas entities
  - Proactive efforts to raise the level of the Center's international recognition
  - Efforts to make the Center into one that attracts excellent researchers from around the world (such as creating of an environment in which researchers can concentrate on their research, providing startup research funding, supporting efforts that will foster young researchers and contribute to advancing their career paths, and arranging support system for the research activities of overseas researchers.)
  - Consolidation of the administrative structures to support implementing the efforts described above
- In Appendix 3-1, describe the state of cooperation with overseas satellites, and list the main international research meetings held by the Center.

Five world-leading overseas PIs and postdoctoral researchers from abroad have contributed greatly to developing ITbM's international research environment. Even after the termination of WPI grant support, the overseas PIs have actively engaged in ITbM's activities. NU secured Co-PI and postdoctoral researcher positions of the overseas PI groups, and many of the groups are allocated students from Graduate School of Science of NU. They have been attending the annual international symposia, ISTbM. Even when they are absent from Nagoya, they have close contacts with their respective Co-PIs and researchers through regular online meetings. They also send a few non-Japanese researchers/students from their institutes to ITbM, although it was suspended for a while due to the COVID-19 pandemic.

Whereas ITbM has Florence Tama as a non-Japanese PI full-time at NU, ITbM created a new post of non-Japanese Junior PI under the NU's support to expand its scope and diversity, and appointed Anuphon Laohavisit in April 2022. ITbM also assigned another non-Japanese Junior PI Quan Phung in October 2022. The ratio of non-Japanese researchers is 30% as of March 2025.

ITbM has been functioning as a global talent pool. Since 2012, ITbM has hired 149 postdocs from over the world, in which 88 (60%) are non-Japanese. Among them, 91 found faculty positions in academia in Japan and overseas. Although hiring from abroad had been suspended during the COVID-19 pandemic, it resumed in 2022.

The Administrative Department consists of staff with good correspondence in both English and Japanese to handle various tasks. It cooperates with the secretaries and staff of research groups to assist researchers from abroad, which allows them to start research works at ITbM immediately.

ITbM has been hosting annual international symposia (ISTbM) and three international awards (Tsuneko & Reiji Okazaki Award, Hirata Award, Nagoya Medal of Organic Chemistry). Although most of the events had been suspended during the COVID-19 pandemic, they were re-issued in person in FY2023. In addition to those regular symposia, ITbM faculty members have organized various international symposia/workshops/summer school, which have significantly contributed to increasing ITbM's international visibility and extending international network. Bode (overseas PI) hosted the 9th Chemical Protein Synthesis Conference (CPS 2024) at ITbM in June 2-5, 2024, which invited 39 lecturers and 100 attendees from over the world (see https://cpsnagoya.ethz.ch/). Yoshimura hosted International Chronobiology Summer School 2024 at ITbM on August 5-8, which invited 22 instructors and 95 attendees from over the world.

ITbM faculty members are also actively engaged in international collaboration through various international programs/partnerships at Nagoya University. The collaboration with the University of Münster (Germany), including the mutual exchange of PhD students, has been organized by Yamaguchi, which started in 2005 and has been continued via collecting various funds. Queen's University, to which Crudden (overseas PI) affiliates, is considering a partnership with Nagoya University. The University of Edinburgh, which has a Joint Degree Program with Nagoya University, was awarded "International Science Partnership Fund (British Council)" to start a research collaboration with NU including the exchange of PhD students in chemistry, and ITbM is to be involved.

5. Making Organizational Reforms

- Describe distinctive effort in managing research operation and administrative organization, such as the strong leadership that the director is giving on the Center's operation, strong performance by the administrative director who provides the center director with strong administrative and managerial support, and division of roles and authority between the Center and its host institution.
- Describe the ripple effects that activities to disseminate experience and know-how accumulated by the Center, such as the followings, have/had on the host institution (or other research institutes, if any):
  - System reforms made through the Center's leading activities to its research operation and administrative organization
  - Experience and know-how accumulated by the Center as it have worked to establish itself as top world-level research institutes.
- Other than the above, give examples, if any, of cooperative activities by the Center and the whole WPI Program or other WPI centers, to disseminate experience and know-how accumulated by the WPI program and/or the WPI centers.

ITbM's Management: The Director of ITbM has the authority to make final decisions over all matters concerning the operation and management of ITbM, such as the appointment of personnel, the Center's budget and research priorities, while the role of the President of NU is limited to the appointment of the Director. The ITbM holds Steering Committee meetings monthly as a place to discuss and provide advice to the Director to make the final decisions. The Director and core members of ITbM hold a meeting with the President of NU to discuss over any issues related to the management of ITbM as needed.

Under the leadership of the Director, Administrative Department was organized to implement various initiatives and provide the environment for ITbM researchers to fully focus on their research works. Led by the Administrative Director, the Department consists of 3 divisions: Management Division, Research Promotion Division (RPD), and Strategic Planning Division (SPD). The RPD & SPD have individuals with specialized skills, such as a science designer and a patent attorney. Most of them hold a PhD or a Masters Degree in related fields and are proficient in English. The high performance of Administrative Department has been strongly supporting ITbM's activities.

Ripple effects: In the process of perpetuating ITbM, NU established Nagoya University Institute for Advanced Study (NAIAS) as an organization to strengthen the NU's advanced basic research further, and positioned ITbM under this umbrella. The Institute for Advanced Research (IAR), which implements next-generation research support programs of NU such as WPI-next, was also placed under the NAIAS, and the know-how accumulated at ITbM is horizontally deployed.

ITbM's cutting-edge research outcomes that develop various new research domains have a significant impact in many aspects. During the thirteen years since its launch in 2012, ITbM's initiatives have been adopted by various research projects or educational programs of NU. Those initiatives have become so prevalent that it is difficult to cite every specific examples, but are being adopted in ways that suit each organization. For instance, the Center for Integrated Future Electronics (CIRFE), established by Professor Hiroshi Amano (2014 Nobel Prize in Physics) with the aim of creating industry-academia-government collaboration, was designed based on the ITbM's Mix Lab and named after ITbM as "CIRFE Transformative Electronics Commons (C-TECs)". ITbM's know-how was also provided in their research integration strategy,

creating a venue for open innovation that leads the future electronics industry. Mix Labs were also adopted into the NU's "Graduate Program of Transformative Chem-Bio Research (GTR)" to advance collaborative research, and the ITbM's Mix concept is expanding University wide including Schools of Medicine and Pharmaceutical Science. The "Institute for Glyco-core Research (iGCORE)" launched in 2024 have a close tie with ITbM, and has been organized in refer to ITbM's initiatives.
The examples are not limited to NU. Crudden has started a research organization "Carbon To Metal Coating Institute (C2MCI)" at Queen's University based on her experience with the ITbM installation. NC State University, an important partner of NU, is planning to launch a new institute "Integrative Science Initiative (ISI)" in 2026. The ISI has a similar concept of ITbM and started to exchange ideas on its operation.

6. Efforts expected to WPI Academy Center to Enhance and Amplify the Visibility and Brand of the Overall WPI Program

- Describe how the Center's outreach activities have contributed to enhancing and amplifying the visibility and brand of the WPI program. Describe the successful cases of the Center's outreach activities in Appendix 4, and enter the number of activities in Appendix 4a.
- Other than the above, describe, if any, the activities and their concrete contents that have contributed to the enhancement and amplification of the visibility and brand of the WPI program (such as holding a large international research meeting, collaborative activities with multiple WPI centers). If you have already provided this information, please indicate where in the report.
- Describe the Center's efforts in making it a place that expands and accelerates the international circulation of the world's best brains. Give their success cases and describe their concrete contents and effect in narrative.
- Describe examples, if any, of cooperative activities by the Center and the whole WPI Program or other WPI centers, to disseminate experience and know-how accumulated by the WPI program and/or the WPI centers.

ITbM established an international press release platform in the RPD and has been regularly publishing international press releases on ITbM's research outcomes, international awards/events and other outreach activities, through international press release services such as EurekAlert!. ITbM has strategically created a wide range of networks with not only top scientists but also with journalists, artists, high school teachers/students, and the general public. Through RPD members' writing skills and science visualization, complex scientific results can be easily understood by the general public. To date, ITbM has distributed a large number of press/event releases and press conferences about their research activities and has been covered in various media (see Appendix 4).

Led by the RPD, ITbM's activities are also introduced to the academic community and industries by means of booth exhibitions at international events, including Super Science High School Presentations, Science Agora, and exhibitions to industries such as BioJapan. Researchers are also deeply involved in holding public lectures in high schools, and the ITbM's research activities were presented to many high school students.

The long-term networking with high schools resulted in joint events including the annual WPI science symposium and Kagaku-zanmai, the largest science event in the Tokai area, an extensive network for University-High School Collaboration, and the involvement of ITbM as a committee member at designated high schools of the MEXT Super Science High School Program.

ITbM recognizes the importance of collaboration with other WPI institutes for WPI's development and increase of the visibility. While ITbM has been involved in SSH Tokai Festa, we asked WPI centers for collaboration in 2024, and iCeMS and IFReC joined. In 2024, Yoshimura gave a special lecture at iCeMS retreat and in the IFReC public event.

ITbM's various international initiatives have also been contributing to promote visibility of ITbM and WPI program. The annual international symposia/awards denoted in Section 4 provided opportunities for the world-leading researchers to witness the ITbM's research activities and the WPI program. ITbM's community expansion via academic promotion of researchers (see Section 7) has been also playing a key-role. Many of them have the title of "Affiliated Researcher of ITbM" and continue their collaboration with ITbM. Accordingly, ITbM's network has been widely spreading.

7. Effort to Secure the Center's Future Development over the Mid- to Long-term

- Address each of the following items that have been done to secure mid- to long-term center development:
  - Contents of the measures taken by the host institution to support maintaining the activities of the Center (such as securing financial and personnel resources, coordination among host institution to bring together in-house researchers, in-kind provision and/or facilities afforded in terms of usage of building, lab space and other equipment, new management reform carried out after the funding period ends).
  - Actions and measures taken to sustain the Center as a world premier international research center.

ITbM is positioned as a flagship research institute of NU. To secure the employment of ITbM's faculty and staff members, NU has launched the Nagoya University Institute for Advanced Study (NAIAS), and positioned ITbM under this umbrella. Even under this new structure, the Director of ITbM retains the

authority to make decisions for matters regarding ITbM.

ITbM has been keeping good relationships with other departments/faculties at NU from its inception. Eight NU PIs continue their cooperation with their original departments, and the students have been allocated. While students were not allocated to the overseas PI groups at the beginning, the Departments had gradually changed their system, and it became possible in FY2022.

NU has also been making a full support to ITbM. At its inception, ITbM had 8 PI positions transferred from Departments of NU. In 2019, 7 more faculty positions (Co-PIs of NU PIs) were officially secured for ITbM by the President-Management Point System and allocated to ITbM as tenure positions. Consequently, NU has been requesting to MEXT the budget (Gaisan Yokyu) since 2018 with the highest priority to strengthening ITbM, and 6 faculty positions have been allocated. From FY2022, NU increases the support to secure additional 8 faculty positions and the selected postdocs/staff who are essential to run ITbM. Accordingly, almost all the faculty positions of ITbM were secured. In addition, NU also made an additional support to install a junior PI position to promote the internationalization and diversity of ITbM in 2022.

On the other hand, the rejuvenation of faculty members is important for future development. As denoted in Section 2, quite a few academic promotion have occurred during 2021-2024; Higashiyama (PI) was appointed as Professor of the University of Tokyo, Itami (PI) as Chief Scientist of RIKEN, Nakamura (Assoc Prof) as Professor of Saitama University, Kon (Lecturer) as Project Leader of National Institutes for Quantum Science and Technology, Taki (Assoc Prof) as Professor of Gifu University, Yamanomoto (Assist Prof) as Assistant Professor of Tokyo Science University, Ohmatsu (Assoc Prof) as Professor of Keio University, and Takeuchi (Assist Prof) as Lecturer of the University of Tokyo. Accordingly younger researchers are being appointed to those positions.

ITbM has been promoting industry-academia collaboration with the full cooperation of NU. As denoted in Section 1, the ITbM Consortium was renewed as the "ITbM/GTR Consortium" in 2020 with the participation of researchers engaging in chemistry & life science in the above-mentioned GTR program, and the ITbM's research scope is expanding. This consortium has 13 companies/institute as members and provides them the latest achievements of ITbM/GTR and a place for exchanging information among the companies and recruiting excellent students, thus functioning as a place for discovering joint research between industry and academia.

ITbM promotes the acquisition of diverse funds such as large competitive funds and fundraising activities through the Nagoya University Foundation.

8. Others

・In addition to the above1-7, note any of the Center's notable efforts and activities.

Prevention of research misconduct

As a world-leading research institute, ITbM is aware of researchers' responsibility and takes actions to avoid any research misconduct. ITbM has established its own policy in accordance with the guidelines of NU and MEXT, including; (i) each research group shall provide education on research misconduct prevention at the beginning of each fiscal year, (ii) each research group shall prepare a concrete action plan according to the policy, and (iii) each PI shall collect all the researchers' signatures to agree to abide by the plan. Thus, all the researchers recognize potential misconduct for each research procedure, and are able to act appropriately to avoid any research misconduct.

For this purpose, NU installed the data storage system and requires all the NU members to save those items immediately after the papers are accepted for publication, which prevent intentional data falsification by researchers.

Environmental and Safety Committee

Upon development of molecules that modulate biological system in plants/animals, it is essential for ITbM to communicate to the general public that ITbM always addresses environmental and safety issues carefully. Accordingly, ITbM has set up an Environment and Safety Committee so that researchers at ITbM are constantly aware of these issues when conducting their research. The committee also contributes to preparation and improvement of ITbM's safety training course stated above. In addition, ITbM has been actively involved in public outreach events as denoted above and explaining ITbM's concern for safety and environmental issues. In the media, ITbM also weighs in on safety issues when needed.

Appendix 1　List of Center's Major Research Achievements

1. List of Major Refereed Papers

*List **up to 20 papers** representative of the Center's research activities during the period between FY 2021 and FY 2024, and give brief descriptions (within 5 to 10 lines) of them.
*For each, write the author name(s); year of publication; journal name, volume, page(s) (or DOI number), and article title. Any listing order may be used as long as format is the same. If a paper has many authors, underline those affiliated with the Center.
*If a paper has many authors (say, more than 10), all of their names do not need to be listed.

1. **Plasma membrane H^+-ATPase overexpression increases rice yield via simultaneous enhancement of nutrient uptake and photosynthesis**, Maoxing Zhang, Yin Wang, Xi Chen, Feiyun Xu, Ming Ding, Wenxiu Ye, Yuya Kawai, Yosuke Toda, Yuki Hayashi, Takamasa Suzuki, Houqing Zeng, Liang Xiao, Xin Xiao, Jin Xu, Shiwei Guo, Feng Yan, Qirong Shen, Guohua Xu, Toshinori Kinoshita and Yiyong Zhu, Nat. Commun. (2021) 12, 735 (DOI: 10.1038/s41467-021-20964-4).

   Kinoshita group, in collaboration with Professor Yiyong Zhu (Nanjing Agricultural University), have succeeded in increasing the biomass of outdoor grown rice by manufacturing stomata. In this study, they created rice plants overexpressing the OSA1 proton pump gene, which is one of the cell membrane proton pump genes in rice, and analyzed their phenotypes. As a result, they found that in the proton pump-overexpressing rice plants, the absorption of inorganic nutrients such as nitrogen in the roots was increased by more than 20% compared to the wild-type strain, and the proportion of stomata opened by light increased more than 25%. Furthermore, detailed analysis revealed that in the proton pump overexpressing rice, carbon dioxide fixation (photosynthetic activity) increased by more than 25%, and dry weight (biomass) increased by 18–33% in hydroponic cultivation in the laboratory. In addition, in a two-year yield evaluation trial conducted at four different isolated paddy fields, they found that rice yield increased by more than 30% compared to wild-type plants. Interestingly, even when the amount of nitrogen fertilizer was reduced by half, the proton pump-overexpressing rice plants yielded more rice than the wild-type plants with normal nitrogen levels.

2. **N-aryl pyrido cyanine derivatives are nuclear and organelle DNA markers for two-photon and super-resolution imaging**, Kakishi Uno, Nagisa Sugimoto and Yoshikatsu Sato, Nat. Commun. (2021) 12, 2650 (DOI: 10.1038/s41467-021-23019-w).

   The Live Imaging Center (Dr. Yoshikatsu Sato) focused on the pyridocyanine skeleton, which has not been reported as a dye for staining DNA, and through structure-physicochemical property relationship study, they have successfully discovered a novel DNA-staining fluorescent dye, Kakshine, which can absorb in the visible light (500–700 nm). Kakshine specifically binds to the adenine (A) and thymine (T) sequence in double-stranded DNA, significantly enhancing its fluorescence, and has been shown to exhibit higher DNA selectivity than the existing dyes. In addition, experiments using HeLa cells demonstrated that at low concentrations (10 nM), Kakshine specifically stains nuclear DNA, and at more diluted concentrations (100 pM), it specifically stains mitochondrial DNA. Furthermore, using fluorescence lifetime microscopy, they demonstrated that nuclear DNA, mitochondrial DNA, and chloroplast DNA can be distinguished, and could successfully separate and visualize all three types of DNA present in plant cells using Kakshine through fluorescence lifetime imaging. Furthermore, by combining one of the Kakshine derivatives with STED microscopy, they demonstrated that nuclear DNA structures and mitochondrial nucleoid structures in sharp focus, which cannot be separated using conventional confocal microscopy, can be clearly visualized.

3. **Structural differences in the FAD-binding pockets and lid loops of mammalian CRY1 and CRY2 for isoform-selective regulation**, Simon Miller, Ashutosh Srivastava, Yoshiko Nagai, Yoshiki Aikawa, Florence Tama, and Tsuyoshi Hirota*, Proc. Natl. Acad. Sci. USA (2021), 118, e2026191118 (DOI: 10.1073/pnas.2026191118).

Hirota and Tama groups successfully determined the crystal structures of CRY1 and CRY2, isoforms of the core circadian rhythm protein CRY, and analyzed the structures of their binding pockets and surrounding regions. In addition, through molecular dynamics simulations, they revealed that differential interactions between the gatekeeper amino acid in each isoform's binding pocket (W399 in CRY1 and W417 in CRY2) and the nearby lid loop give rise to compound selectivity. Although CRY1 and CRY2 were previously thought to function redundantly, the research groups have elucidated the biological mechanisms that underlie isoform-specific selectivity. The present findings not only shed light on the dynamic behavior of this selectivity but also offer valuable insights for the future design of isoform-selective drugs targeting CRY proteins.

4. A negative-solvatochromic fluorescent probe for visualizing intracellular distributions of fatty acid metabolites, Keiji Kajiwara, Hiroshi Osaki, Steffen Greßies, Keiko Kuwata, Ju Hyun Kim, Tobias Gensch, Yoshikatsu Sato, Frank Glorius*, Shigehiro Yamaguchi*, Masayasu Taki*, Nat. Commun (2022) 13, 2533 (DOI: 10.1038/s41467-022-30153-6).

Yamaguchi group, in collaboration with Professor Frank Glorius at the University of Münster (Germany), successfully discovered a novel environment-responsive fluorescent dye, "AP-C12," capable of visualizing fatty acid metabolism within living cells. They found that AP-C12 exhibits changes in its fluorescence spectrum in response to local polarity differences within organelles. By observing the behavior of AP-C12 in the presence of fatty acid metabolism inhibitors, they were able to classify the effects of these inhibitors based on distinct fluorescence patterns. Furthermore, in nutrient-starved cells (specifically HepG2 cells derived from liver cancer), they demonstrated that lipolysis – the hydrolysis of lipid droplets by lipases – proceeds preferentially over lipophagy, the autophagic degradation of lipids.

5. Synthesis of a Möbius carbon nanobelt, Yasumoto Segawa*, Tsugunori Watanabe, Kotono Yamanoue, Motonobu Kuwayama, Kosuke Watanabe, Jenny Pirillo, Yuh Hijikata, Kenichiro Itami*, Nat. Synth. (2022) 1, 535 (DOI: 10.1038/s44160-022-00075-8).

Itami group, in collaboration with Specially Appointed Associate Professor Hijikata at the Institute for Chemical Reaction Design and Discovery (WPI-ICReDD, Hokkaido University), successfully synthesized a molecular nanocarbon structure with a complex topology – a Möbius-shaped nanocarbon belt composed solely of hydrocarbons. NMR analysis and molecular dynamics simulations confirmed that the synthesized Möbius nanocarbon belt exhibits magnetically averaged properties. Furthermore, the team succeeded in optical resolution of the synthesized Möbius nanocarbon belt and observed circular dichroism in the UV-visible absorption spectra of each enantiomer.

6. Prostaglandin E2 synchronizes lunar-regulated beach-spawning in grass puffers, Junfeng Chen, Yuma Katada, Kousuke Okimura, Taiki Yamaguchi, Ying-Jey Guh, Tomoya Nakayama, Michiyo Maruyama, Yuko Furukawa, Yusuke Nakane, Naoyuki Yamamoto, Yoshikatsu Sato, Hironori Ando, Asako Sugimura, Kazufumi Tabata, Ayato Sato, and Takashi Yoshimura*, Curr. Biol. (2022) 32, 4881 (DOI: 10.1016/j.cub.2022.09.062).

Yoshimura group, in collaboration with the Live Imaging Center, industry partners, and the Chemical Library Center, uncovered the mechanism behind the synchronous spawning of grass pufferfish (Takifugu niphobles) during new and full moons. They first conducted a comprehensive analysis of gene expression in the hypothalamus and pituitary of grass pufferfish under spring tide conditions (when spawning occurs) and neap tide conditions (when

spawning does not occur). Through this analysis, they identified "spring tide genes" that are activated during spring tides and "neap tide genes" that are activated during neap tides. Subsequently, they discovered the presence of prostaglandin E2 (PGE2) in the waters of the pufferfish's spawning grounds and revealed that PGE2 is secreted into the seawater during spawning. Furthermore, they demonstrated – even under artificial conditions – that PGE2 induces spawning behavior in grass pufferfish, thereby triggering synchronous mass spawning.

7. Dynamic chromatin accessibility deploys heterotypic cis/trans acting factors driving stomatal cell fate commitment, Eun-Deok Kim, Michael W. Dorrity, Bridget A. Fitzgerald, Hyemin Seo, Krishna Mohan Sepuru, Christine Queitsch, Nobutaka Mitsuda, Soon-Ki Han, Keiko U. Torii*, Nat. Plants (2022) 8, 1453 (DOI: 10.1038/s41477-022-01304-w).

Torii group identified novel co-*cis* regulatory elements (CREs) that characterize the early precursor stage, including BBR/BPC (GAGA) motifs and bHLH (E-box) motifs. At these CREs, the master regulatory bHLH transcription factors SPEECHLESS and MUTE bind sequentially to initiate and terminate the proliferative state, respectively. Furthermore, BPC transcription factors form a complex with MUTE, and this complex represses SPEECHLESS expression via local deposition of repressive histone modifications. Their findings reveal a mechanism by which cell-state-specific heterotypic TF complexes facilitate cell fate commitment by recruiting chromatin modifiers through key co-CREs.

8. Artificial Neural Network Encoding of Molecular Wavefunctions for Quantum Computing, Masaya Hagai*, Mahito Sugiyama, Koji Tsuda and Takeshi Yanai*, Digit. Discov. (2023) 2, 634 (DOI: 10.1039/d2dd00093h).

Yanai group developed a novel quantum algorithm that encodes molecular wavefunctions using artificial neural networks (ANNs). In this approach, electron configuration occupancies are represented by qubits, and the neural-network quantum state (NQS) is accurately prepared on a quantum computer using quantum gates. Meanwhile, the model training based on energy minimization is efficiently performed on a classical computer, placing this method within the framework of variational quantum eigensolvers (VQE). Based on the Boltzmann machine (BM) model, this approach utilizes quantum phase estimation techniques without requiring Hamiltonian time evolution. Verification on a quantum simulator confirmed that the method achieves accuracy comparable to conventional classical approaches at the complete active space configuration interaction (CASSCF) theory level. This development promises efficient and high-precision representation and computation of wavefunctions in quantum chemistry calculations.

9. Identification and improvement of isothiocyanate-based inhibitors on stomatal opening to act as drought tolerance-conferring agrochemicals, Yusuke Aihara, Bumpei Maeda, Kanna Goto, Mika Nomoto, Koji Takahashi, Shigeo Toh, Wenxiu Ye, Yosuke Toda, Mami Uchida, Eri Asai, Yasuomi Tada, Ayato Sato, Kenichiro Itami, Kei Murakami*, Toshinori Kinoshita*, Nat. Commun. (2023) 14, 2665 (DOI: 10.1038/s41467-023-38102-7).

Kinoshita group, together with Itami group and the Chemical Library Center, successfully identified a stomatal opening inhibitor. Through a chemical screening since 2014 targeting modulation of stomatal behavior, they identified benzyl isothiocyanate, a natural product from Brassicales plants. They clarified that its mode of action involves suppressing the activation of the plasma membrane proton pump – the engine driving stomatal opening – thus leading to stomatal closure. Furthermore, through structure-activity relationship studies, they succeeded in developing a more potent molecule named "super ITC (m-Bis-BITC). Treatment with super

ITCs was shown to suppress leaf wilting in plants both in the short term (1.5 hours) and long term (24 hours), suggesting the potential of these compounds as agrochemicals that confer drought tolerance by inhibiting stomatal opening.

10. A transcriptional program underlying the circannual rhythms of gonadal development in medaka, Tomoya Nakayama, Miki Tanikawa, Yuki Okushi, Thoma Itoh, Tsuyoshi Shimmura, Michiyo Maruyama, Taiki Yamaguchi, Akiko Matsumiya, Ai Shinomiya, Ying-Jey Guh, Junfeng Chen, Kiyoshi Naruse, Hiroshi Kudoh, Yohei Kondo, Naoki Honda, Kazuhiro Aoki, Atsushi J, Nagano, Takashi Yoshimura*, Proc. Natl. Acad. Sci., USA (2023) 120, e2313514120 (DOI: 10.1073/pnas.2313514120).

The Japanese medaka (*Oryzias latipes*) serves as a well-established model for studying seasonal biological rhythms. This study demonstrates that medaka possess an endogenous circannual rhythm of approximately six months. Through genome-wide gene expression analysis of the hypothalamus and pituitary gland, Yoshimura group identified a set of transcription factors that regulate seasonal variations in gonadal development. These transcription factors form a transcriptional program that drives the circannual rhythm controlling gonadal maturation and function. The findings provide important insights into the molecular mechanisms underlying seasonal reproductive strategies and their evolutionary significance.

11. Deep imaging reveals dynamics and signaling in one-to-one pollen tube guidance, Yoko Mizuta, Daigo Sakakibara, Siori Nagahara, Ikuma Kaneshiro, Takuya T. Nagae, Daisuke Kurihara, Tetsuya Higashiyama, EMBO Rep. (2024) 25, 2529 (DOI: 10.1038/s44319-024-00151-4).

In this study, Mizuta and Kurihara groups developed a live imaging technique using two-photon excitation microscopy to directly observe pollen tube guidance within the pistil of *Arabidopsis thaliana*. This approach revealed signaling and cellular behaviors involved in guiding pollen tubes. It was suggested that ovules emit multiple signals, including directional cues dependent on the inner integument layer and adhesion signals at the site where the pollen tube germinates on the ovule. Furthermore, receptor-like kinases such as FERONIA and LORELEI were confirmed to play roles in pollen tube guidance. These findings deepen the understanding of the one-to-one pollen tube guidance mechanism in angiosperms and suggest potential applications for improving crop productivity in the future.

12. Differences in male *Aedes aegypti* and *Aedes albopictus* hearing systems facilitate recognition of conspecific female flight tones, YuMin Loh, Yifeng YJ Xu, Tai-Ting Lee, Takuro S. Ohashi, Yixiao D. Zhang, Daniel F. Eberl, Matthew P. Su, Azusa Kamikouchi, iScience (2024) 27, 110264 (DOI: 10.1016/j.isci.2024.110264).

Kamikouchi group, in collaboration with the University of Iowa, elucidated the mechanism by which male *Aedes aegypti* and *Aedes albopictus* mosquitoes recognize their own species using the flight tones produced by females. The study found that the wingbeat frequencies of females differ between the two species, and males' auditory systems are specifically tuned to these species-specific frequencies. This auditory specialization enables males to accurately identify conspecific females and avoid interspecies mating. These findings may contribute to the development of mosquito control technologies, such as species-specific traps.

13. *p*-Diarylbory Halothiophenols as Multifunctional Catalysts via Photoactive Intramolecular Frustrated Lewis Pairs, Takeru Kikura, Yuya Taura, Yoshitaka Aramaki and Takashi Ooi, J. Am.

Chem. Soc. (2024) 146, 20425 (DOI: 10.1021/jacs.4c06122).

Ooi group developed a novel class of triarylborane compounds called *p*-diarylboryl halothiophenols. These compounds exhibit unique photophysical properties and catalytic performance. Upon absorbing visible light, an intramolecular electron transfer occurs, generating a radical pair composed of a boron radical anion and a thiyl radical. This radical pair acts as a single-electron reductant and participates in hydrogen atom transfer reactions, regenerating the original borylthiophenol. Utilizing this reaction mechanism, they established a unique catalytic cycle that efficiently promotes the assembly of sterically congested 1,2-diols and 1,2-aminoalcohol derivatives via radical–radical cross-coupling reactions.

14. Enantiospecific Cross-coupling of Cyclic Alkyl Sulfones, Roberto Nolla-Saltiel, Zachary T. Ariki, Stefanie Schiele, Jana Alpin, Yasuyo Tahara, Daisuke Yokogawa, Masakazu Nambo and Cathleen M. Crudden, Nat. Chem. (2024) 16, 1445 (DOI: 10.1038/s41557-024-01594-x).

Crudden-Nambo group, together with Daisuke Yokokawa (the University of Tokyo, a former Co-PI of Irle's group in ITbM), has achieved the first time in the world a novel enantioselective cross-coupling reaction using a nickel catalyst that enables simultaneous cleavage of the carbon–sulfur bond and stereocontrol of optically active cyclic alkyl sulfones as starting material. The reaction mechanism, particularly the stereocontrol aspect, was investigated using density functional theory (DFT) and coupled-cluster (CCSD) calculations. The anionic species generated after the coupling reaction can be reacted with various electrophiles to be converted into sulfones or sulfonamides, which are structural motifs frequently found in pharmaceutical, agricultural, and organic functional materials.

15. Synthesis and preclinical testing of a selective beta-subtype agonist of thyroid hormone receptor ZTA-261, Masakazu Nambo, Taeko Nishiwaki-Ohkawa, Akihiro Ito, Zachary T. Ariki, Yuka Ito, Yuuki Kato, Muhammad Yar, Jacky C. -H. Yim, Emily Kim, Elizabeth Sharkey, Keiko Kano, Emi Mishiro-Sato, Kosuke Okimura, Michiyo Maruyama, Wataru Ota, Yuko Furukawa, Tomoya Nakayama, Misato Kobayashi, Fumihiko Horio, Ayato Sato, Cathleen M. Crudden and Takashi Yoshimura, Commun. Med. (2024) 4, 152 (DOI: 10.1038/s43856-024-00574-z).

Yoshimura group, Crudden-Nambo group, and the Chemical Library Center successfully developed a novel compound, ZTA-261, which binds with high selectivity to thyroid hormone receptor β (THRβ). ZTA-261 exhibits over 100-fold isoform selectivity for the receptor and is expected to have significantly fewer side effects such as cardiac hypertrophy, enhanced bone catabolism, and weight loss, which are thought to result from binding to receptor α. Subsequently, when administered to obese mice, ZTA-261 effectively reduced lipids in the blood and liver, particularly triglycerides. Importantly, no hepatotoxicity was observed, and no changes in heart weight were detected. Furthermore, whereas endogenous thyroid hormone T3 reduced bone mineral density and trabecular number and increased bone marrow space in the mouse femur, ZTA-261 showed fewer adverse effects on bone compared to T3 and the previously developed compound GC-1.

16. Chemical inhibition of stomatal differentiation by perturbation of the master-regulatory bHLH heterodimer via an ACT-Like domain, Ayami Nakagawa, Krishna Mohan Sepuru, Shu Jan Yip, Hyemin Seo, Calvin M. Coffin, Kota Hashimoto, Zixuan Li, Yasutomo Segawa, Rie Iwasaki, Hiroe Kato, Daisuke Kurihara, Yusuke Aihara, Stephanie Kim, Toshinori Kinoshita, Kenichiro Itami, Soon-Ki Han, Kei Murakami, and Keiko U. Torii, Nat. Commun. (2024) 15, 8996 (DOI: 10.1038/s41467-024-53214-4).

Torii and Itami groups discovered a novel compound, Stomidazolone, which selectively inhibits stomatal differentiation in plants. Stomidazolone functions by directly binding to the ACT-Like (ACTL) domain of the MUTE transcription factor, a master regulator in the stomatal development pathway. This binding disrupts the heterodimerization between MUTE and SCREAM, thereby arresting the progression of stomatal precursor cells (meristemoids) into mature stomata. Importantly, Stomidazolone does not affect overall seedling growth, indicating its specificity in targeting stomatal development. The study further demonstrates that engineered MUTE proteins with reduced affinity for Stomidazolone retain their functionality and confer resistance to the compound in vivo. These findings highlight the potential of targeting the ACTL domain of bHLH transcription factors to modulate plant development and drought resistance.

17. High-throughput synthesis provides data for predicting molecular properties and reaction success, Julian Götz, Moritz K. Jackl, Chalupat Jindakun, Alexander N. Marziale, Jérôme André, Daniel J. Gosling, Clayton Springer, Marco Palmieri, Marcel Reck, Alexandre Luneau, Cara E. Brocklehurst, Jeffrey W. Bode, Sci. Adv. (2023) 9, eadj2314 (DOI: 10.1126/sciadv.adj2314).

Bode group, in collaboration with Novartis, developed a high-throughput synthesis platform aimed at the rapid generation and evaluation of pharmaceutical candidate molecules. This platform integrates photocatalytic N-heterocycle formation, high-throughput experiment, automated purification, and physicochemical property assessment, enabling the execution of 1,152 reactions. By applying deep learning models to the resulting dataset, the team was able to predict the synthetic accessibility and physicochemical properties of stereochemically diverse substituted saturated N-heterocycles.

18. SWEET13 transport of sucrose, but not gibberellin, restores male fertility in Arabidopsis sweet13;14, Reika Isoda, Zoltan Palmai, Akira Yoshinari, Li-Qing Chen, Florence Tama, Wolf B. Frommer, Masayoshi Nakamura, Proc. Natl. Acad. Sci. (2022) 119, e2207558119 (DOI: 10.1073/pnas.2207558119).

Frommer-Nakamura group, in collaboration with Tama group, revealed the role of the sucrose transporters SWEET13 and SWEET14 in restoring male fertility in the model plant *Arabidopsis thaliana*. While these transporters are known to carry both sucrose and the plant hormone gibberellin (GA), it was previously unclear which substrate is physiologically important for male reproduction. The research team analyzed the structure of SWEET13 through molecular dynamics simulations and identified the binding sites for sucrose and GA. They found that a sucrose-selective mutant (S142N) was able to restore male fertility, whereas a GA-selective mutant (N76Q) did not have this effect. This result demonstrated that sucrose transport is essential for male reproduction.

19. In Silico Screening and Experimental Verification of Near-Infrared-Emissive Two-Boron-Doped Polycyclic Aromatic Hydrocarbons, Izumi Hattori, Masaya Hagai, Masato Ito, Mika Sakai, Hiroki Narita, Kazuhiro J Fujimoto, Takeshi Yanai, Shigehiro Yamaguchi, Angew. Chem. Int. Ed. (2024) 63, e202403829 (DOI: 10.1002/anie.202403829).

Yamaguchi and Yanai groups achieved a new strategy for designing near-infrared (NIR) emitting organic molecules using diboron-doped polycyclic aromatic hydrocarbons (B_2-PAHs). Through quantum chemical calculations (TD-DFT), they screened numerous B_2-PAHs to identify promising candidates with strong NIR emission properties. Selected compounds were synthesized and characterized by X-ray crystallography and optical properties. Several showed efficient NIR fluorescence above 700 nm, with tunable emission based on molecular

structure. They also demonstrated that boron incorporation effectively lowers LUMO levels, enabling narrow bandgaps and stable NIR emission.

20. Phosphorylation of plasma membrane H^+-ATPase Thr881 participates in light-induced stomatal opening, Yuki Hayashi, Kohei Fukatsu, Koji Takahashi, Satoru N Kinoshita, Kyohei Kato, Taku Sakakibara, Keiko Kuwata, Toshinori Kinoshita, Nat. Commun. (2024) 15, 1194 (DOI: 10.1038/s41467-024-45248-5).

Kinoshita group elucidated a novel molecular mechanism involved in stomatal opening in Arabidopsis. Previously, phosphorylation of Threonine 948 (penultimate Thr, pen-Thr) at the C-terminus of the membrane protein H^+-ATPase was considered critical for its activation during stomatal opening. In this study, they revealed that red and blue light induce phosphorylation of threonine 881 (Thr881) on H^+-ATPase using phosphoproteome analysis using guard cell protoplasts from Vicia faba. In addition, blue light and auxin induced phosphorylation of Thr881 and pen-Thr in etiolated seedlings and leaves, respectively, and the dephosphorylation of these sites was mediated by isoforms of the type 2C protein phosphatase D clade. These findings demonstrate that phosphorylation of Thr881, together with pen-Thr, plays an important role in regulating H^+-ATPase activity and is crucial for light-induced stomatal opening in Arabidopsis.

2. Major Invited Lectures, Plenary Addresses (etc.)

*List up to 10 main presentations made between FY 2021 and FY 2024 in order from most recent.
*For each, write the date(s), lecturer/presenter's name, presentation title and conference name.

Date(s)	Lecturer/Presenter's name	Presentation title	Conference name
2024/8/11-16	Shigehiro Yamaguchi	Main-Group-Based π-Electron Materials for Stimuli-Responsive Materials and Fluorescent Probes	20th International Symposium on Novel Aromatic Compounds (ISNA-20), Toronto, Canada
2024/6/22-26	Keiko Torii	Award Lecture: Controlling Stomatal Differentiation – From Chemical Biology to Environmental Regulation- (Vegetable Staticks 2024)	Plant Biology 2024, Honolulu, Hawaii
2023/9/3-7	Jeffrey Bode	Synthetic and Medicinal Chemistry for Biologics	IX EFMC International Symposium on Advances in Synthetic and Medicinal Chemistry (EFMC-ASMC 2023), Zagreb, Croatia
2023/7/24-28	Cathleen Crudden	N-Heterocyclic Carbenes as Ligands for Molecules and Materials	21st International Symposium on Organometallic Chemistry Directed Toward Organic Synthesis (OMCOS21), Vancouver, Canada
2023/7/24-27	Takashi Ooi	Exploiting zwitterions in organic synthesis and catalysis	27th International symposium: Synthesis in organic chemistry, Oxford, UK
2023/7/23-27	Azusa Kamikouchi	Innate and experience-dependent mechanisms for song evaluation in Drosophila	Asia Pacific Drosophila Research Conference (APDRC) 6, Australia
2023/7/4-8	Yuichiro Tsuchiya	Unknown volatile compounds orient roots of parasitic plant toward host	24th International Conference on Plant Growth Substances, Gyeongju, Korea
2023/4/26	Takashi Yoshimura	Seasonal transcriptome atlas of 80 neural and peripheral tissues of non-human primate Macaca mulatta	14th International Workshop on Resistance to Thyroid Hormones & Thyroid Hormone Actions (14th IWRTH), Monterey, Canada
2022/9/22	Wolf Frommer	Sugar transport - from discovery to the field	XVI Meeting of Plant Molecular Biology, Sevilla, Spain
2022/6/17	Kenichiro Itami	Molecular nanocarbons: Diverse structures, diversity-oriented synthesis, and diverse applications	The105th Canadian Chemistry Conference and Exhibition, Calgary, Canada

3. Major Awards

*List main awards received between FY 2021 and FY 2024 in order from the most recent (within 10 awards)..
*For each, write the date issued, recipient's name and the name of award. In case of multiple recipients, underline those affiliated with the Center.

Date	Recipient's name	Name of award
2025/3/27	Akiko Yagi	・The Chemical Society of Japan Award for Young Chemists for 2024 ・The Chemical Society of Japan Award for Outstanding Young Women Chemists for 2024
2024/11/19	Toshinori Kinoshita Wolf Frommer	Highly Cited Researcher 2024 (Clarivate)
2024/7/29	Cathleen Crudden	2024 ACS Fellow
2024/5/1	Takashi Yoshimura	Aschoff's Rule Prize (Society for Biological Rhythms)
2024/5/1	Keiko Torii	Medal of Honor with Purple Ribbon (Shiju-houshou)
2024/4/30	Wolf Frommer Keiko Torii	Member, National Academy of Sciences (NAS)
2023/11/15	Toshinori Kinoshita Wolf Frommer	Highly Cited Researcher 2023 (Clarivate)
2022/11/17	Wolf Frommer Steve Kay	Highly Cited Researcher 2022 (Clarivate)
2022/1/1	Keiko Torii	The Asahi Prize 2021
2021/11/16	Kenichiro Itami Wolf Frommer Steve Kay	Highly Cited Researcher 2021 (Clarivate)

Appendix 2 FY 2024 List of Principal Investigators

NOTE:

*Underline names of principal investigators who belong to an overseas research institution.

*Indicate newly added researchers for FY 2021-2024 in the "Notes" column.

	<Principal Investigators at the end of FY 2024>					Principal Investigators Total: 17
Name	Age	Affiliation (Position title, department, organization)	Academic degree, Specialty	Effort (%) *	Starting date of participation	Status of participation (Describe in concrete terms)	Note
Takashi YOSHIMURA	55	Director, Professor Institute of Transformative Bio-Molecules, Nagoya University	Dr. Agriculture Specialties: Animal Physiology, Systems Biology, Neuroendocrinology	80	from the beginning	usually stays at the center	
Jeffrey W. BODE	51	Professor of Organic Chemistry Department of Chemistry and Applied Biosciences, ETH Zürich, Switzerland	Doctoral of Natural Science Specialties: Organic Synthesis, Peptide and Protein Chemistry, Catalysis, Ligation and Bioconjugation	21	from the beginning	Connected 24 hours through iPad to the center. Holds online group meeting once a week. Joins PI meeting online.	
Cathleen M. CRUDDEN	58	Professor Department of Chemistry, Queen's University, Canada	Ph.D Specialities: Catalysis, Organic Synthesis, Materials Chemistry, Chirality	21	from the beginning	Holds online group meeting once a week. Joins PI meeting online.	
Kenichiro ITAMI	53	Chief Scientist, Director of Molecule Creation Laboratory, RIKEN	Dr. Engineering Specialties: Organic Synthesis, Catalysis, Pharmaceuti-cal Science, Nanocarbon Chemistry	21	from the beginning	Holds online meeting on an as-needed basis. Joins PI meeting online.	moved from NU to RIKEN as of April 1, 2024
Toshinori KINOSHITA	56	Professor Institute of Transformative Bio-Molecules, Nagoya University	Dr. Science Specialities: Plant Molecular Physiology	70	from the beginning	usually stays at the center	

Takashi OOI	59	Professor Institute of Transformative Bio-Molecules, Nagoya University	Dr. Engineering Specialties: Organic Synthesis, Catalysis, Molecular Recognition	70	from the beginning	usually stays at the center	
Keiko TORII	59	Professor College of Natural Sciences The University of Texas at Austin Investigator Howard Hughes Medical Institute	Ph.D. Specialties: Plant Development, Signal Transduction, Stem Cell Maintenance/Differenti ati-on in Plants	21	from the beginning	Holds online plant biology meeting "Mixplant meeting" once a week. Joins PI meeting online.	
Shigehiro YAMAGUCHI	56	Vice-Director, Professor Institute of Transformative Bio-Molecules, Nagoya University	Dr. Engineering Specialties: Main Group Chemistry, Physical Organic Chemistry	70	from the beginning	usually stays at the center	
Steve A. KAY	65	University and Provost Professor of Neurology, Biomedical Engineering and Biological Sciences, Director of Convergent Bioscience Co-Director of the USC Norris Center for Cancer Drug Development, Keck School of Medicine, University of Southern California	Ph.D. Specialties: Chronobiology, Genetics, Biochemistry, Systems Biology	10	from April 1st 2014	Holds online meeting on an as-needed basis. Joins PI meeting online.	
Florence TAMA	50	Professor Institute of Transformative Bio-Molecules / Department of Physics, Graduate School of Science, Nagoya	Ph.D Specialties: Computational Biophysics	50	from April 1st 2016	usually stays at the center	
Wolf B. FROMMER	67	Professor, Heinrich Heine University Dü sseldorf and Max Planck Institute for Breeding Research	Dr. rer. nat. Specialties: Biology	21	from October 16th 2016	Holds online group meeting once a week. Joins PI meeting online.	
Takeshi YANAI	50	Professor Institute of Transformative Bio-Molecules, Nagoya University	Dr. Engineering Specialties: Theoretical Chemistry, Computatoinal	70	from April 1st 2018	usually stays at the center	
Yuichiro TSUCHIYA	50	Designated Professor Institute of Transformative Bio-Molecules, Nagoya University	Dr. Agriculture Specialties: Plant Genetics, Chemical Biology	70	from April 1st 2022	usually stays at the center	

Azusa KAMIKOUCHI	50	Professor Institute of Transformative Bio-Molecules / Department of Biological Science, Graduate School of Science, Nagoya University, Nagoya University	Dr. Pharmaceutical Sciences Specialities: Neuroscience	50	from October 1st 2022	usually stays at the center	
Anuphon LAOHAVISIT	40	Designated Associate Professor Institute of Transformative Bio-Molecules, Nagoya University	Ph.D. Specialties: Plant Signaling, Plant Physiology, Chemical Biology	80	from April 1st 2022	usually stays at the center	
Quan PHUNG	38	Associate Professor Institute of Transformative Bio-Molecules / Graduate School of Science, Nagoya University	Ph.D. Specialties: Data Science, Theoretical Science	50	from December 1st 2022	usually stays at the center	
Yoko MIZUTA	43	Designated Assistant Professor Institute of Transformative Bio-Molecules, Nagoya University	Dr. Science Specialities: Plant Molecular Physiology	80	from September 1st 2022	usually stays at the center	

*Percentage of time that the principal investigator devotes to his/her work for the Academy center vis-à-vis his/her total working hours.

Principal Investigators resigned since FY 2021

2025.7.3 rev

Name	Next Affiliation (Position title, department, organization)	Period of participation
Tetsuya HIGASHIYAMA	Professor, Biologocal Sciences, Graduate School of Science, The University of Tokyo	beginning~2022.3.31

Appendix 3-1 Record of Center Activities (FY 2021-FY 2024)

1. Researchers and Center Staffs, Satellites, Partner Institutions

1-1. Researchers and Center Staffs Participated in the Center's Activities

- Enter the number of researchers and center staffs affiliated with the Center in the table in Appendix 3-1a.

Special mention

- Describe the Center's concrete plans for the future and already-established schedules for employing researchers, particularly principal investigators.
- As background to how the Center is working on the global circulation of world's best brains, give good examples, if any, of how career paths are being established for the Center's researchers; that is, from which top-world research institutions do researchers come to the Center and to which research institutions do the Center's researchers go, and how long are their stays at those institutions.
- In Appendix 3-1b, describe the positions that postdoctoral researchers acquire upon leaving the Center.

1-2. Satellites and Partner Institutions

- List the satellite and partner institutions, both domestic and overseas, in the table below.
- Indicate newly added and deleted institutions in the "Notes" column.

<Satellite institutions>

Institution name	Principal Investigator(s), if any	Notes
N/A		

< Partner institutions>

Institution name	Principal Investigator(s), if any	Notes
ETH Zurich	Jeffrey W. BODE	
Queen's University	Cathleen M. CRUDDEN	
University of Texas at Austin	Keiko TORII	
University of Southern California	Steve A. KAY	
Heinrich Heine University Düsseldorf	Wolf B. FROMMER	
NSF Center for Selective C-H Functionalization	N/A	
RIKEN Center for Sustainable Resource Science (CSRS)	N/A	
Institute of Chemistry (IoC), Academia Sinica	N/A	

2. Status of Collaboration with Overseas Satellites

2-1. Coauthored Papers

- List the refereed papers published between FY 2021 and FY 2024 that were coauthored between the Center's researcher(s) in domestic institution(s) (include satellite institutions) and overseas satellite institution(s). List them by overseas satellite institution in the below blocks.
- Transcribe data in same format as in Appendix 1. Italicize the names of authors affiliated with overseas satellite institutions.

N/A

Overseas Satellite 1 Name (Total: OO papers)
1)

2-2. Status of Researcher Exchanges

- Using the below tables, indicate the number of researcher exchanges between the Center (include domestic satellite institutions) and overseas satellite institutions during the period of FY 2021-FY 2024. Enter by institution and fiscal year.
- Write the number of principal investigator visits in the upper space and the number of other researcher visits in the lower space.

N/A

Overseas Satellite 1:

<To overseas satellite>

	FY 2021	FY 2022	FY 2023	FY 2024	Total
Principal investigators					
Other researchers					
Total					

<From overseas satellite>

	FY 2021	FY 2022	FY 2023	FY 2024	Total
Principal investigators					
Other researchers					
Total					

Overseas Satellite 2:

<To overseas satellite>

	FY 2021	FY 2022	FY 2023	FY 2024	Total
Principal investigators					
Other researchers					
Total					

<From overseas satellite>

	FY 2021	FY 2022	FY 2023	FY 2024	Total
Principal investigators					
Other researchers					
Total					

3. Holding and Participating in International Research Meetings

3-1. Holding international Research Meetings

- Indicate the number of international research conferences or symposiums held between FY 2021 and FY 2024, and give up to **five examples** of the most representative ones using the table below.

FY 2021: 4 meetings	FY 2022: 0 meetings	FY 2023: 2 meetings	FY 2024: 4 meetings

Major examples (meeting titles, places and dates held)	Number of participants
The 8th International Symposium of Transformative Bio-Molecules (ISTbM-8), 16th Hirata Award, 6th Okazaki Award February 2, 2022 (online meeting)	From domestic institutions: 254 From overseas institutions: 6
The 25th Nagoya Medal of Organic Chemistry March 3, 2022 (online meeting)	From domestic institutions: 450 From overseas institutions: 10
The 9th International Symposium of Transformative Bio-Molecules (ISTbM-9), 7th Tsuneko & Reiji Okazaki Award Nagoya, December 13, 2023	From domestic institutions: 150 From overseas institutions: 5
The 9th Chemical Protein Synthesis Conference (CPS 2024) Nagoya, June 2-5, 2024	From domestic institutions: 107 From overseas institutions: 32
International Chronobiology Summer School 2024 (Co-hosted by European Biological Rhythms Society, and others) Nagoya, August 5-8, 2024	From domestic institutions: 73 From overseas institutions: 22

3-2. Participating in International Research Meetings

- Give up to five examples of the most representative case in which the Center, not individual researchers, participated in international research meetings to enhance the visibility and brand of the Center or of the overall WPI Program

Meeting titles, places, dates held and number of participants	Form of participation (e.g. operating a booth)	Number of participants from the Center
The 44th Annual Meeting of the Molecular Biology of Japan December 1-3, 2021 (Yokohama)	Operating a booth	20
BioJapan 2023, Yokohama, October 11-13, 2023 (14,891 participants)	Operating a booth and booth session talks	3
BioJapan 2024, Yokohama, October 9-11, 2024 (18,003 participants)	Operating a booth and booth session talks	2

4. List of the Cooperative Research Agreements with Overseas Institutions

- Indicate the number of agreements concluded with overseas institutions still in effect as of the end of FY 2024 (March 31, 2025). Give five examples of the most representative agreements.

Number of effective agreements (as of March 31, 2025): 9

Five examples of the most representative agreements:

1. Name of the Agreement: Memorandum of Understanding
   Dates of the Agreement: April 1, 2013
   Counterpart in the Agreement: Queen's University
   Summary of the Agreement: The MOU is to affiliate Dr. Cathleen M. Crudden (Queen's Univ) to NU with the position of Overseas Principal Investigator to be engaged in collaborative research at NU. The MOU includes relationship, commitment, MTA, IP, publications and so on.

2. Name of the Agreement: Memorandum of Understanding
   Dates of the Agreement: September 1, 2013
   Counterpart in the Agreement: ETH Zurich
   Summary of the Agreement: The MOU is to affiliate Dr. Jeffrey Bode (ETH Zurich) to NU with the position of Overseas Principal Investigator to be engaged in collaborative research at NU. The MOU includes relationship, commitment, MTA, IP, publications and so on.

3. Name of the Agreement: Memorandum of Understanding on collaboration and cooperation/ Memorandum of Understanding on Joint Workshop
   Dates of the Agreement: January 7, 2015
   Counterpart in the Agreement: The RIKEN Center for Sustainable Resource Science (CSRS)
   Summary of an Agreement: Memorandum of Understanding on collaboration and cooperation is to promote researches in biology, chemistry, and their interdisciplinary fields under collaboration and cooperation. Memorandum of Understanding on Joint Workshop is to hold Joint-Workshop under non-disclosure agreement.

4. Name of the Agreement: Memorandum of Understanding
   Dates of the Agreement: April 1, 2017
   Counterpart in the Agreement: Heinrich Heine University Düesseldorf
   Summary of the Agreement: The MOU is to affiliate Dr. Wolf B. Frommer (Heinrich Heine University Düesseldorf) to NU with the position of Overseas Principal Investigator to be engaged in collaborative research at NU. The MOU includes relationship, commitment, MTA, IP, publications and so on.

5. Name of the Agreement: Agreement for Academic Exchange and Cooperation
   Dates of the Agreement: Sep. 7, 2017
   Counterpart in the Agreement: Institute of Chemistry, Academia Sinica
   Summary of the Agreement: The agreement is to develop academic exchange and cooperation in education and research between two institutes, including exchange of students and faculty, exchange of scientific materials, publications and information, and joint research and other activities within the range of interest of both Institutes.

5. Postdoctoral Positions through Open International Solicitations

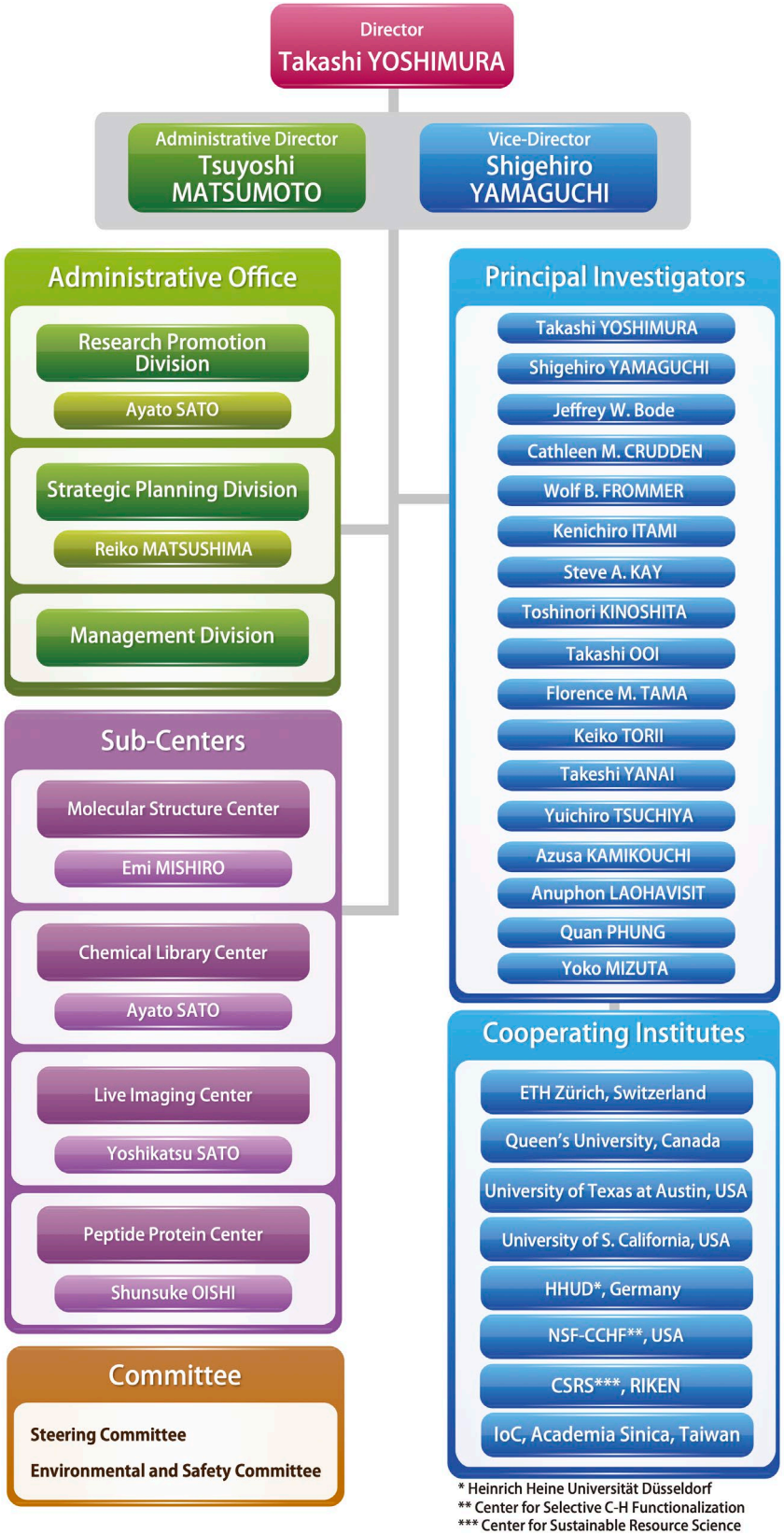
- In the columns "number of applications" and "number of selections," put the total number (upper) and the number and percentage of overseas researchers in the < > brackets (lower).
- In Appendix 3b, describe the status of employment of postdoctoral researchers.

Fiscal year	Number of applications	Number of selections
FY 2021	6	6
	〈 5, 83%〉	〈 5, 83%〉
FY 2022	45	7
	〈 44, 98%〉	〈 6, 86%〉
FY 2023	3	3
	〈 2, 67%〉	〈 2, 67%〉
FY 2024	13	2
	〈 13, 100%〉	〈 2, 100%〉

6. Diagram of Management System

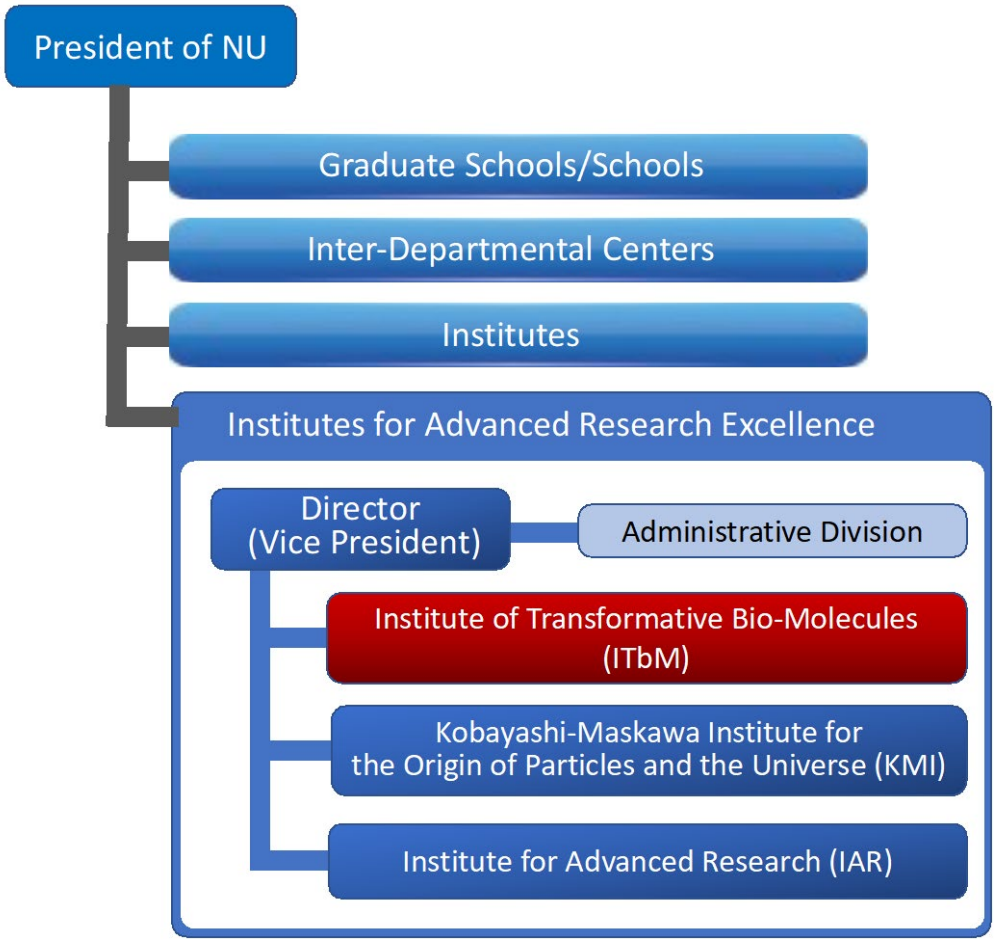
6-1.

- Diagram the Center's management system within the Center in an easily understood manner.
- If any changes have been made in the Center's management system vis-à-vis that stated in the application for WPI Academy center certification, describe them. Especially describe any important changes made in such as the center director, administrative director, head of host institution, and officer(s) in charge at the host institution (e.g., executive vice president for research).



6-2.

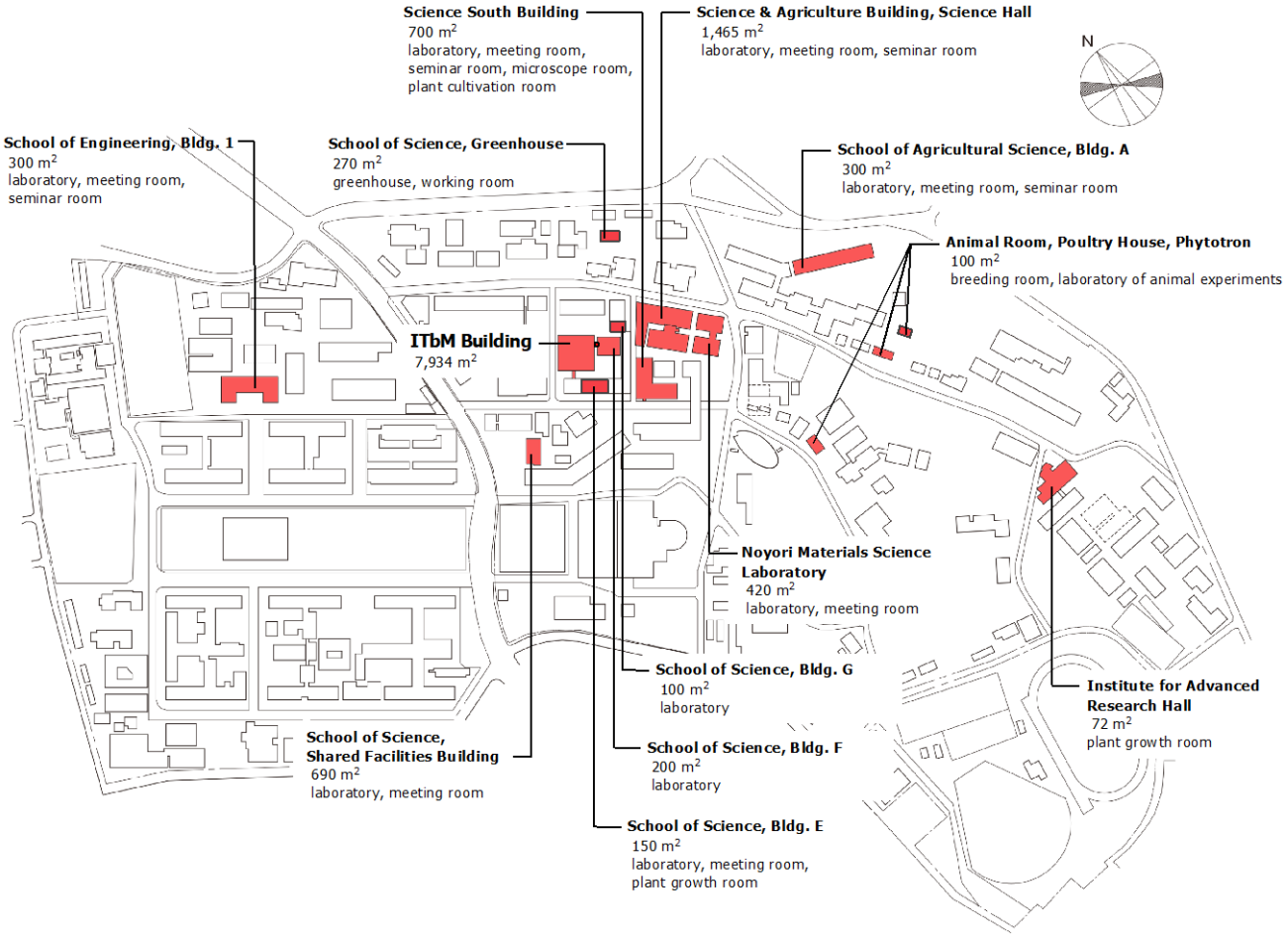
- Make a diagram of the organizational chart to show Center's position **within the host institution**.



7. Campus Map

- Draw a simple map of the campus showing where the main office and principal investigator(s) are located.

ITbM's main office and principal investigators are located in the ITbM Building.



Appendix3-1a Number of Center Personnel FY 2021-FY 2024

	FY 2021		FY 2022		FY 2023		FY 2024	
	Number of persons	%	Number of persons	%	Number of persons	%	Number of persons	%
Researchers	58		62		60		54	
Overseas researchers	15	26	18	29	18	30	16	30
Female researchers	17	29	22	35	19	32	17	31
Principal investigators (PIs)	13		17		17		17	
Overseas PIs	5	38	7	41	7	41	7	41
Female PIs	3	23	5	29	5	29	5	29
Other researchers	28		27		26		25	
Overseas researchers	2	7	2	7	1	4	1	4
Female researchers	9	32	7	26	7	27	7	28
Postdocs	17		18		17		12	
Overseas Postdocs	8	47	9	50	10	59	8	67
Female Postdocs	5	29	10	56	7	41	5	42
Research support staffs	56		44		46		46	
Administrative staffs	11		6		6		6	
TOTAL	125		112		112		106	

Number of persons who were/have been paid using the host institution's operating budget (excluding indirect funding) among the above persons.

	FY 2021	FY 2022	FY 2023	FY 2024
Principal investigators (PIs)	8	10	11	11
Other researchers	2	19	20	18
Postdocs	1	2	0	0
Research support staffs	0	4	5	6
Administrative staffs	8	4	4	3

※ Make consistent with the number of persons reported in Appendix 3-2.

	FY 2021		FY 2022		FY 2023		FY 2024	
	Number of persons	%	Number of persons	%	Number of persons	%	Number of persons	%
Doctoral students	28		30		28		37	
Employed	27	96.4	29	96.7	27	96.4	36	97.3

※ The number of doctoral students indicated in the lower table can also include those in the upper table of Total numbers.

Changes vis-à-vis the Center's application for academy center certification

※ If changes have been made vis-à-vis the Center's application for academy center certification, describe the main changes and the reasons for them.

Appendix 3-1b　Career Path of WPI Postdocs

Enter the information below during the period from the start of the center through the end of FY 2024.

* For each person, fill in the spaces to the right. More spaces may be added.
* Leave "Position as of April 2025" blank if unknown.

Japanese Postdocs

Employment period	Position before employed at WPI center		Next position after WPI center		Position as of April 2025*	
	Position title, organization	Country where the organization is located	Position title, organization	Country where the organization is located	Position title, organization	Country where the organization is located
2017/9/1-Present	Research Fellow, Osaka Prefecture University	Japan	(Currently at ITbM)	Japan	(Currently at ITbM)	Japan
2017/12/1-2025/3/31	Research Fellow, Tokyo University of Science	Japan	Program-Specific Researcher, Saitama University	Japan	Program-Specific Researcher, Saitama University	Japan
2019/8/1-2024/3/31	Research Fellow, Hokkaido University	Japan	Researcher, National Institute of Advanced Industrial Science and Technology (AIST)	Japan	Researcher, National Institute of Advanced Industrial Science and Technology (AIST)	Japan
2020/5/1-2020/9/30	Research Fellow, Saitama University	Japan	Researcher, Heinrich-Heine-Universität Düsseldorf	Germany	Specially Appointed Researcher, The University of Tokyo	Japan
2015/4/1-2018/3/31	Technical Assistant, Nagoya University	Japan	Suntory Flowers Ltd.	Japan	Research Fellow, Nagoya University	Japan
2016/4/1-2019/3/31	Doctoral Student, Kyoto University	Japan	NUProtein Co., Ltd.	Japan		
2013/4/1-2014/3/31	Research Fellow, Nagoya University	Japan	Assistant Professor, Okayama University	Japan		

2013/4/1- 2013/11/30	Research Fellow, Nagoya University	Japan	Designated Associate Professor, Nagoya University	Japan	Associate Professor, Kwansei Gakuin University	Japan
2015/4/1- 2017/3/31	Research Fellow, Nagoya University	Japan	Assistant Professor, Chuo University	Japan	Lecturer, Ochanomizu University	Japan
2015/10/1- 2016/3/31	Research Fellow, Nagoya University	Japan	Assistant Professor, Waseda University	Japan	Associate Professor, Nagoya University	Japan
2017/2/1- 2017/3/31	Research Fellow, Nagoya University	Japan			Special Researcher, Kyoto University	Japan
2018/4/1- 2018/6/30	Doctoral Student, Kyoto University	Japan	Assistant Professor, The University of Tokyo	Japan	Designated Associate Professor, The University of Tokyo	Japan
2015/4-2018/12	Research Fellow, Nagoya University	Japan	Researcher, Institute of Physical and Chemical Research	Japan	Researcher, Institute of Physical and Chemical Research	Japan
2015/4/1- 2020/3/31	Research Fellow, Nagoya University	Japan	Assistant Professor, Nagoya University	Japan	Assistant Professor, Nagoya University	Japan
2015/4/ 1 - 2018/3/31	Research Fellow, Nagoya University	Japan	Assistant Professor, Yokohama City University	Japan		
2016/6/1- 2017/11/30	Research Fellow, Nagoya University	Japan	Assistant Professor, Hokkaido University	Japan	Lecturer, Hokkaido University	Japan
2016/4-2019/3	Research Fellow, Nagoya University	Japan	Program-Specific Assistant Professor, Kyoto University	Japan	Lecturer, Kyoto University	Japan

2014/4-2015/12	Research Fellow, Nagoya University	Japan	Associate Professor, University of Science and Technology of China	China	Assistant Professor, Tohoku University	Japan
2014/10/1-2018/5/31	Research Fellow, Nagoya University	Japan	Assistant Professor, Nagoya University	Japan	Designated Associate Professor, Kyoto University	Japan
2013/5-2014/3	Research Fellow, Nagoya University	Japan	Assistant Professor, Gifu Pharmaceutical University	Japan	One Medicine Translational Research Center	Japan
2018/3-2018/4	Research Fellow, Nagoya University	Japan	Postodoctoral Researcher, ETH-Zürich	Switzerland	Designated Assistant Professor, Kyoto University	Japan
2019/4/1-2019/4/30	Designated Assistant Professor, National Institute for Basic Biology	Japan	Designated Assistant Professor, National Institute for Basic Biology	Japan	Designated Assistant Professor, The Exploratory Research Center on Life and Living Systems	Japan
2009/4/1-2013/5/31	Doctoral Course, Azabu University	Japan	Designated Assistant Professor, National Institute for Basic Biology	Japan	Professor, Tokyo University of Agriculture and Technology	Japan
2023/4/1-2024/5/31	Doctoral Student, Ehime University	Japan	Assistant Professor, Hiroshima University	Japan	Assistant Professor, Hiroshima University	Japan
2016/4/1-2017/6/18	Doctoral Student, Kyoto University	Japan	Assistant Professor, Kochi University of Technology	Japan	Assistant Professor, Osaka University	Japan
2017/4/1-2018/10/31	Research Fellow, Nagoya University	Japan	Air Liquide Laboratories	Japan	AGC Inc.	Japan
2018/4/1-2019/3/31	Doctoral Student, Tokyo Institute of Technology	Japan	Assistant Professor, Kyushu University	Japan	Assistant Professor, Kyushu University	Japan

2014/4/1- 2015/3/31	Postdoctral Fellow, Technische Universität Berlin	Germany	Researcher, National Institute for Materials Science	Japan	Researcher, National Institute for Materials Science	Japan
2013/9/1- 2015/3/31	Doctoral Student, Nagoya University	Japan	Research Fellow, The University of Tokyo	Japan	Idemitsu Kosan Co.,Ltd.	Japan
2013/4/1- 2015/10/31	Doctoral Student, Osaka University	Japan	Research Fellow, Osaka Unversity	Japan	Assistant Professor, Kyoto University	Japan
2017/4/1- 2018/3/31	Doctoral Student, Kyoto University	Japan	Assistant Professor, Kyoto University	Japan	Assistant Professor, Kyoto University	Japan
2019/4/1- 2019/12/31	Doctoral Student, Nagoya University	Japan	Researcher, Emory University	USA	Researcher, Emory University	USA
2015/4/1- 2016/3/31	Doctoral Student, Nagoya University	Japan	Mitsubishi Chemical Corporation	Japan	Mitsubishi Chemical Corporation	Japan
2013/9/1- 2017/6/15	Student, California State University	USA	Graduate Student, National Institute of Informatics	Japan	Advertising Company	Japan
2020/10/1- 2022/3/31	Board Member, NPO Scianotec	Japan			Freelance Fund Raiser	Japan
2016/2/1- 2016/3/31	Research Fellow, Kyoto University	Japan	Assistant Professor, Nagoya University	Japan	Assistant Professor, Nagoya University	Japan
2014/4/1- 2017/3/31	HFSP Postdoc, Monash University	Australia	Research Fellow, Gakushuin University	Japan	Professor, Hiroshima University	Japan

2013/10/1- 2017/2/28	Doctoral Student, National Institute for Basic Biology	Japan	Designated Assistant Professor, Yokohama City University	Japan	Lecturer, Kyoto Prefectural University	Japan
2016/4/1- Present	Research Fellow, Chubu University	Japan	(Currently at ITbM)	Japan	(Currently at ITbM)	Japan
2016/12/1- 2019/9/30	Post-doctoral Position, Nara Institute of Science and Technology	Japan				
2020/10/1- 2022/3/31	Researcher, Kyoto Sangyo University	Japan	Postdoctoral Researcher, Kyoto Sangyo University	Japan	Postdoctoral Researcher, Kyoto Sangyo University	Japan
2013/4/1- 2016/3/31	Research Fellow, Nagoya University	Japan	Assistant Professor, Yokohama City University	Japan	Associate Professor, Yokohama City University	Japan
2013/4/1- 2015/5/31	Research Fellow, Nagoya University	Japan	Postdoc, University of Geneva	Switzerland	Assistant Professor, The University of Tokyo	Japan
2015/4/1- 2018/3/31	Research Fellow, Kyushu University	Japan	Research Fellow, Nagoya University	Japan	Designated Assistant Professor, The University of Tokyo	Japan
2015/4/1- 2019/3/31	Research Fellow, The University of Tokyo	Japan	Assistant Professor, Ritsumeikan University	Japan	Associate Professor, Ritsumeikan University	Japan
2016/4/1- 2019/3/31	Research Fellow, Technical University of Munich	Germany	Assistant Professor, National Institute for Basic Biology	Japan	Assistant Professor, National Institute for Basic Biology	Japan
2017/1/1- 2020/10/31	Associate Specialist, Chinese Academy of Sciences (PSC)	China	Researcher, The National Institute of Advanced Industrial Science and Technology	Japan		

2018/4/1-2021/3/31	Research Fellow, Nagoya University	Japan	Researcher, ETH Zurich	Switzerland		
2019/4/1-2019/6/30	Technical Assistant, Nagoya University	Japan	Research Fellow, Nagoya University	Japan	Assistant Professor, Kyoto University	Japan
2021/1/1-2022/3/31	Research Fellow, Nagoya University	Japan	Research Fellow, Nagoya University	Japan	Assistant Professor, Kyoto University	Japan
2022/11/1-2023/10/31	Research Fellow, Nagoya University	Japan	Assistant Professor, Kyoto University	Japan	Assistant Professor, Kyoto University	Japan
2015/4/1-2016/3/31	Doctoral Student, Nagoya University	Japan				
2014/11/1-Present	Research Fellow, University of Toronto	Canada	Designated Associate Professor, Nagoya University	Japan	(Currently at ITbM)	Japan
2019/4-2022/3	Research Fellow, Nagoya University	Japan	Research Fellow, Nagoya University	Japan	Assistant Professor, Nara Institute of Science and Technology	Japan
2020/4/1-2020/9/30	Research Fellow, Nagoya University	Japan	Research Fellow, Nagoya University	Japan	Associate Professor, Kobe University	Japan
2017/4-Present	Tokai Medical Products, Inc	Japan	Research Fellow, Nagoya University	Japan	Assistant Professor, Nagoya University	Japan
2015/4-2018/3	Researcher, University of Toronto	Japan	Assistant Professor (Non-tenured), Meiji University	Japan	Associate Professor, Meijo University	Japan

2015/4-2016/6	Research Fellow, Kyushu University	Japan	Assistant Project Scientist, University of California, San Diego	USA	(Currently at ITbM)	Japan
2022/4/1-2024/3/31	Research Fellow, Tottori University	Japan	Assistant Professor, The University of Tokyo	Japan	Assistant Professor, The University of Tokyo	Japan
2020/6/1-Present	Research Associate, National Institute for Basic Biology	Japan	(Currently at ITbM)	Japan	(Currently at ITbM)	Japan
2021/5/1-Present	Research Fellow, JSPS	Japan	(Currently at ITbM)	Japan	(Currently at ITbM)	Japan

Overseas Postdocs

Employment period	Position before employed at WPI center		Next position after WPI center		Position as of April 2025*		Nationality
	Position title, organization	Country where the organization is located	Position title, organization	Country where the organization is located	Position title, organization	Country where the organization is located	
2015/11/1-2019/9/30	Doctoral Student, University of Hong Kong	Hong Kong	Associate professor, Shanghai Children's Medical Center, School of Medicine, Shanghai Jiao Tong University	China	Associate professor, Shanghai Children's Medical Center, School of Medicine, Shanghai Jiao Tong University	China	China
2013/6/1-2014/3/31	Researcher, Institute of Physical and Chemical Research	Japan	Reserch Fellow,ETH Zürich	Switzerland	Scientist, Sygnature Discovery	Canada	France
2013/6/1-2015/11/30	Doctoral Student, University of South Florida	USA	Postdoctoral Research Associate, The University of Sydney	Australia	Postdoctoral Research Associate, The University of Sydney	Australia	India
2013/6/1-2015/8/31	Post-Doc Research Fellow, Max-Planck-Institut	Germany	Post-Doc Research Fellow, Max-Planck-Institut	Germany	Professor, South China University of Technology	China	China
2015/12/1-2016/3/31	Doctoral Student, Bangalore University	India					India

2016/5/16-2016/12/31	Doctoral Student, ETH Zürich	Switzerland			Siegfried AG	Switzerland	Switzerland
2017/1/1–2017/12/31	Research Fellow, University of Washington	USA	Assistant Professor, Central Drug Research Institute	India	Assistant Professor, Central Drug Research Institute	India	India
2017/1/1-2019/10/31	Research Fellow, Indian Institute of Technology Tirupati	India	Research Associate, University of Cambridge	UK	Research Fellow, University College London	UK	India
2017/8/1-2020/12/31	Research Associate, Indian Institute of Technology Madras	India	INSPIRE Researcher, Indian Institute of Technology Tirupati	India	INSPIRE Researcher, Indian Institute of Technology Tirupati	India	India
2018/10/1-2020/7/31	Student, University of California	USA	Doctoral Student, The Scripps Research Institute	USA			Switzerland
2019/10/1-2021/9/30	University of Pennsylvania	USA	Researcher, ETH	Switzerland	SYNLAB Suisse SA	Switzerland	Germany
2020/11/1-2022/3/13	University of Pittsburgh	USA			Researcher, A*Star	Singapore	Singapore
2024/11/1-Present	Postdoctoral Fellow, CSIR	India	(Currently at ITbM)		(Currently at ITbM)		India
2013/5/1-2014/3/31	Researcher, Rovira i Virgili University	Spain			Lecturer, University of Sussex	UK	Spain
2013/6/1-2014/5/31	Assistant Professor, COMSATS Institute of Information and Technology	Pakistan	Assistant Professor, COMSATS Institute of Information and Technology	Pakistan	Associate Professor, COMSATS Institute of Information and Technology	Pakistan	Pakistan
2013/7/5-2014/7/31	Doctoral Student, University College Dublin (CSCB)	Ireland	Research Fellow, National Autonomous University of Mexico (UNAM)	Mexico	Principal Investigator, Chapingo University	Mexico	Mexico
2014/9/1-2014/12/19	Postdoctoral Fellow, Queen's University	Canada	Postdoctoral Fellow, Queen's University	Canada	Product Development Researcher, Green Center	Canada	Switzerland

2014/11/1-2015/10/31	Doctoral Student, Queen's University	Canada					Canada
2015/4/16-2020/5/6	Doctoral Student, University of British Columbia	Canada	Air Liquide	Japan	Air Liquide	Japan	Canada
2015/4/16-2021/7/31	Doctoral Student, University of British Columbia	Canada	Researcher, Acty Inc.	Japan	Researcher, CNCEC Japan Research Institute	Japan	Canada
2015/5/16-2017/5/15	Post-doctoral Research Scientist, University of Jyvä skylä	Finland			Researcher, Neste	Finland	Finland
2017/11/16-2021/3/31	Postdoctoral Fellow, University of Toronto	Canada	Research scientist, FPInnovations	Canada	Research scientist, FPInnovations	Canada	Canada
2020/1/16-2020/9/30	Humbodlt Research Fellowship, TU Berlin	Germany	Research Fellow, JSPS	Japan	Associate Professor, University of Wuhan	China	China
2020/11/1-2021/10/27	Osaka University	Japan			Senior Scientific Manager, Aragen Life sciences	India	India
2022/5/1-2023/3/30	Doctoral Student, University of California	USA	Research Fellow, JSPS	Japan			USA
2024/4/1-2024/11/30	Research Fellow, JSPS	Japan	Designated Assistant Professor, Hokkaido University	Japan	Designated Assistant Professor, Hokkaido University	Japan	USA
2022/5/1-2023/9/30	Postdoctoral Fellow, Queen's University	Canada	Research Fellow, JSPS	Japan	Research Fellow, JSPS	Japan	USA
2023/11/1-2024/7/31	Postdoctoral Fellow, Queen's University	Canada					Mexico
2022/9/1-Present	Research Fellow, JSPS	Japan	(Currently at ITbM)		(Currently at ITbM)		Taiwan
2013/4/1-2014/4/7	Research Fellow, Nagoya University	Japan	Doctoral Student, Massachusetts Institute of Technology	USA	Professor, Western Washington University	USA	USA

2013/4/1- 2015/4/30	Doctoral Student, Nagoya University	Japan	Assistant Professor, Indian Institute of Science Education and Research	India	Associate Professor, Indian Institute of Science Education and Research	India	India
2013/6/16- 2016/1/31	AstraZeneca India Pvt Ltd	India	Designated Assistant Professor,Nagoya University	Japan			India
2015/6/1- 2017/4/30	Postdoctoral Research Fellow, Karlsruhe Institute of Technology	Germany	Schrödinger, Inc.	Germany			Germany
2016/10/1– 2017/10/31	Research Fellow, Free University of Berlin	Germany	Program-Specific Lecturer, Kyoto University	Japan			Germany
2017/8/1- 2019/2/28	Doctoral Student, University of Calabria	Italy	Postdoctoral Researcher, Hokkaido University	Japan	Designated Assistant Professor,Nagoya University	Japan	Italy
2019/1/1- 2022/3/31	Postdoctoral Scientist, High Energy Accelerator Research Organization	Japan	Senior Scientis, AgroDesign Studios	Japan	Designated Associate Professor, High Energy Accelerator Research Organization	Japan	UK
2022/10/16- Present	Don Bosco College of Agriculture, Arakkonam・Assistant Professor	India	(Currently at ITbM)		(Currently at ITbM)		India
2016/4/1- 2020/12/28	Research Fellow, Nagoya University	Japan	Assistant Professor, Indian Institutes of Technology Gandhinagar	India	Assistant Professor, Indian Institutes of Technology Gandhinagar	India	India
2017/9/1– 2019/3/31	Postdoc, ENS Paris-Saclay	France					Hungary
2019/8/1- 2025/2/28	Student, UNIVERSITY OF MADRAS	India	Manager(R&D), MERAI NEWAGE PRIVATE LIMITED	India	Manager, Nuvo AI Pvt Ltd	India	India
2021/4/1- 2022/3/31	Researcher, RIKEN	Japan	Beamline Scientist, Diamond Light Source Ltd	UK	Beamline Scientist, Diamond Light Source Ltd	UK	India
2017/10/15- 2019/10/14	Assistant, Polish Academy of Sciences	Poland	Senior Scientist, Polish Academy of Sciences	Poland	Senior Scientist, Polish Academy of Sciences	Poland	Poland

2018/11/1-2022/3/31	Researcher, Stockholm University	Sweden			Managing Editor, American Chemical Society	USA	Spain
2013/11/1–2016/8/31	Postdoc Research Fellow, Okayama University	Japan	Lecturer, Xi'an Jiaotong University	China	Associate Professor, Xi'an Jiaotong University	China	China
2014/12/16-2017/6/30	Doctoral Student, University Rovira I Virgili	Spain	Designated Assistant Professor, Nagoya University	Japan			Sweden
2017/1/16-2018/8/31	Doctoral Student, The University of Manchester	UK	Lecturer, The University of Manchester	UK	Lecturer, University of Southampton	UK	UK
2017/7/1-2018/3/31	Doctoral Student, Wilhelm University of Westphalia	Germany	Professor, Fuzhou University	China	Professor, Fuzhou University	China	China
2019/4/1-2019/9/30	Research Fellow, Nagoya University	Japan					USA
2020/12/1-2022/3/30	University of Hyderabad	India			PD, University of Pennsylvania	USA	India
2014/4/1-2019/3/30	Research Fellow, Nagoya University	Japan	Assistant Professor, Shanghai University	China	Assistant Professor, Shanghai University	China	China
2016/4/1-2019/2/28	Research Fellow, Nagoya University	Japan	Assistant Professor, Nanjing University	China	Assistant Professor, Nanjing University	China	China
2014/4/1-2016/9/30	Research Fellow, Nagoya University	Japan	Associate Professor, Jiangnan University	China	Associate Professor, Jiangnan University	China	China
2014/8/1-2016/7/31	Research Fellow, Nagoya University	Japan	Assistant Professor, Huazhong University of Science and Technology	China	Assistant Professor, Huazhong University of Science and Technology	China	China
2015/11/1-2019/3/31	Research Fellow, University College London	UK			Assistant Project Scientist, University of California, Los Angeles	USA	USA
2017/6/1-2020/7/31	Postdoctoral Fellow, Academia Sinica	Taiwan	Postdoctoral Fellow,Academia Sinica	Taiwan	Postdoctoral Fellow, Academia Sinica	Taiwan	Taiwan

2021/10/16- 2021/12/31	Research Fellow, JSPS	Japan	Designated Assistant Professor, Nagoya University	Japan	Principal Investigator, Chinese Academy of Sciences	China	China
2013/4/1- 2013/11/14	Research Fellow, Nagoya University	Japan	Research Fellow, Nagoya University	Japan	Professor, National Kaohsiung University	Taiwan	Taiwan
2016/6/21- 2016/8/23	Doctoral Student, Goethe University	Germany	Doctoral Student, Goethe University	Germany			Germany
2013/10/1- 2015/7/31	Doctoral Student, Nagoya University	Japan	Associate Professor, Nanchang University	China	Associate Professor, Nanchang University	China	China
2016/1/16- 2017/8/31	Doctoral Student, Wilhelm University of Westphalia	Germany					Bolivia
2015/8/1- 2018/8/31	Research Fellow, Polish Academy of Sciences	Poland	Research Fellow, Polish Academy of Sciences	Poland	Assistant Professor, Polish Academy of Sciences	Poland	Poland
2018/6/12- 2018/8/22	Doctoral Student, Friedrich Alexander University	Germany	Doctoral Student, Friedrich Alexander University	Germany			Germany
2018/6/12- 2018/8/22	Doctoral Student, University of British Columbia	Canada	Doctoral Student, University of British Columbia	Canada			Canada
2018/10/1- 2019/8/31	Doctoral Student, National University of Singapore	Singapore	Lecturer, YuLin College	China	Associate Professor, Inner Mongolia University	China	China
2019/10/1- 2022/3/31	Beijing Institute of Technology	China					China
2019/12/1- 2020/3/31	Technische Universität Berlin, Institute of Chemistry	Germany	Research Fellow, JSPS	Japan	Professor, Nankai University	China	China
2013/10/1- 2017/8/31	Research Fellow, Nagoya University	Japan	Research Fellow, Nagoya University	Japan	Professor, Jilin University	China	China
2021/6/1- 2022/3/31	Doctoral Student, University Rennes and University Bremen	Germany					Germany

2020/1/16-2022/3/31	Q26・Sales and Marketing staff	UK	Academic Specialists, Nagoya University	Japan			UK
2014/1/1-2016/2/29	Doctoral Student, University of North Carolina	USA	Amgen Inc.	USA	Amgen Inc.	USA	USA
2013/10/1-2015/12/31	Doctoral Student, Indian Institute of Technology Madras	India			Senior Scientific Manager, Zenfold Sustainable Technologies	India	India
2014/5/1-2015/1/31	Postdoc, University of Amsterdam	Netherlands	Research Associate, Institut des Sciences Chimiques de Rennes CNRS	France	Senior Researcher, Institut des Sciences Chimiques de Rennes CNRS	France	Spain
2016/3/1-2017/8/31	Doctoral Student, The Indian Institute of Science	India	Scientist, Central Drug Research Institute	India	Senior Scientist, CSIR-Central Drug Research Institute, Lucknow	India	India
2017/8/1-2020/11/30	Doctoral Student, University of Edinburgh	UK	Xinglin Young Scholar, Guangzhou University of Chinese Medicine	China	Principal Scientist of Organic Synthesis, Enzymaster	China	China
2021/8/1-2022/7/11	Researcher, Oxford University	UK			Principal Scientist, Novartis	Switzerland	France
2022/4/24-2023/7/19	Doctoral Student, University of Regensburg	Germany	Project Chemist, Siegfried AG	Switzerland	Project Chemist, Siegfried AG	Switzerland	Germany
2014/1/16-2016/3/14	Research Assistant, Heinrich-Heine-Universität Düsseldorf	Germany	Next Move KK	Japan			Germany
2022/12/16-2023/8/31	Researcher, INRAE	France	Lanzhou University	China	Professor, Lanzhou University	China	China
2017/11/1-2021/1/20	Doctoral Student, Sun Yat-sen University	China	Associate Professor, Sun Yat-sen University	China	Associate Professor, Sun Yat-sen University	China	China
2015/11/18-2018/1/31	Doctoral Student, University of Calgary	Canada	Post-doctoral -Researcher,Cold Spring Harbor Laboratory	USA	Assistant Professor, Indian Institute of Technology	India	India

2017/4/1-2019/2/16	Research Fellow, Okayama University	Japan	Assistant Professor, Shanghai Jiao Tong University	China	Professor, Peking University/Institute of Advanced Agriculture Science	China	China
2013/4/1-2019/3/31	Research Fellow, The University of Tokyo	Japan	Professor, Peking University	China	Professor, Peking University	China	China
2019/4/1-2021/2/28	Research Fellow, Nanjing Agricultural University	China	Assistant Professor, Foshan University	China	Assistant Professor, Foshan University	China	China
2023/3/1-2023/8/31	Researcher, Nagoya University	Japan	Lecturer, Yangzhou University	China	Lecturer, Yangzhou University	China	China
2018/4/1-2018/12/31	Researcher, Institute for Molecular Science	Japan	Associate Professor, Sun Yat-sen University	China	Associate Professor, Sun Yat-sen University	China	China
2019/1/16-2020/9/30	Postdoctoral Researcher, KU Leuven	Belgium	Associate Professor, Nagoya University	Japan	Associate Professor, Nagoya University	Japan	Vietnam
2022/11/1-Present			(Currently at ITbM)		(Currently at ITbM)		Thailand
2023/10/1-Present	Research Assistant, Nagoya University	Japan	(Currently at ITbM)		(Currently at ITbM)		Malaysia

Project Expenditures FY2024

(Thousand yens)

	Amount	Details	Operational subsidies to National University Corporations/Incorporated Administrative Agency		Funding by WPI Academy		Government Subsidies except Funding from WPI Academy		Donations		Indirect funding		Joint research projects		Competitive funding		Others	
			Total costs	Details (no. of persons)	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details
Personnel	358,399	Operational subsidies to National University Corporations/Incorporated Administrative Agency	17,174	Center director 1														
	14,811	Funding by WPI Academy															12,183	Administrative director 1
	-	Government Subsidies except Funding from WPI Academy	100,257	Principal investigators 10	-	0	-	0	-	0	-	0	-	0	-	0	21,700	2
	11,157	Donations	81,713	・Full-time／Japanese 6													11,835	・Full-time／Japanese 1
	7,058	Indirect funding	180	・Concurrent／Japanese 1														
	8,177	Joint research projects	17,913	・Full-time／Overseas 2													9,865	・Full-time／Overseas 1
	44,469	Competitive funding	451	・Concurrent／Overseas 1														
	136,205	Others	167,484	Other researchers 18	-	0	-	0	-	0	6,575	Other researchers 1	-	0	9,893	Other researchers 1	26,700	Other researchers 5
			109,850	・Associate professor /Assistant professor 11											9,893	・Associate professor /Assistant professor 1	9,241	・Associate professor /Assistant professor 1
			57,634	・Others 7							6,575	・Others 1					17,459	・Others 4
					14,811	Postdocs 5			4,590	Postdocs 2					11,427	Postdocs 2	19,189	Postdocs 7
			48,127	Research support staffs 6					6,567	Research support st: 3	483	Research support st: 1	8,177	Research support st: 4	23,149	Research support staffs 13	52,777	Research support staffs 17
			25,357	Administrative staffs 3													3,656	Administrative staffs 1
Subtotal	580,276		358,399	38	14,811	5	-	0	11,157	5	7,058	2	8,177	4	44,469	16	136,205	33
Project activities	47,586	Operational subsidies to National University Corporations/Incorporated Administrative Agency	6,500	Consumables expenses	2,763	Consumables expenses					17,394	Consumables expenses					1,683	Consumables expenses
	18,603	Funding by WPI Academy	40,912	Utility charges	14,055	Others					31,528	Utility charges					15,481	Utility charges
	-	Government Subsidies except Funding from WPI Academy	99	Miscellaneous service expenses	1,667	Consumption tax					12,076	Miscellaneous service expenses					9,344	Miscellaneous service expenses
	-	Donations	75	Outreach	118	Lecture honorarium					3,183	Administrative expenses					991	Administrative expenses
	64,268	Indirect funding									87	Outreach					254	Outreach
	-	Joint research projects																
	-	Competitive funding																
	27,753	Others																
Subtotal	158,210		47,586		18,603		-		-		64,268		-		-		27,753	
Travel	273	Operational subsidies to National University Corporations/Incorporated Administrative Agency	273	Travel expenses (domestic)	1,573	Travel expenses (domestic)					181	Travel expenses (domestic)					103	Travel expenses (domestic)
	2,950	Funding by WPI Academy			1,377	Travel expenses (overseas)					500	Travel expenses (overseas)						
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	681	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	103	Others																
Subtotal	4,007		273		2,950		-		-		681		-		-		103	
Equipment	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency									6,394	Furniture						
	-	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	6,394	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	6,394		-		-		-		-		6,394		-		-		-	
Research projects	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency							85,344	Donations	12,030	Joint research indirect funds	47,308	Joint research direct funds	194,023	Grant direct funds	194,023	Commissioned research direct funds
	-	Funding by WPI Academy									24,913	Grant indirect funds						
	-	Government Subsidies except Funding from WPI Academy									7,668	Commissioned research indirect funds						
	85,344	Donations																
	44,611	Indirect funding																
	47,308	Joint research projects																
	194,023	Competitive funding																
	194,023	Others																
Subtotal	565,309		-		-		-		85,344		44,611		47,308		194,023		194,023	
Others	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency			3,636	Commission charge												
	3,636	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	3,636		-		3,636		-		-		-		-		-		-	
Total	1,317,832		406,258		40,000		-		96,501		123,012		55,485		238,492		358,084	

Operational subsidies to National University Corporations/Incorporated Administrative Agency	運営費交付金
Funding by WPI Academy	WPIアカデミー国際頭脳循環の加速・拡大事業
Government Subsidies except Funding from WPI Academy	機関補助金（WPIアカデミー国際頭脳循環の加速・拡大事業を除く）
Donations	寄付金
Indirect funding	間接経費
Joint research projects	共同研究費
Competitive funding	競争的資金
Others	その他

Project Expenditures FY2023

(Thousand yens)

	Amount	Details	Operational subsidies to National University Corporations/Incorporated Administrative Agency		Funding by WPI Academy		Government Subsidies except Funding from WPI Academy		Donations		Indirect funding		Joint research projects		Competitive funding		Others	
			Total costs	Details (no. of persons)	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details
Personnel	393,030	Operational subsidies to National University Corporations/Incorporated Administrative Agency	17,080	Center director 1														
	11,375	Funding by WPI Academy	3,029	Administrative director													9,088	Administrative director 1
	-	Government Subsidies except Funding from WPI Academy	111,672	Principal investigator 10	-	Principal investigator 0	-	0	-	0	151	0	-	0	-	0	21,061	2
	11,302	Donations	93,999	・Full-time／Japane 7		・Full-time／Japanese					151	・Full-time／Japanese					11,261	・Full-time／Japane 1
	19,762	Indirect funding		・Concurrent／Japanese		・Concurrent／Japanese												
	9,704	Joint research projects	17,342	・Full-time／Overse 2		・Full-time／Overseas											9,800	・Full-time／Overse 1
	52,367	Competitive funding	331	・Concurrent／Over 1		・Concurrent／Overseas												
	113,558	Others	187,626	Other researchers 20	-	Other researchers 0	-	0	-	0	8,592	1	-	0	9,768	2	5,552	1
			113,465	・Associate professor /Assistant professor 11		・Associate professor /Assistant professor					8,563	・Associate professc 1			5,050	・Associate professc 1	5,552	・Associate professc 1
			74,161	・Others 9		・Others					29	・Others			4,718	・Others 1		
			2,061	Postdocs	11,375	Postdocs 4							2,044	Postdocs	22,368	Postdocs 5	17,762	Postdocs 4
			42,705	Research support staffs 5		Research support staffs		Research support staffs	6,357	Research support sta 2	11,017	Research support sta 4	7,660	Research support sta 3	20,231	Research support sta 11	56,409	Research support sta 17
			28,857	Administrative staffs 4		Administrative staffs		Administrative staffs	4,945	Administrative staffs 6	2	Administrative staffs					3,686	Administrative staffs 1
Subtotal	611,098		393,030	40	11,375	4	-	0	11,302	8	19,762	5	9,704	3	52,367	18	113,558	26
Project activities	53,841	Operational subsidies to National University Corporations/Incorporated Administrative Agency	6,429	Miscellaneous service expe	4,022	Consumables expenses					41,055	Consumables expenses					87	Consumables expenses
	22,546	Funding by WPI Academy	47,412	Utility charges	16,808	Others					21,433	Utility charges					18,855	Utility charges
	-	Government Subsidies except Funding from WPI Academy			1,467	Consumption tax					44,512	Miscellaneous service expenses					763	Miscellaneous service expenses
	-	Donations			249	Lecture honorarium					108	Administrative expenses					5,868	Administrative expenses
	108,400	Indirect funding									60	Outreach					87	Outreach
	-	Joint research projects									1,232	International Symposium						
	-	Competitive funding																
	25,660	Others																
Subtotal	210,447		53,841		22,546		-		-		108,400		-		-		25,660	
Travel	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency			884	Travel expenses (domestic)					241	Travel expenses (domestic)						
	4,243	Funding by WPI Academy			3,359	Travel expenses (overseas)					2,640	Travel expenses (overseas)						
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	2,881	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	7,124		-		4,243		-		-		2,881		-		-		-	
Equipment	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency									5,833	Furniture					1,302	Audio equipment
	-	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	5,833	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	1,302	Others																
Subtotal	7,135		-		-		-		-		5,833		-		-		1,302	
Research projects	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency							65,419	Donations	7,405	Joint research indirect funds	59,596	Joint research direct funds	368,126	Grant direct funds	239,010	Commissioned research direct funds
	-	Funding by WPI Academy									27,539	Grant indirect funds						
	-	Government Subsidies except Funding from WPI Academy									8,343	Commissioned research indirect funds						
	65,419	Donations																
	43,287	Indirect funding																
	59,596	Joint research projects																
	368,126	Competitive funding																
	239,010	Others																
Subtotal	775,438		-		-		-		65,419		43,287		59,596		368,126		239,010	
Others	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency			3,816	Commission charge												
	3,816	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	3,816		-		3,816		-		-		-		-		-		-	
Total	1,615,058		446,871		41,980		-		76,721		180,163		69,300		420,493		379,530	

Operational subsidies to National University Corporations/Incorporated Administrative Agency	運営費交付金
Funding by WPI Academy	WPIアカデミー国際頭脳循環の加速・拡大事業
Government Subsidies except Funding from WPI Academy	機関補助金（WPIアカデミー国際頭脳循環の加速・拡大事業を除く
Donations	寄付金
Indirect funding	間接経費
Joint research projects	共同研究費
Competitive funding	競争的資金
Others	その他

Project Expenditures FY2022

(Thousand yens)

	Amount	Details	Operational subsidies to National University Corporations/Incorporated Administrative Agency		Funding by WPI Academy		Government Subsidies except Funding from WPI Academy		Donations		Indirect funding		Joint research projects		Competitive funding		Others	
			Total costs	Details (no. of persons)	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details
Personnel	322,150	Operational subsidies to National University Corporations/Incorporated Administrative Agency	16,763	Center director 1														
	22,468	Funding by WPI Academy		Administrative director							11,991	Administrative director 1						
	3,534	Government Subsidies except Funding from WPI Academy	92,938	Principal investigator 9	241	Principal investigator 1	-	0	-	0	11,485	1	-	0	-	0	9,784	1
	5,947	Donations	84,144	・Full-time／Japane 7		・Full-time／Japanese					11,485	・Full-time／Japane 1					2	・Full-time／Japanese
	61,153	Indirect funding		・Concurrent／Japanese		・Concurrent／Japanese						・Concurrent／Japanese						・Concurrent／Japanese
	16,707	Joint research projects	8,614	・Full-time／Overse 2		・Full-time／Overseas						・Full-time／Overseas					9,782	・Full-time／Overse 1
	59,931	Competitive funding	180	・Concurrent／Overseas	241	・Concurrent／Over 1						・Concurrent／Overseas						・Concurrent／Overseas
	62,001	Others	142,617	Other researchers 19	7,406	Other researchers 0	-	0	-	0	11,768	2	-	0	14,091	3	6,221	1
			68,844	・Associate professor /Assistant professor 10		・Associate professor /Assistant professor					8,534	・Associate professor /Assistant professor 1			4,052	・Associate professor /Assistant professor 1	4,465	・Associate professor /Assistant professor
			73,773	・Others 9	7,406	・Others					3,234	・Others 1			10,039	・Others 2	1,756	・Others 1
			6,553	Postdocs 2	7,406	Postdocs 2			2,320	Postdocs 2	414	Postdocs	2,446	Postdocs 1	24,827	Postdocs 5	15,307	Postdocs 4
			35,811	Research support staffs 4	7,415	Research support staffs	3,534	Research support staffs 1	3,627	Research support staffs 5	21,817	Research support staffs 7	14,261	Research support staffs 6	21,013	Research support staffs 10	30,689	Research support staffs 11
			27,468	Administrative staffs 4		Administrative staffs					3,678	Administrative staffs 1						
Subtotal	553,891		322,150	39	22,468	3	3,534	1	5,947	7	61,153	12	16,707	7	59,931	18	62,001	17
Project activities	46,877	Operational subsidies to National University Corporations/Incorporated Administrative Agency	191	Outreach	4,190	Consumables expenses					1,532	Consumables					455	Consumables expenses
	16,683	Funding by WPI Academy	5,848	Miscellaneous service expens	10,133	Others					37,802	Miscellaneous service expenses					1,657	Outreach
	-	Government Subsidies except Funding from WPI Academy	622	Administrative expenses	2,360	Consumption tax					43,549	Utility charges					271	Miscellaneous service expenses
	-	Donations	38,949	Utility charges													5,226	Administrative expenses
	82,883	Indirect funding	1,267	Temporary staffing expenses													32,750	Utility charges
	-	Joint research projects																
	-	Competitive funding																
	40,359	Others																
Subtotal	186,802		46,877		16,683		-		-		82,883		-		-		40,359	
Travel	388	Operational subsidies to National University Corporations/Incorporated Administrative Agency	55	Transfer allowances (domest	215	Travel expenses (domestic)					36	Travel expenses (domestic)					135	Transfer allowances (overseas)
	2,034	Funding by WPI Academy	333	Transfer allowances (oversea	1,819	Travel expenses (overseas)					261	Travel expenses (overseas)						
	-	Government Subsidies except Funding from WPI Academy									36	Transfer allowances (domestic)						
	-	Donations									603	Transfer allowances (overseas)						
	936	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	135	Others																
Subtotal	3,493		388		2,034		-		-		936		-		-		135	
Equipment	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency			1,144	Vacuum pump												
	5,179	Funding by WPI Academy			1,078	X-ray analyzer												
	-	Government Subsidies except Funding from WPI Academy			1,124	Projector												
	-	Donations			1,695	Ultrasonic crushing equipment												
	-	Indirect funding			138	Others												
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	5,179		-		5,179		-		-		-		-		-		-	
Research projects	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency							37,452	Donations	2,672	Joint research indirect funds	53,424	Joint research direct funds	286,765	Grant direct funds	151,335	Commissioned research direct funds
	-	Funding by WPI Academy									23,180	Grant indirect funds						
	-	Government Subsidies except Funding from WPI Academy									6,084	Commissioned research indirect funds						
	37,452	Donations																
	31,936	Indirect funding																
	53,424	Joint research projects																
	286,765	Competitive funding																
	151,335	Others																
Subtotal	560,912		-		-		-		37,452		31,936		53,424		286,765		151,335	
Others	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency			4,636	Commission charge												
	4,636	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	4,636		-		4,636		-		-		-		-		-		-	
Total	1,314,913		369,415		51,000		3,534		43,399		176,908		70,131		346,696		253,830	

Operational subsidies to National University Corporations/Incorporated Administrative Agency	運営費交付金
Funding by WPI Academy	WPIアカデミー国際頭脳循環の加速・拡大事業
Government Subsidies except Funding from WPI Academy	機関補助金（WPIアカデミー国際頭脳循環の加速・拡大事業を除く
Donations	寄付金
Indirect funding	間接経費
Joint research projects	共同研究費
Competitive funding	競争的資金
Others	その他

Project Expenditures FY2021

(Thousand yens)

	Amount	Details	Operational subsidies to National University Corporations/Incorporated Administrative Agencies		WPI grant		Government subsidies except WPI grant		Donations		Indirect funding		Joint research projects		Competitive funding		Others	
			Total costs	Details (no. of persons)	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details
Personnel	154,288,553	Operational subsidies to National University Corporations/Incorporated Administrative Agencies	35,624,369	Center director 3	6,720,000	Center director						Center director						Center director
	321,497,402	WPI grant	7,189,166	Administrative director	7,792,789	Administrative direct 1						Administrative director						Administrative director
	6,654,417	Government subsidies except WPI grant	61,790,776	Principal investigator 5	11,520,000	Principal investigator 0	–	0	–	0	–	Principal investigator 0	–	0	–	0	–	Principal investigator 0
	-	Donations	61,790,776	・Full-time／Japane 5	11,520,000	・Full-time／Japanese						・Full-time／Japanese						・Full-time／Japanese
	6,718,031	Indirect funding		・Concurrent／Japanese		・Concurrent／Japanese						・Concurrent／Japanese						・Concurrent／Japanese
	-	Joint research projects		・Full-time／Overseas		・Full-time／Overseas						・Full-time／Overseas						・Full-time／Overseas
	-	Competitive funding		・Concurrent／Overseas		・Concurrent／Overseas						・Concurrent／Overseas						・Concurrent／Overseas
	37,861,990	Others	21,300,474	Other researchers 2	109,609,101	Other researchers 14	6,654,417	1	–	0	6,718,031	Other researchers 2	–	0	–	0	33,007,954	Other researchers 7
				・Associate professor /Assistant professor	51,385,146	・Associate professor /Assistant professor 5						・Associate professor /Assistant professor					24,697,701	・Associate professor /Assistant professor 5
			21,300,474	・Others 2	58,223,955	・Others 9	6,654,417	1			6,718,031	・Others 2					8,310,253	・Others 2
				Postdocs 1	74,734,667	Postdocs 19						Postdocs					4,854,036	Postdocs 1
				Research support staffs	56,586,295	Research support staffs 26		Research support staffs				Research support staffs						Research support staffs
			28,383,768	Administrative staffs 8	54,534,550	Administrative staffs 19		Administrative staffs				Administrative staffs						Administrative staffs
Subtotal	527,020,393		154,288,553	19	321,497,402	93	6,654,417	2	–	0	6,718,031	4	–	0	–	0	37,861,990	15
Project activities	32,392,821	Operational subsidies to National University Corporations/Incorporated Administrative Agencies	3,622,628	Administrative expenses	9,774,376	Temporary staffing expenses					39,569	Administrative expenses					5,000	Outreach
	254,688,356	WPI grant	50,730	Outreach	2,174,878	Start-up (Research Award)					37,422	Temporary staffing expenses					65,093	Consumables
	-	Government subsidies except WPI grant	2,781,778	Consumables expenses	213,600	Expenses for symposia					5,031,675	Consumables					159,167	Miscellaneous service expenses
	-	Donations	5,496,761	Miscellaneous service expens	3,610,706	Facility rental fees					346,310	Miscellaneous service expenses						
	6,340,832	Indirect funding	892,924	Utility charges	57,881,505	Consumables					885,856	Utility charges						
	-	Joint research projects	19,548,000	Facility rental fees	57,335,285	Utility charges												
	-	Competitive funding			123,698,006	Others												
	229,260	Others																
Subtotal	293,651,269		32,392,821		254,688,356		–		–		6,340,832		–		–		229,260	
Travel	655,725	Operational subsidies to National University Corporations/Incorporated Administrative Agencies	33,260	Travel expenses (domestic)	283,800	Travel expenses (domestic)												
	4,165,833	WPI grant	622,465	Transfer allowance (domesti	1,718,645	Travel expenses (overseas)												
	-	Government subsidies except WPI grant			408,180	Transfer allowances (domestic)												
	-	Donations			1,755,208	Transfer allowances (overseas)												
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	4,821,558		655,725		4,165,833		–		–		–		–		–		–	
Equipment	-	Operational subsidies to National University Corporations/Incorporated Administrative Agencies			12,000,000	Portable plant photosynthesis analysis system											12,980,000	Equipments and facilities
	65,298,409	WPI grant			11,223,300	Fluorescence lifetime measurement system												
	-	Government subsidies except WPI grant			5,262,488	Preparative chromatography												
	-	Donations			36,812,621	Other equipment and supplies												
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	12,980,000	Others																
Subtotal	78,278,409		–		65,298,409		–		–		–		–		–		12,980,000	
Research projects	-	Operational subsidies to National University Corporations/Incorporated Administrative Agencies							31,572,968	Domations	12,717,918	Joint research indirect funds	39,212,762	Joint research projects	416,201,730	Kakenhi grants	208,823,247	Commissioned research funds
	-	WPI grant									122,110,880	Grant Indirect funds						
	-	Government subsidies except WPI grant									59,606,474	Commissioned research indirect funds						
	31,572,968	Donations																
	194,435,272	Indirect funding																
	39,212,762	Joint research projects																
	416,201,730	Competitive funding																
	208,823,247	Others																
Subtotal	890,245,979		–		–		–		31,572,968		194,435,272		39,212,762		416,201,730		208,823,247	
Others	-	Operational subsidies to National University Corporations/Incorporated Administrative Agencies																
	-	WPI grant																
	-	Government subsidies except WPI grant																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	-		–		–		–		–		–		–		–		–	
Total	1,794,017,608		187,337,099		645,650,000		6,654,417		31,572,968		207,494,135		39,212,762		416,201,730		259,894,497	

Operational subsidies to National University Corporations/Incorporated Administrative Agencies	運営費交付金
WPI grant	国際研究拠点形成促進事業補助金
Government subsidies except WPI grant	機関補助金（WPI補助金を除く）
Donations	寄付金
Indirect funding	間接経費
Joint research projects	共同研究費
Competitive funding	競争的資金
Others	その他

Appendix 4 Outreach Activities and Their Results

List up to three of the Center's outreach activities carried out during the period between FY 2021 and 2024 that have contributed to enhancing the brand or recognition of your Center and/or the brand of the overall WPI program, and describe its concrete contents and effect in narrative style. (Where possible, indicate the results in concrete numbers.)

Examples:
- As a result of using a new OO press-release method, a OO% increase in media coverage was obtained over the previous year.
- By holding seminars for the public that include people from industry, requests for joint research were received from companies.
- We changed our public relations media. As a resulting of using OO to disseminate information, a OO% increase in inquiries from researchers was obtained over the previous year.
- As a result of vigorously carrying out OO outreach activity, ¥OO in external funding was acquired.

Enter a list of your outreach activities in Attachment 4a.

Example 1: Continuous Participation in the SSH Tokai Festa

ITbM took the opportunity of a faculty (Ayato Sato) participating in the SSH Steering Committee of Meijo University Affiliated High School to exhibit a booth for the first time as an institution other than a high school at the SSH Tokai Festa, held annually at Meijo University's Tempaku Campus. This event is a student research presentation meeting held mainly by SSH designated schools in Aichi, Gifu, Mie, and Shizuoka, including schools from other regions. In the 2024 academic year, 26 schools participated, including two from the Kanto region and one from Thailand, with approximately 800 high school students in attendance. ITbM has been a regular exhibitor at this event since 2020, and since 2023, IFReC and PRIMe have also been co-exhibiting, contributing to the WPI community. ITbM receives numerous high school visits as a result of this event, and every year, ITbM conducts mini-lectures and lab tours for about 200 high school students.

Example 2: Continuous Participation in BioJapan & AgriBusiness Creation Fair

ITbM has participated in BioJapan, Asia's largest industry-academia matching event, since 2015. At this event, ITbM showcases its research achievements through booth exhibitions and actively engages in researcher seminars and partnership activities aimed at finding collaboration partners and strengthening collaborations. This ongoing engagement has successfully established a network of over 100 domestic and international pharmaceutical companies. Since 2022, under the leadership of ITbM, a significant booth area for the Tokai National Higher Education and Research System has been established in collaboration with other departments and Gifu University, enhancing the organization's presence.
Additionally, ITbM has been continuously participating in the Agri-Business Creation Fair, a technology exchange exhibition in the agriculture, forestry, and fisheries fields hosted by the Ministry of Agriculture, Forestry and Fisheries (MAFF), since 2022. Here, ITbM focuses on disseminating its plant-related research achievements and has built a network with over 50 companies in the pesticide, agriculture, forestry, and fisheries industries.

Example 3: Efficient Use of Research Graphical Abstracts

ITbM actively creates impactful graphical abstracts (GAs) to increase the number of media publications of its research achievements upon releasing research results. In 2024, seven papers that were featured in press release articles ranked in the top 5% of all research outputs according to Altmetric scores. GAs are utilized not only on EurekAlert! and Nagoya University's press release article site but also on ITbM's research highlights page, brochures, and internal promotional monitors for research introductions. During event exhibitions and ITbM tours for high school students, business card-sized printed cards (molecule cards) featuring GAs are distributed to promote ITbM's research achievements. These molecule cards include a QR code that links to ITbM's research highlights page, allowing readers to access press release articles associated with the GAs. Due to their convenient size, several hundred cards are distributed at each outreach event, totaling over 5,000 cards annually. This significantly contributes to the dissemination of ITbM's research achievements. Currently, there is a stock of over 70 types of GAs, and they are prepared to be provided flexibly to various media.

Appendix 4a　State of Outreach Activities from FY 2021 to FY 2024

* For each activity, enter the number of times that the activity was held each fiscal year.

Activities	FY 2021 (number of activities, times held)	FY 2022 (number of activities, times held)	FY 2023 (number of activities, times held)	FY 2024 (number of activities, times held)
PR brochure, pamphlet	6	1	2	1
Lectures, seminars for general public	10	10	9	10
Teaching, experiments, training for elementary, secondary and high school students	10	17	24	25
Science café	2	–	2	1
Open house	3	3	4	3
Participating, exhibiting in events	8	6	6	5
Press releases	11	14	18	25
Publications of popular science books	–	–	1	–
Others（exihibitions, workshops)	10	10	13	16

*If there are activities that the center hasn’t implemented, delete those lines. If you have other activities, list them in the space between parentheses after “Others” and state the number of times they were held in the spaces on the right. Another line under “Others” can be added, if needed.

<Notes>

WPI Academy

Submittal of List of Center's Research Results

Prepare the following two materials and submit them with your Activities Report.

1. Refereed Papers published from 2021 to 2024 (Free format)

List only the Center's refereed papers published during the period from 2021 to 2024. (Note: The list should be for the calendar year, not the fiscal year.)

Divide the papers into two categories, A and B.

A. WPI papers
List papers whose author(s) can be identified as affiliated with the WPI program (e.g., that state "WPI" and the name of the WPI center (WPI-center name)). (Not including papers in which the names of persons affiliated with the WPI program are contained only in the acknowledgements.)

B. WPI-related papers
List papers related to the WPI Academy center but whose authors are not noted in the institutional affiliations as WPI affiliated. (Including papers whose acknowledgements contain the names of researchers affiliated with the WPI program.)

Note: On 14 December 2011, the Basic Research Promotion Division (the Basic and Generic Research Division at present) in MEXT's Research Promotion Bureau circulated an instruction requiring paper authors to include the name or abbreviation of their WPI center among their institutional affiliations.

Method of listing paper

- For each, write the author name(s); year of publication; journal name, volume, page(s) (or DOI number), and article title. Any listing order may be used as long as format is consistent. (The names of the center researchers do not need to be underlined.)
- If a paper has many authors (say, more than 10), all of their names do not need to be listed.

2. Submission of electronic data of refereed papers published in 2024

- Among the papers listed in the Item 1, provide a .csv file output of the papers published in 2024 from the Web of Science (e.g.) or other database giving the paper's raw data including Document ID. (Note: the Document ID is assigned by paper database.)
- The papers should be divided into A or B categories on separate sheets, not divided by paper categories.

3. Use in assessments

- The list of papers will be used in assessing the state of WPI Academy center's research progress.
- It will be used as reference in analyzing the trends and overall state of research in the WPI Program and/or the said WPI Academy center, not for evaluating individual researcher performance.
- The special characteristics of each research domain will be considered when conducting assessments.

A. WPI papers (Jan 1, 2021 – Dec 31, 2024)

1. Original Articles

(1) Ichinose, Mizuho; Sugita, Mamoru, RNA EDITING: Methods and Protocols, 2021, 2181, 1-12, "Substitutional RNA Editing in Plant Organelles" (DOI: 10.1007/978-1-0716-0787-9_1)

(2) Ohmatsu, Kohsuke; Kiyokawa, Mari; Shirai, Yuto; Nagato, Yuya; Ooi, Takashi, HETEROCYCLES, 2021, 103, 2218-224, " Hybrid Catalysis of 8-Quinolinecarboxaldehyde and Bronsted Acid For Efficient Racemization of alpha-Amino Amides and Its Application in Chemoenzymatic Dynamic Kinetic Resolution" (DOI: 10.3987/COM-20-S(K)32)

(3) Ohmatsu, Kohsuke; Morita, Yusuke; Kiyokawa, Mari; Hoshino, Kimihiro; Ooi, Takashi, ASIAN JOURNAL OF ORGANIC CHEMISTRY, 2021, 10, 3237-3240, "Catalytic Asymmetric Strecker Reaction of Ketoimines with Potassium Cyanide" (DOI: 10.1002/ajoc.202100608)

(4) Clarke, Joshua J.; Maekawa, Yuuki; Nambo, Masakazu; Crudden, Cathleen M., ORGANIC LETTERS, 2021, 23, 6617-6621, "Borenium-Catalyzed Reduction of Pyridines through the Combined Action of Hydrogen and Hydrosilane" (DOI: 10.1021/acs.orglett.1c01892)

(5) Ye, Wenxiu; Koya, Shota; Hayashi, Yuki; Jiang, Huimin; Oishi, Takaya; Kato, Kyohei; Fukatsu, Kohei; Kinoshita, Toshinori, FRONTIERS IN PLANT SCIENCE, 2021, 12, 744991, "Identification of Genes Preferentially Expressed in Stomatal Guard Cells of Arabidopsis thaliana and Involvement of the Aluminum-Activated Malate Transporter 6 Vacuolar Malate Channel in Stomatal Opening" (DOI: 10.3389/fpls.2021.744991)

(6) Nakashima, Tsubasa; Ohmatsu, Kohsuke; Ooi, Takashi, ORGANIC & BIOMOLECULAR CHEMISTRY, 2021, 19, 141-145, "Mannich-type allylic C-H functionalization of enol silyl ethers under photoredox-thiol hybrid catalysis" (DOI: 10.1039/d0ob01862g)

(7) Miller, Simon; Srivastava, Ashutosh; Nagai, Yoshiko; Aikawa, Yoshiki; Tama, Florence; Hirota, Tsuyoshi, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA, 2021, 118, e2026191118, "Structural differences in the FAD-binding pockets and lid loops of mammalian CRY1 and CRY2 for isoform-selective regulation" (DOI: 10.1073/pnas.2026191118)

(8) Nambo, Masakazu; Crudden, Cathleen M., CHEMICAL RECORD, 2021, 21, 3978-3989, "Transition Metal-Catalyzed Cross-Couplings of Benzylic Sulfone Derivatives" (DOI: 10.1002/tcr.202100210)

(9) Yanagisawa, Naoki; Kozgunova, Elena; Higashiyama, Tetsuya, RSC ADVANCES, 2021, 11, 27011-27018, "Pulsatile reverse flow actuated microfluidic injector: toward the application for single-molecule chemotropism assay" (DOI: 10.1039/d1ra04505a)

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