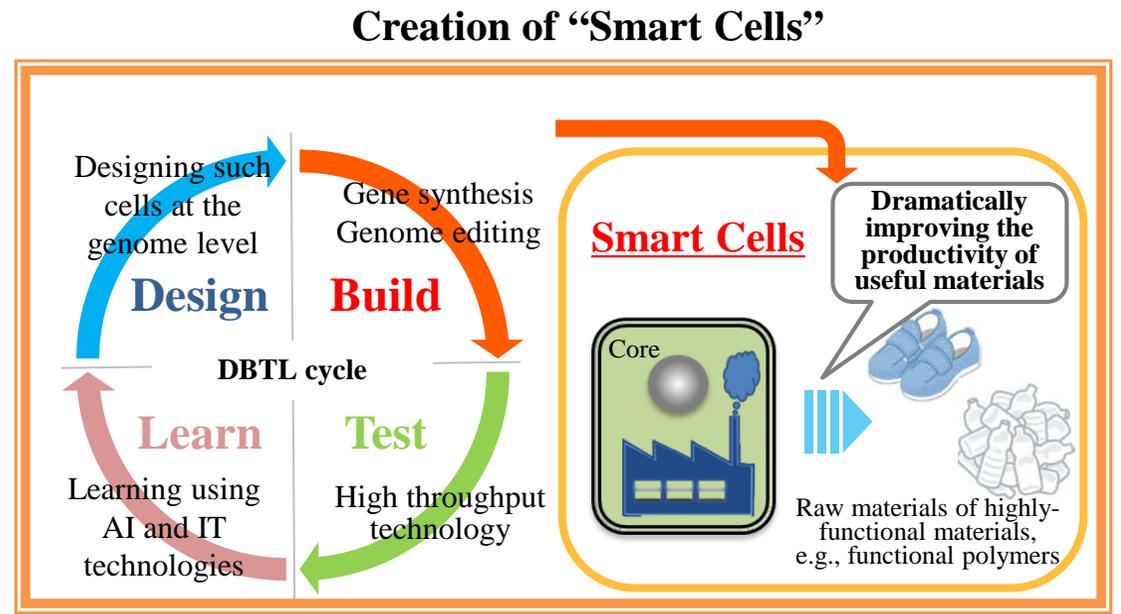


“Fifth Industrial Revolution” Cultivated with Biotechnology

- Backed by recent advancement of biotechnology as seen in cost reduction of genome-decoding, arrival of innovative genome-editing technology, and integration of biotechnology and AI, IT and other digital technologies, **a “bioeconomy” is considered to be arriving worldwide** creating a society in which **biotechnology is utilized in all “monozukuri” (manufacturing) areas**, such as healthcare and medical care, energy and highly-functional materials.
- The government formulated a Strategy for Biotechnology in 2019 and has upheld its **goal of realizing a globally-advanced bioeconomy in 2030 in Japan**.
- Against this backdrop, the Bio-Industry Subcommittee **held discussions on measures contributing to further improving the competitiveness of the bio-industry in Japan as a pillar supporting industries leading the next-generation economy**, and compiled the discussion results into a report.

1. Background (development of synthetic biology)

- **Cost reduction of genome-decoding** (one-100,000th from the cost in 2000)
- **Birth of innovative genome-editing technology (CRISPR-CAS9)**
- **Development of IT/AI technologies** allowing analysis of relationships between genome sequences and biofunctions



2. Recognition of current situations (industrial development placing biotechnology at the core)

- The market scale of the bio-industry is **expected to grow** for the coming five years **with 7.0% annual average growth** at a global level and **by 6.8% in Japan as well**.
- **Forty-nine countries** around the world have **formulated strategic policies related to the development of bioeconomy**.
- **The government of Japan is increasing expenditures** for R&D in the field of healthcare along with the U.S., the U.K., Germany and the ROK, showing **intensifying international competition in the field**.
- Japan's **international competitiveness** in basic research in the field of life science has been decreasing .
- Challenges are seen in **the low reproducibility unique to biology, low research efficiency, risks of infection**, etc.
- **Human resources expertized in DX for the bio-industry and those playing leading roles in manufacturing of biological products are insufficient**.

3. Directions of future efforts

(1) Improving productivity by introducing robots and automation

- **Accelerating introduction of automation into phases of R&D and product development** by making use of humanoid experimental robots and combinations of devices modularized for each operation

(2) Formulation of a global biocommunity

- Formulating **global bio-innovation hubs in the Tokyo and Kansai areas** to facilitate a virtuous cycle of people, goods and money
- Inaugurating a **Greater Tokyo Biocommunity Council** in the Tokyo area as a body executing leadership in industry-academia-government collaboration and **formulating and presenting a master plan** containing specific actions and quantitative goals

(3) Fostering human resources expertized in DX for the bio-industry and that can play leading roles in manufacturing of biological products

- Building a system reflecting the latest demands of companies and academic knowledge; and **establishing a sustainable ecosystem for fostering human resources through industry-academia-government collaboration**

(4) Priority Research issues to be tackled

- **Formulating a strategy for life science technologies** in the fields of health care and medical care, that organizes and prioritizes R&D issues to be tackled
- Facilitating R&D for **establishing advanced basic technologies, e.g., cell-free technology**

(5) Enhancing the competitiveness of CMOs/CDMOs of bio-pharmaceuticals, etc.

- Encouraging **CMOs/CDMOs to participate in national projects** which are intended to develop manufacturing processes in order to enhance Japan's ability to deal with new technological seeds
- **Discussing specific support measures** from the perspective of **securing domestic infrastructures for manufacturing**

(6) Disseminating bio-derived products

- **Reviewing the Label Display Program** in order to encourage markets to choose bio-derived products
- **Inaugurating an award program** to recognize development and utilization of pioneering bio-derived products

Correctly ascertaining changes brought about by the “fifth industrial revolution” by taking advantage of the combination of biotechnology and IT/AI and improving the competitiveness of the bio-industry in Japan.