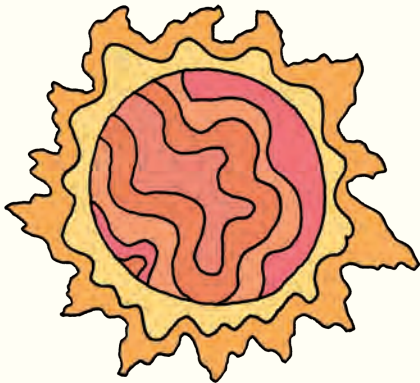


CSRS promotes flagship projects towards achievement of the Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development

In 2015, the United Nations General Assembly adopted a set of 17 SDGs to be achieved by 2030. The power of science and innovation is essential when addressing these global issues. Against this backdrop, CSRS will leverage its strength in research and promote flagship projects focusing on seven goals as shown below. In addition to transdisciplinary research in plant science, chemical biology, catalytic chemistry, and biomass engineering, CSRS will adopt latest technology in data science, artificial intelligence (AI), and genome analysis to produce innovative results.



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Contributing to a sustainable society through research oriented towards “problem-solving” based on the concept of developing manufacturing methods with reduced environmental impact



Since its establishment in 2013, RIKEN Center for Sustainable Resource Science (CSRS) has been a leader in creating a sustainable society through transdisciplinary integration of plant science, chemical biology, catalytic chemistry, and biomass engineering. The growing risk from climate change and energy issues, however, calls for research oriented towards “problem-solving” that contributes, more than ever before, to sustainable growth and that addresses global issues.

Using as guides the Sustainable Development Goals (SDGs) and the Paris Agreement on achieving zero greenhouse gas emissions, CSRS has set up six flagship projects. Each of these projects aims to further advance basic research in the efficient creation, exploration, and use of beneficial substances from natural resources, sustainable food production, and bioproduction that CSRS has been undertaking in the past. In addition, the projects will move beyond the boundaries of research fields and develop manufacturing methods with less impact on the environment. In particular, advances made in recent years in artificial intelligence (AI) and data science can bring about a significant step forward.

While establishing new research field of “sustainable resource science” that contributes to solving environmental problems and food-related issues, and also actively nurturing the next-generation of scientists, CSRS will lead in creating a future world where people can live healthy and prosperous lives.

Director
Kazuki SAITO

Deputy Directors



Ken SHIRASU



Zhaomin HOU



Mikiko SODEOKA



Akihiko KONDO



From basic research to application and innovation: Six flagship projects, using information science, providing solutions to global issues

Through cross-cutting research collaboration in plant science, chemical biology, catalytic chemistry, and biomass engineering, CSRS has consistently produced world-class research.

Our next mission will be to apply this state-of-the-art research and leverage research findings in the respective fields towards achievement of the SDGs and produce tangible results contributing to creation of a sustainable society. For example, our success in the demonstration of drought-resistant rice cultivation will become the foundation for further development in "Innovative Plant Biotechnology" project. Similarly, the elucidation of the symbiotic strategy between legumes and rhizobia will be developed in the "Integrative Symbiological Solutions" project, and the synthesis of isoprene, a raw material used for synthetic rubber, from biomass, development of high-performance catalysts and highly functional polymers will be further advanced in the "Metabolic Genome Engineering" project and in the "Innovative Catalysts" and "Leading-edge Polymers" projects, respectively.

CSRS sees these flagship projects as the core foundation for research and will collaborate with research institutes, universities, and corporations in and outside Japan to address global issues.

B Innovative Plant Biotechnology

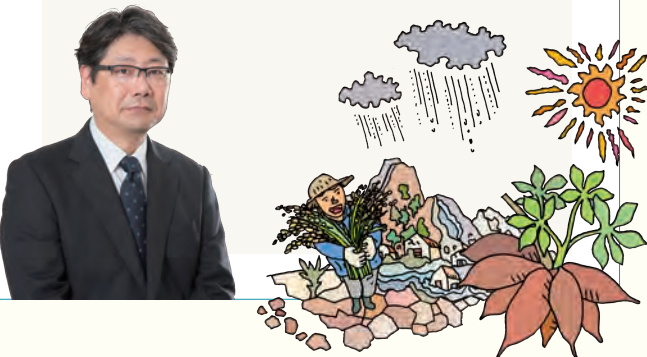


Contributing to sustainable food and biomass production through development of plant trait improvement techniques

With global warming, climate change, and population increase, sustainable food supply and procurement is now a global issue. CSRS has been using model plants to explore and elucidate the functions of beneficial genes and promoting research for translating the results in actual crops. Based on these research results, the Innovative Plant Biotechnology project aims to develop plants with high qualitative and quantitative value added with resistance to environmental stress and diseases.

In addition, the project will use omics analysis to explore peptides and other regulators and employ chemical biology approaches to elucidate main factors leading to improvement of productivity and functionality of foods and biomass. To ensure transfer of the results in the field to the actual farmland under varying conditions, the project will also use information science to store and analyze data from multiple angles for trait improvement.

Project Leader
Minami MATSUI



S Integrative Symbiological Solutions



Developing scientific technologies based on symbiotic interactions for solving global environmental problems

To solve environmental problems such as pollution and climate change, we will elucidate symbiotic relationships in the soil and hydrosphere. By utilizing symbiotic microbial functions, we will develop sustainable and environmentally friendly agricultural and environmental technologies that do not rely heavily on chemical fertilizers and pesticides.

We will also develop technologies to monitor symbiotic dynamics in order to quickly recognize and predict environmental changes. In addition, we aim to identify symbiotic microorganisms that have the ability to produce unknown useful substances, and to elucidate their biosynthetic mechanisms and create useful compounds using genome mining, omics, biochemistry, structural biology, and computational chemistry approaches.

Project Leader
Ken SHIRASU



M Metabolic Genome Engineering



Maximizing capacities of plants and microorganisms for chemical synthesis in expanding the production and use of bioproducts

Departure from our dependence on fossil resources requires creation of bioproducts essential to our lives through innovative methods. Using genomic analysis data that are increasing exponentially as well as synthetic biology, genome engineering, and data science, the Metabolic Genome Engineering project will artificially maximize capacities of plants and microorganisms for chemical synthesis in developing and configuring sustainable production systems.

The project will promote the synthesis of useful substances from plants and microorganisms by taking on the challenge of developing smart organisms through designing metabolic pathways from the interactions of multiple cells, creating advanced forms of breeding of plants and microorganisms that make up the production systems, and synthesizing compounds that had been difficult to develop using existing chemical synthesis. There are many potential targets, including raw materials for the chemical industry, functional foods, drugs, and raw materials for cosmetics. Development of the technology base and partnership with the industry is expected to bring about further advances in this field.

Project Leader
Akihiko KONDO



C Innovative Catalysts

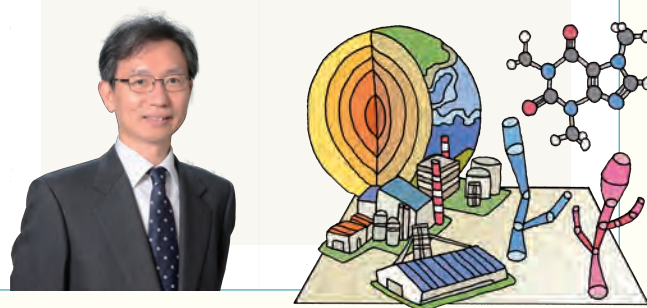


Developing new, highly efficient catalysts that use natural resources

Transformation of our lifestyle to one without dependence on fossil fuel is an important theme for bringing about a sustainable society. Even though natural resources are finite, new beneficial resources can be produced from natural resources through the actions of highly functional catalysts. The Innovative Catalysts project will develop advanced catalysts that enable efficient use of the atmosphere, water, and earth crust resources of the global environment to contribute to stable supply and recycling of environmental resources.

Some of the focal points will be development of new catalyst technology for synthesizing ammonia from nitrogen and hydrogen under mild conditions and development of catalysts for synthesis of carboxylic acids using carbon dioxide, which is considered as the major cause of global warming, as raw material. In addition, the project will develop metal-based catalysts for manufacture of hydrogen and other substances through water splitting, biofunctional catalysts that function in water, and catalysts that are based on cheap, earth-abundant elements and that take the advantage of the features of all available metals for chemical synthesis. Through such innovation, the project will change the notion that "Japan is a country poor in resources."

Project Leader
Zhaomin HOU



P Leading-edge Polymers

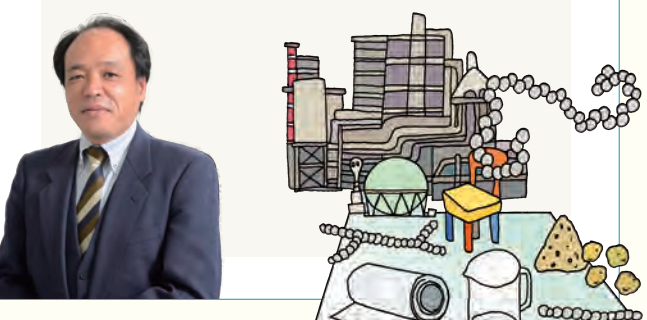


Developing new polymers with beneficial functions improving efficiency in the use of resources and creating new industries

Achieving the Sustainable Development Goal (SDG) of "Responsible Consumption and Production" also means that we make efforts towards achieving a sustainable society that strikes a balance between the environment and economy. Through groundbreaking synthesis techniques using molecular catalysis, the Leading-edge Polymers project will develop, from plants, biomass, and fossil resources, biopolymers having new functionalities, and lead efforts towards their commercialization.

Polyethylene and other polyolefins make up about 70% of all polymers used in our world today. To further broaden its potential, the project will develop functional polyolefin materials that have excellent adhesive properties with other materials, develop acrylic resins used in organic glass, create super engineering polymers with high-strength and high-temperature heat resistance properties, and develop the technology for creating high-toughness peptide polymer materials that combine strength and flexibility. These efforts will, through collaboration with the industry, promote efficiency in the use of resources as well as bring innovation in the chemical industry.

Project Leader
Hideki ABE



TP Advanced Research and Technology Platforms

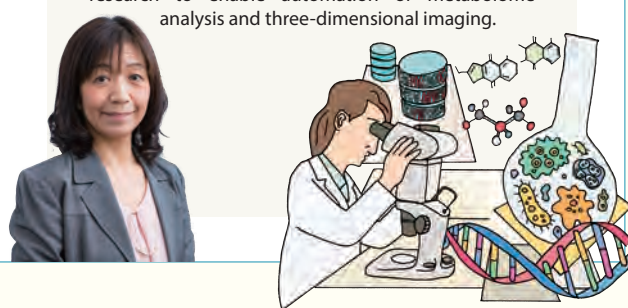


Advancing analytical technology and information platforms and leading innovation as a science and technology hub in Japan

RIKEN, with its state-of-the-art platform for molecular analysis, is actively conducting joint research with other research institutes and universities, with the Technology Platform Division at the core. The Advanced Research and Technology Platforms project will use and further refine RIKEN's analytical and information platforms and support the efficient promotion of the flagship projects.

Specifically, such efforts will include development of analytical technology for automatic identification of compounds; sophistication of the integrated metabolome analytical platform, including plant hormones that help us understand all intracellular metabolism, the imaging technology platform using electron microscopy, and the phenotype analytical platform; establishment of the platform for development of bioactive substances that combines research covering an extensive field from plants to microorganisms; and further expansion of the chemical bank. To support these analytical technologies, the project will also use and refine the cross-cutting information platform. The project will lead RIKEN's efforts in forming a science and technology hub and bring about the next-generation innovation while deepening collaboration with the industry.

Project Leader
Masami HIRAI



Project Leader
Minoru YOSHIDA

It is truly rewarding to be taking on the challenge of using the information platform to further refine the analytical technology platform, both in terms of hardware and software. We will further promote research to enable automation of metabolome analysis and three-dimensional imaging.



Gathering CSRS's research findings to vigorously promote cross-cutting collaboration within RIKEN and collaboration with other research institutes and industries in Japan and abroad

D Drug Discovery Platforms Cooperation Division

Academic drug discovery has become a world-wide movement at universities and research institutions. RIKEN facilitates academic drug discovery by conducting the Drug Discovery and Medical Technology Platforms (DMP). To achieve this goal, it is necessary to develop novel assay systems based on recent advances in genome and iPS cell research. Capitalizing on RIKEN's vast library of bioactive natural products, optimized assay systems, and state of the art equipment for high throughput screening (HTS), our division aims at making innovative contributions to the academic drug discovery effort.

