RIKEN BRC

RIKEN BioResource Research Center

Contributing to Science and Innovation with Bioresources

Toshihiko Shiroishi, Director of BioResource Research Center

In the past, bioresources were preserved by the individual researchers who developed them, and then provided to other researchers as needed. However, in Europe and the United States, bioresource centers were established more than a century ago to centrally collect, preserve, and provide bioresources. The centralized management of bioresources has enabled the efficient prevention of bioresource loss. A great advantage of sharing the same the United States, bioresource centers were is that it vastly improves the reproducibility of experiments.

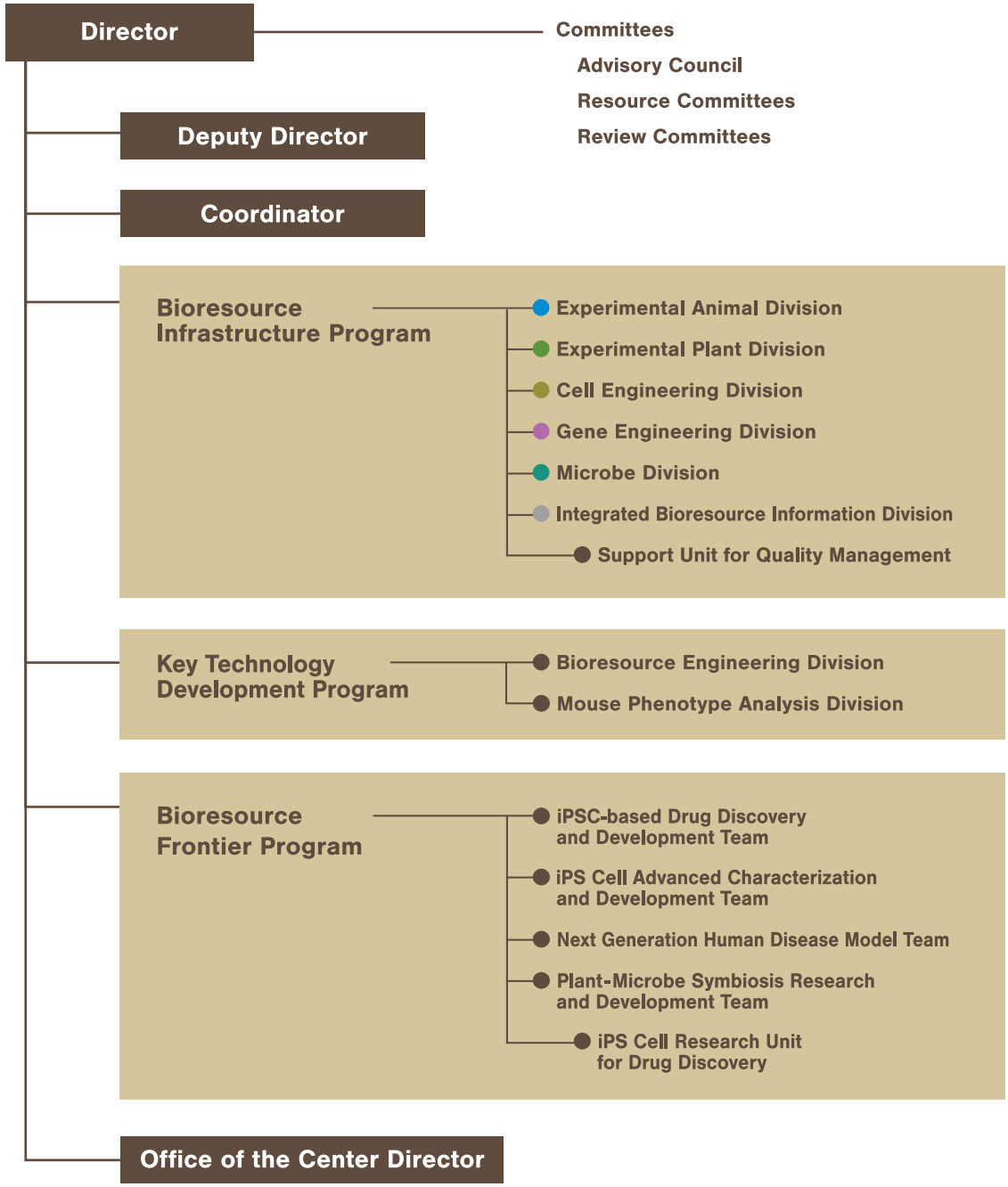
In January 2001, RIKEN established the BioResource Center (BRC) on the Tsukuba campus as a core facility for bioresources in Japan. Since then, BRC has collected, preserved, and distributed five major types of bioresources: experimental mice, experimental plants, cultured cell lines derived from humans and animals, genetic materials, and microorganisms. Furthermore, BRC has also collected, integrated, and disseminated information related to the bioresources for promoting their widespread use. In particular, BRC has focused on unique bioresources developed through excellent research in Japan, and has emphasized quality control to help ensure the reproducibility of experiments. In addition, BRC has implemented the Key Technology Development Program to develop technologies for sustainable and efficient bioresource projects, as well as R&D programs to promote the development and utilization of new bioresources that meet the needs of society and the research community. In terms of the number of stored bioresources, BRC is now one of the top three major repositories in the world for each of the five bioresource types, and it is recognized worldwide as a public bioresource center that handles multiple bioresources.

Modern society faces a variety of challenges, including health and medical issues, environmental and food-related problems that are worsening on a global scale, and infectious diseases. BRC has a critical responsibility to prepare and develop cutting-edge bioresources that address these challenges. Advances in genomics and the emergence of innovative genome-editing technologies have made the development of new bioresources much easier, and we expect that more and more new bioresources will be developed by the research community using the bioresources that we provide. Therefore, one of BRC's important missions is to drive the circulation of bioresources between BRC and the research community, and to stimulate life science research and innovation.

In April 2018, BRC changed its name to the BioResource Research Center (the abbreviation remains the same), and in 2021 it celebrated its 20th anniversary. It will continue to work to further improve life science-related research infrastructure with the mottos of "reliability," "sustainability," and "leadership", which we have upheld since its establishment. We would like to express our deepest gratitude for your long-standing support and look forward to your continued understanding and support.

As one of the most advanced research infrastructure centers, BRC will contribute to the promotion of life science research and human welfare in the 21st century

The study of life science requires not only excellent researchers and research facilities, but also high-quality research materials, so called bioresources. BRC strategically collects, preserves, and provides reliable, world-class bioresources, which accurately meet societal and research needs. In addition, we develop key technologies for the preservation and utilization of the bioresources in order to promote sustainable bioresource projects. Furthermore, we will continue to closely follow the latest research trends so that we can promote our bioresource projects, and help take leadership in the field of life science.



Bioresource Infrastructure Program

Cutting edge and top-of-the-line bioresources for scientists around the world

RIKEN BRC is the world's largest infrastructure center for bioresources. It offers five resources: laboratory mice, experimental plants, cultured cell lines, genetic materials, and microorganisms. Based on societal and scientific needs, we collect, preserve, and distribute these bioresources and their related information to scientists around the world. Our work is performed according to a quality management system accredited by ISO9001, and we distribute reliable and top-of-the-line bioresources to help ensure the reproducibility of experiments.
In addition, we conduct research aimed at accelerating the use of bioresources and developing new bioresources based on changing societal and scientific needs. This research includes: development of disease-model mice, research on the response to stress in plants, isolation of microorganisms in symbiotic relationships, development of vectors that enable tissue-specific expression of marker genes, and development of integrated bioresource information for users.
RIKEN BRC is contributing to the robust expansion of life science research in the 21st century through the collection, preservation, and distribution of world-leading bioresources, as well as through research and development relating to bioresources.

Collection and preservation

▲ Liquid nitrogen tanks
Many of the collected bioresources are stored at -196℃ in tanks containing liquid nitrogen, which allows them to be preserved without compromising their properties.

Distribution

▲ Barcode controls
Genes and other bioresources are controlled by barcodes to verify the combination of attachments and envelopes.

Key Technology Development Program

Development of key technologies to support sustainable and efficient bioresource infrastructure

We execute research and development strategies to create the key technologies necessary for bioresource infrastructure. Specifically, we are developing techniques for cryopreservation, nuclear transfer, ICSI, and generation of mouse models and high-quality stem cell lines in mice.
In addition, we participate in the International Mouse Phenotyping Consortium and organize information related to gene function by analyzing mouse phenotypes. We also provide training courses that encourage the widespread use of these techniques.

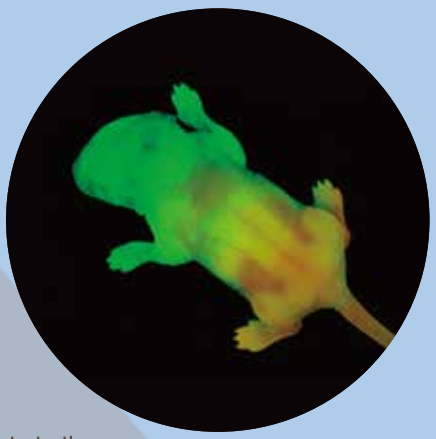
Bioresource Frontier Program

Leading research and development for bioresources to solve social issues

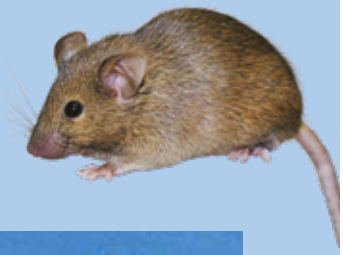
Based on the strength of our five world-class bioresources, we conduct research and development projects that promote breakthroughs in the life sciences, through internal and external collaborations with academia and companies. Our projects will lead to the solution of academic, medical, and social issues.

Mouse

Experimental Animal Division



◀The Kaede mouse is a useful fluorescent reporter of cell dynamics that works through photoconversion.



Widely used as human disease models and analysis tools for gene functions at the organismal level

As a model animal for humans, mice contribute to the understanding of complex biological phenomena such as development, immunity, physiology/metabolism, and behavior. They also contribute to life science studies to promote human health and treat diseases. We collect, preserve, and maintain quality-control of cutting-edge mouse models that are useful for basic biology and applied disease studies and provide mice to researchers in Japan and overseas. Furthermore, we develop and evaluate mouse strains that will lead to the creation of new fields in life sciences, and are developing technology for the world's highest level of quality control.

▲MSM (upper right) and JF1 (lower) are Japanese subspecies of the house mouse (*Mus musculus*) provided together with whole genome information.

Gene

Gene Engineering Division

◀Fluorescent proteins: essential tools for bioimaging technology

To understand and use the power of living organisms as essential tools for life science research

Genetic materials are one of the most important and fundamental bioresources for life science research. Our division collects important and valuable genetic materials from humans, animals, microbes, and viruses and distributes them to scientists after rigorous quality control in order to ensure the reproducibility of experimental results. We also carry out research and development to facilitate the use and application of bioresources.

▲Genetic material: essential resource for almost all life science fields, from basic research to applied studies.

Plant

Experimental Plant Division

◀ Thousands of Arabidopsis seeds can be harvested from each plant grown in a laboratory.

Maximizing the power of plants Leading plant science with Arabidopsis

Plant science is indispensable for resolving global issues involving food and the environment. We collect, preserve, and distribute seeds, genetic material, and cultured cells taken from experimental plants. We also develop preservation technology and collect genetic and phenotypic information. In addition, we contribute to high school education by providing resources.

▲ Each Arabidopsis plant is grown separately in a pot equipped with a plastic cylinder.

◀ Brachypodium bridges the gap between Arabidopsis and cereal crops.

Microorganisms

Microbe Division

◀ Dimorphic colonies in smooth and filamental forms of a *Candida* yeast

Diverse microbial species as bioresources Contributing to research in environments and human health

Our division, known as the Japan Collection of Microorganisms, is collecting, preserving, and distributing microbial cultures of diverse species of bacteria, archaea, and fungi. We aim to contribute to the scientific community through these resources, particularly those that are useful for research related to the environments and human health. We are also exploiting new microbial resources and developing techniques for both their identification and classification and for investigating symbionts and yet-uncultured microorganisms.

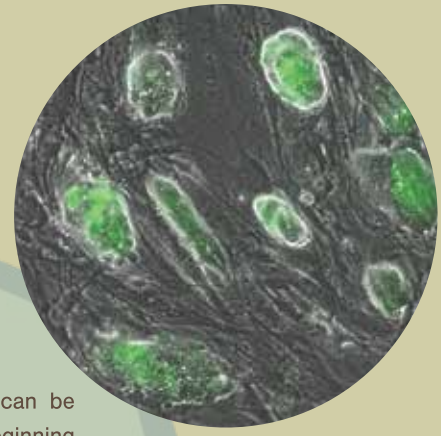
▲ A *Lactococcus* bacterium used actively in research related to human health and fermented foods

Cell

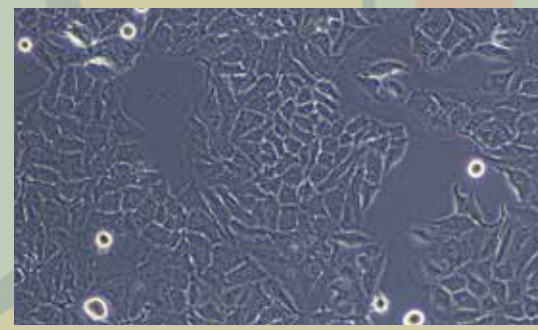
Cell Engineering Division

Contribution to numerous fields of basic biology and medical sciences including disease research and regenerative medicine

The generation of immortalized cell lines that can be cultured indefinitely was made possible at the beginning of the 20th century and has enabled the repeated use of defined cell types by scientists as a common resource for research. These cell lines have greatly contributed to the development of the life sciences. In addition, the development of technology to generate induced pluripotent stem (iPS) cells, which can differentiate into any kind of tissue, tremendously extended the fields of research to which cell lines can contribute. This division is principally concerned with collecting and distributing such immortalized cell lines and is performing the important function of quality control to ensure the reproducibility of experimental results using cell from these lines.



◀ The world's first artificially generated induced pluripotent stem (iPS) cells. This study was published by Dr. Shinya Yamanaka of Kyoto University in 2006.



▲ The world first generated human cancer cell line, HeLa. This study was published in 1951 and the cells are still used in many experiments.

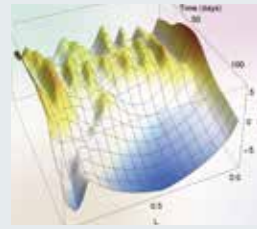
Information Service on Bioresources

Integrated Bioresource Information Division

No Information, no resources Accelerating life sciences with information technology

Information is indispensable for bioresources to function as the foundation of science. To ensure that information is used effectively and efficiently in research and industry, the Integrated BioResource Information Division is engaged in three programs: (1) research and development of integration, international standardization, and cross-search of bioresource-related information; (2) expansion of the website as a communication tool for bioresources users; and (3) research and development of large-scale data analysis technology and data visualization technology.

▲ Cross-search system for bioresources



▲ Energy landscape representing the transition dynamics of mouse intestinal microbiota elucidated by big data analysis

▲ "MoG+", a genome variation database of mouse

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