



Institute for Molecular Science (IMS) is one of the world's leading core research facilities in molecular science and is also a center for inter-university joint research in Japan. It sets an extremely wide range of research goals, from understanding the behavior of individual molecules to that of collective molecular systems. These molecular systems are closely related to scientific understanding in biology, engineering and space sciences. Currently, IMS is engaged in four major research areas and two interdisciplinary research fields: theoretical and computational molecular science, photo-molecular science, materials molecular science, and life and coordination-complex molecular science. Since April 2013, Research Center of Integrative Molecular Systems (CIMoS) has been working to develop highly functional molecular systems, including molecular rhythms, sensing and response, and even self-repair. In April 2017, Center for Mesoscopic Sciences (CMS) was launched to develop innovative methodologies to study mesoscopic

molecular systems, ranging from theoretical methods to state-of-the-art measurement techniques. A year later, IMS also established Advanced Molecular Science Research Division, which showcases outstanding examples of research in molecular science. Division of Research Innovation and Collaboration started in April 2019, working to strengthen collaboration with social activities. Other than these research divisions, IMS has three research facilities; UVSOR Synchrotron Facility, Instrument Center facilitated with various molecular detectors, and Equipment Development Center. IMS also operates Research Center for Computational Science, jointly with National Institute for Physiological Sciences and National Institute for Basic Biology located on the same campus. In April 2018, Okazaki Institute for Integrative Bioscience (OIIB) was reorganized into Exploratory Center for Life and Living Systems (ExCELLS) directly under National Institutes of Natural Sciences (NINS) to advance its activities.

Annual Review 2024 is a summary of the research activities by all individual research groups conducted at IMS during October 2023–September 2024 on molecular structures, reactions and functions demonstrating “novel molecular possibilities.” In addition to these individual activities, IMS conducts many special programs in the institute basis such as (i) Large-scale and high-coherence fault-tolerant quantum computer with dynamical atom arrays supported by a JST program “MOONSHOT Goal 6: Realization of a fault-tolerant universal quantum computer that will revolutionize economy, industry, and security by 2050,” (ii) Development of cold-atom based quantum simulators and their applications to quantum computing within the framework of Japan's flagship program on quantum sciences and technologies “Q-LEAP” by MEXT and “PRISM” by the Cabinet Office of Japan (2018–2028), (iii) in 2024, IMS, National Institute for Physiological Sciences (NIPS), and ExCELLS have jointly launched “the Core for Spin Life Sciences.” In this project, a wide range of life science and physiological science research will be promoted under one roof, covering technological development at the molecular level and life phenomena at the individual level, such as novel magnetic resonance (MR) imaging of individual molecules targeted by new MR molecular probes. As a complementary collaboration with the Core for Spin Life Sciences, the project was adopted by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) as part of the “Coalition of Universities for Research Excellence Program (CURE)” program, and collaboration with related universities has been initiated. IMS also conducts (iv) Advanced Research Infrastructure for Materials and Nanotechnology in Japan, and (v) Inter-University Network for Common Utilization of Research Equipments. In addition to these national projects, IMS runs several international collaboration programs and also owns an internship program for young scientists: Institute for Molecular Science International Internship Program (IMS-IIP). IMS-IIP provides internship opportunities for young overseas researchers (master's and doctoral students, post-doctoral fellows, young faculty members of MOU partners, *etc.*) to stay in IMS laboratories.

IMS will continue to contribute to lead the molecular science together with many young promising and well-established senior scientists. This institute has been well benefited with your constant support and we do expect your further support and advice for creating this new era of molecular science.

August, 2024

A handwritten signature in black ink, appearing to read 'Y. Watanabe'.

WATANABE, Yoshihito
Director General, Institute for Molecular Science