Launch of the RITE Biomanufacturing Center

Molecular Microbiology and Biotechnology Group

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1. Background of Establishment

In recent years, expectations for the utilization of biotechnology have continued to grow, with investments amounting to several trillion yen being made worldwide. In Japan as well, under the national vision of "realizing a world-leading bioeconomy society by 2030," there is a strong demand for a transition toward Biomanufacturing that utilizes underused resources in order to simultaneously address environmental challenges and achieve economic growth.

As a key national initiative, the **Biomanufacturing Revolution Promotion Program** has been launched with a total budget of 300 billion yen, and RITE was among the earliest organizations to be commissioned under this program. The **RITE Biomanufacturing Center** was constructed as one of its core hubs to establish a strain development platform and to promote intensive R&D and demonstration activities.

RITE Biomanufacturing Center

- **Total floor area:** 1,353 m^2
- **Completion:** November 2025
- **Full-scale operation:** Starting April 2026

2. Facility Overview

2.1. Experimental Facilities

1. Strain Engineering Laboratory

The strain engineering laboratory consolidates equipment required for highly efficient development of production strains through genetic modification. Facilities include automated breeding robots (planned), automated nucleic acid extraction systems (planned), automated Western blot systems, PCR instruments, and sequencers. This integrated setup enables rapid and efficient strain development within short timeframes.

Genetic analysis system

2. Culture Laboratory

The culture laboratory is equipped with a wide variety of jar fermenter systems ranging from 1 mL to 10 L, enabling efficient evaluation of production strains and development of cultivation processes.

In addition to automated sugar feeding, online monitoring of growth behavior, and exhaust gas analysis, the facility supports detailed analysis of process dynamics. The laboratory also features an automated resistance development system based on RITE's proprietary *Mutator Method*, as well as plasma-based mutation

induction equipment, allowing for advanced host strain enhancement.

100 mL Jar fermenter

1 L Jar fermenter

10 L Jar fermenter

Resistance strain automatic acquisition system

3. Analytical Laboratory

The analytical laboratory houses a diverse array of analytical instruments, including multi-cell spectrophotometers, fully automated sample preparation systems, six HPLC units, GC, GC-MS, automated derivatization GC-MS, and multiple LC-MS systems (single quadrupole, triple quadrupole, and Orbitrap).

By leveraging these resources, optimal analytical workflows can be established for a wide range of target compounds.

The laboratory has also introduced **metabolomics analysis**, which enables comprehensive measurement and analysis of metabolites using combined GC-MS and LC-MS approaches. Approximately 1,000 metabolites can be analyzed. Automated sample preparation systems and AI-based waveform processing and analysis software have been implemented, achieving semi-automation from sample pretreatment to data analysis.

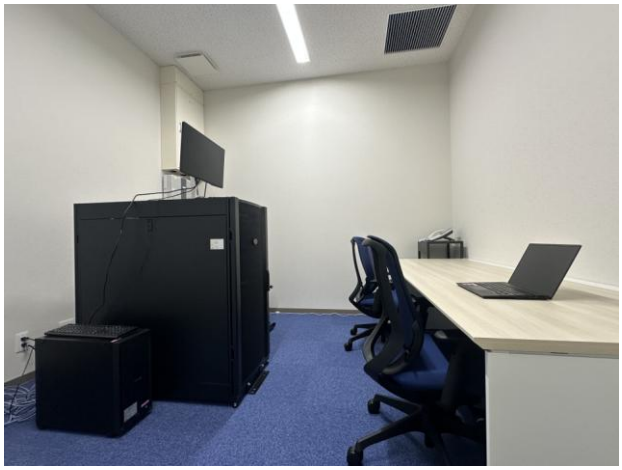
Metabolomics data can be projected onto customized metabolite maps tailored for *Corynebacterium glutamicum*, enabling visualization of metabolic states during cultivation.

Metabolite analysis system

4. Bioinformatics and Data Analysis Room

This facility is responsible for the storage and analysis of large-scale datasets. It is equipped with storage systems, file servers, and backup NAS systems, enabling advanced analyses using databases of underutilized resources, compound toxicity, and resistance mutations.

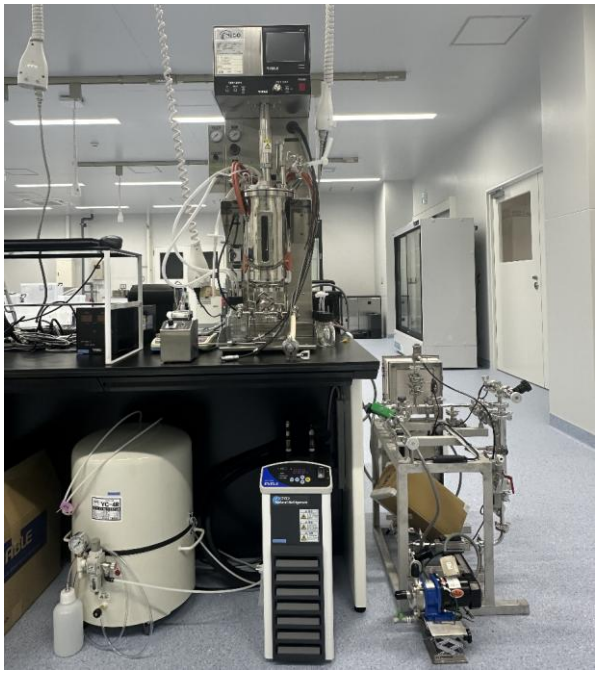
The computational infrastructure supports metabolic simulations (e.g., flux balance analysis), strain engineering assistance, culture optimization, and metabolic pathway design, forming the foundation for the entire R&D pipeline.



Bioinformatics and data analysis room

5. Scale-Up Experimentation Laboratory

Centered on 30 and 90 L jar fermenters, this laboratory will be equipped with membrane separation systems, continuous centrifuges, crystallization units, and large-scale evaporators. These facilities enable integrated process demonstrations, from cultivation to target compound recovery.



5 L Jar fermenter - membrane separation system

The laboratory also supports evaluation of diverse feedstocks, including underutilized resources, as well as functions required for LCA (Life Cycle Assessment) and TEA (Techno-Economic Assessment), facilitating development with mass production in mind.

6. Purification Laboratory

This laboratory focuses on examining purification strategies for target products obtained from microbial cultivation. It is equipped with small-scale membrane separation systems, crystallization units, vacuum dryers, and freeze dryers, enabling evaluation of efficient separation, concentration, high-purity production, and recovery processes.

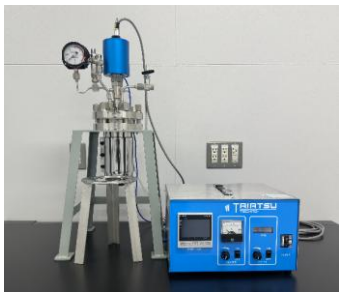
Additionally, detailed assessment of cultivation conditions and purification parameters is conducted through automated exhaust gas analysis using multi-jar fermenters directly connected to GC systems.

100 mL Jar fermenter-online GC system

7. Biomass Pretreatment Laboratory

The biomass pretreatment laboratory is equipped with biomass milling machines, hydrothermal reactors, and saccharification reactors, covering the entire pretreatment process for underutilized resources. A large refrigerated storage room is also provided, enabling efficient handling from raw material storage to processing.

Optimal pretreatment conditions can be studied for a wide variety of biomass feedstocks



Reactor

Cutting mill

Web meeting room

Meeting space

Conference room

2.2 Other Facilities

In addition to laboratories, the center includes office spaces and meeting rooms. The office, located on the second floor, adopts a free-address system. Meeting facilities include one large conference room formed by combining small and medium rooms, three web conference rooms, and multiple meeting spaces capable of accommodating simultaneous discussions of varying sizes.

The laboratories are arranged with functional optimization, with four rooms on the first floor and three on the second floor.

Office space

3. Summary and Future Outlook

For many years, RITE has continuously promoted strain development with industrial applications in mind. The Biomanufacturing Center, constructed as part of the Biomanufacturing Revolution Promotion Program, serves as a cutting-edge hub to accelerate the establishment and social implementation of next-generation Biomanufacturing technologies.

The center provides a comprehensive research environment capable of seamlessly integrating bio-process development using microorganisms, scale-up, feedstock evaluation, purification, and applied research.

High-throughput experimental systems, digital breeding technologies, automated robotics, and fermentation and cultivation evaluation equipment are consolidated in this facility, enabling researchers to collaborate closely with industry partners in a co-creation-driven R&D environment. In addition, a data-driven bi-

omanufacturing platform has been established, integrating AI, robotics, and advanced measurement technologies to realize a highly innovative and practical research environment.

Looking ahead, the center will promote R&D aimed at developing new materials, reducing environmental impact, advancing carbon recycling, and upgrading production processes, thereby contributing to the growth of the bioeconomy. It will also function as a hub for nurturing the next generation of researchers. The RITE Biomanufacturing Center will continue to strengthen its role and value as one of Japan's leading research hubs driving the Biomanufacturing revolution.

We sincerely hope that many companies engaged in Biomanufacturing will actively utilize this center through collaborative research with us.

Overview of RITE Biomanufacturing Center

Note:

This work was conducted as part of projects commissioned and subsidized by the New Energy and Industrial Technology Development Organization (NEDO).

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Fostering Group Synergy and Advancing Research Planning Capabilities — Design and Operation of Internal Seminar —

Internal Seminar Program Working Group (As of Apr. 2026)

Systems Analysis Group	Senior Research Scientist	**Miyuki Nagashima**
Molecular Microbiology and Biotechnology Group	Senior Research Scientist	**Takahisa Kogure**
Chemical Research Group	Research Scientist	**Takayasu Kiyokawa**
CO_2 Storage Research Group	Senior Research Scientist	**Keisuke Uchimoto**
Research & Coordination Group	Manager	**Minehiro Takahashi**

1. Introduction

At the Research Laboratory of Innovative Technology for the Earth (RITE) (hereinafter referred to as the "Research Laboratory"), an Internal Seminar Series has been conducted as an initiative proposed by Director-General Shimoda.

The series aims to foster a sense of unity within the Research Laboratory, promote group synergy, and enhance research planning capabilities by providing opportunities to engage with a broad range of knowledge.

In this article, we report on the five Internal Seminars held during the previous fiscal year.

2. Overview of the Internal Seminar Series

2.1. First Seminar — Introduction of the Molecular Microbiology and Biotechnology Group's Initiatives —

In April 2025, a seminar was held to introduce the initiatives of the Molecular Microbiology and Biotechnology Group, focusing on the theme "New initiatives undertaken by the Molecular Microbiology and Biotechnology Group" and "Activities under the Bio-manufacturing Revolution Promotion Program."

Following the seminar, guided tours were conducted at the Biotechnology Manufacturing Laboratory Building and the Molecular Microbiology and Biotechnology Group laboratories.

2.2. Second Seminar — Introduction of the Chemical Research Group's Initiatives —

In June 2025, a seminar was held to introduce the initiatives of the Chemical Research Group, focusing on the theme "RITE Carbon Capture Center (RCCC)."

Following the seminar, guided tours were conducted at the RITE Carbon Capture Center (RCCC) and the Direct Air Capture (DAC) experimental laboratory.

2.3. Third Seminar — Introduction of the CO_2 Storage Research Group's Initiatives —

In September 2025, a seminar was held to introduce the initiatives of the CO_2 Storage Research Group, focusing on the theme "The Evolution of Optical Fiber Measurement Technology Development in the CO_2 Storage Research Group."

During the seminar, actual casing equipped with optical fiber cables were displayed at the venue.

2.4. Fourth Seminar — Introduction of the Systems Analysis Group's Initiatives —

In December 2025, a seminar was held to introduce the initiatives of the Systems Analysis Group, focusing on the theme "Scenario analyses for the 7th Strategic Energy Plan's energy supply and demand outlook conducted by the Systems Analysis Group."

Following the seminar, a poster-based question-and-answer session was held, allowing participants to engage directly with seminar speakers.

2.5. Fifth Seminar — Sharing the Expo Legacy —

In March 2026, a seminar was held under the theme "The Legacy of Expo 2025 Osaka, Kansai," featuring a lecture by Director-General Shimoda (Chairperson of the Decarbonization Working Group, Japan Association for the 2025 World Exposition).

Following the lecture, a roundtable-style session was conducted with members involved in the RITE Future Forest.

3. Conclusion

The Internal Seminar Series is designed and operated by the Internal Seminar Program Working Group, which is composed of members selected from each research group within the Research Laboratory.

Seminar themes are examined through exchanges of views among the Working Group members.

Going forward, we will continue organizing the Internal Seminar on topics such as policies related to global environmental challenges and other issues.