



# Preface

*Synthetic [Mo<sub>3</sub>S<sub>4</sub>Fe] Cubes; 6) Harnessing Infrared Solar Energy with Plasmonic Energy Upconversion; 7) Synthesis of Twisted [N]Cycloparaphenylene by Alkene Insertion.* Other distinctive achievements were presented also in the 122nd ICR Annual Symposium on December 9, 2022.

ICR collaborates with other research institutions as a key member of MEXT Inter-University Collaborative Project “Integrated Consortium on Chemical Synthesis”, MEXT Large-scale Scientific Research Project “Spintronics Research Network of Japan”, and the Kyoto University Research Coordination Alliance. We have also been engaged in over 60 international collaborations with overseas universities and research institutions. In 2018, based on our strong global activity in chemistry-oriented fields, ICR was certified by MEXT as an International Joint Usage/Research Center. In 2019, we established an On-site Laboratory, the “Kyoto University Shanghai Lab” in Shanghai, China under the MEXT’s Designated National University program. To foster and secure young researchers we have initiated several programs to support research and graduate education, including an in-house annual grant system, “ICR Grant for Promoting Integrated Research.” These collaborative achievements highlight our commitment to promoting ICR as a global research core in chemistry-oriented fields.

The environment surrounding us is now experiencing a wave of changes. The growing economy has exposed various worldwide problems including climate change and social inequity. For a just and sustainable society, science and technology must become a credible beacon of light. ICR contributes towards this goal by providing leadership and expertise in scientific research, promoting multidisciplinary, chemistry-related communities, and developing new and technologically important innovations. We hope this Annual Report will serve to update you on the progress of our research activities and globalization. We appreciate your continued encouragement and support.

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AOYAMA, Takashi  
Director

The history of the Institute for Chemical Research (ICR) dates back to 1915, when the Specialized Center for Chemical Research, the predecessor of ICR, was established for research and production of Salvarsan and other pharmaceutical chemicals at the Faculty of Science, Kyoto Imperial University. In 1926, ICR was formally established as the first research institute in Kyoto University, with the founding philosophy “To Excel in the Investigation of Basic Principles of Chemistry and Their Applications.” ICR has promoted pioneering studies with a focus on basic sciences ever since. Our staffs include 120 faculty members, 200 graduate students including 50 from foreign countries, and 60 researchers. These scientists are grouped into 30 laboratories divided into five research divisions—Synthetic Chemistry, Materials Chemistry, Biochemistry, Environmental Chemistry, and Multidisciplinary Chemistry—and three research centers—Advanced Research Center for Beam Science, International Research Center for Elements Science, and Bioinformatics Center. The laboratories are diversely affiliated with the graduate schools of science, engineering, agriculture, pharmaceutical sciences, medicine, and informatics.

The research activity of ICR encompasses a wide range of scientific disciplines, including physics, biology, and informatics as well as chemistry. ICR members are conducting cutting-edge research not only in fields of their own specific disciplines but also in interdisciplinary and innovative fields. Some of outstanding research achievements in 2022 are as follows: 1) *A Carlactonoic Acid Methyltransferase that Contributes to the Inhibition of Shoot Branching in Arabidopsis*; 2) *A Triple Photoredox/Cobalt/Brønsted Acid Catalysis Enabling Markovnikov Hydroalkoxylation of Unactivated Alkenes*; 3) *Size-Controlled Quantum Dots Reveal the Impact of Intraband Transitions on High-Order Harmonic Generation in Solids*; 4) *Field-Free Superconducting Diode Effect in Noncentrosymmetric Superconductor/Ferromagnet Multilayers*; 5) *Nitrogen Reduction by the Fe Sites of*