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Korea to announce the National Synthetic Biology Initiative

The Ministry of Science and ICT (“MSIT”, Minister: Lee Jong-Ho) announced the ‘National Synthetic Biology Initiative’ on November 29 to nurture synthetic biology and enhance innovative capabilities in biomanufacturing.

Synthetic biology* is a technology that can help biological research overcome its chronic limitations put on by speed, scale, and uncertainty. Due to the immense impact it may have on various bio-related industries including pharmaceuticals, energy, chemical, and agriculture, synthetic biology is regarded as a critical technology upon which the success of the future bio-industry depends.

* Synthetic biology refers to a study/technology that incorporates the concept of engineering into bio-science. In synthetic biology, the components and systems that compose a living organism are artificially designed, manufactured, and synthesized. This technology shortened the development period of Moderna’s mRNA vaccine.

Synthetic biology is emerging as a key technology in the recently intensifying global competition for technological hegemony in the bio-industry. The US, UK, Japan, China, and other major countries have designated synthetic biology as a technology to be nurtured at a national level, and have established biofoundry*, a core infrastructure of the technology, all fiercely racing to secure technological supremacy.

* A facility that supports biological experiments and manufacturing processes by converging biotechnologies with digital, AI, robotics and other ICT to standardize, automate and speed up the DBTL (Design, Build, Test, and Learn) cycle of synthetic biology research.

In particular, the United States announced the ‘National Biotechnology and Biomanufacturing Initiative’, issuing an Executive Order to declare that the US would maintain its technological hegemony in the bio-industry. It is projected that synthetic biology will replace over one-third of the existing petrochemical and other manufacturing industries (worth over \$30 trillion) within 10 years.

Accordingly, the Korean government announced the ‘National Strategic Technology Nurture Plan’ and listed advanced biotechnology among the 12 strategic technologies, recognizing synthetic biology as one of the key technologies. As a follow-up to the announcement, the government revealed its plan to launch the ‘National Synthetic Biology Initiative’ and implement policies to foster synthetic biology on a major scale.

The key contents of the ‘National Synthetic Biology Initiative’ announced today are explained in the following paragraphs; details will be fleshed out and unveiled at the Council for Comprehensive Biotechnology Policy scheduled for December 6.

1. Backgrounds of the policy

Since the 2000s, the rapid advancement of genome-related base technologies and accumulation of data ushered in a new era of writing genomes, moving on from the past era of only being able to read. This change is driving the fast emergence of synthetic biology that enables the artificial design, manufacture, and synthesis of a living system. In particular, the convergence of synthetic biology with digital, AI, and robotics is expected to provide a solution to the long-standing conundrum of biotechnology, namely limitations of speed, scale, and uncertainty, thereby delivering tremendous ripple effects in the future economy, society and security.

Many countries have declared synthetic biology as their strategic technology and are racing to secure technological superiority at a national level. Joining this race, Korea nominated synthetic biology as a key national strategic technology in the advanced biotechnology field. As it is necessary to secure a competitive edge in technology, the ‘National Synthetic Biology Initiative’ is proposed as a blueprint to become a front-runner in synthetic biology.

2. Vision and Accomplishment Action Plan

Under the vision of accelerating innovation in national bio-manufacturing by nurturing synthetic biology, the following goals have been set. ① Raise the domestic level of synthetic biotechnology to 90% compared to the global top level. ② Transition 30% of the manufacturing industry to bio-industry within the next 10 years. ③ Establish a world top-level national biofoundry industry. ④ Nurture synthetic biology with special emphasis on the six strategic areas. To accomplish these goals, the Ministry plans to focus on securing core technologies in synthetic biology, establishing and utilizing biofoundry, and creating a sustainable ecosystem.

3. Key Contents

【 I 】 Securing Core Technologies in Synthetic Biology

① The MSIT will establish an innovation system for synthetic biology research.

O (Nurturing Six Strategic Areas) The MSIT will select six strategic areas of ‘super gap’ in which Korea can secure technological superiority, and create new R&D programs exclusive for nurturing these areas in order to secure core technologies by each strategic area at an early stage.

* The six areas will be selected after comprehensively taking into account overseas cases, domestic capabilities, new industry prospects, supply chains, and national security.

* (Tentatively named) ‘Core Synthetic Biotechnology Development Plan’ will be carried forward.

O (Establishing technology classification systems and a technology road map) The concepts, scope, and classification standards of synthetic biology will be defined. A strategic road map will be drawn to develop and industrialize core technologies in the six strategic areas. (2023)

* Once established, the technology classification system will be utilized as an official system such as the ‘science and technology classification system’ under the Framework Act on Science and Technology, and the ‘biotechnology classification system’ under the Biotechnology Support Act.

② The MSIT will nurture strategic areas through hub-based and accumulative research.

O (Nurturing hub research institutes by strategic areas) Mission-centered research hub institute (tentatively named ‘Synbio-Hub’) will be designated and function as the hub for domestic research collaboration. (2024)

* Accumulation of technology will be facilitated by building an industry-academia-research collaboration system and conducting whole-cycle convergence research.

O (Operating a mission-oriented, goal-driven research system) Clear missions and goals will be set for each research hub. Authority and responsibility for flexible project management will be given. Challenging and competitive R&D will be authorized.

O (Operating a support center for research and policy-making) An institute that specializes in information & policy will be designated and operated to provide support for efficient synthetic biotechnology R&D and utilization, and for making relevant policies.

【 II 】 Building and Utilizing Biofoundry

① The MSIT will build and expand a biofoundry that accelerates innovation in synthetic biotechnology.

O (Building a national biofoundry) By building a government-led public foundry (from 2024), the Ministry aims to speed up synthetic biology R&D by five times and secure comprehensive capacities to establish and operate a global top-tier core infrastructure of synthetic biology that can design and manufacture artificial cells.

* Digital technologies including AI and robotics will be incorporated to standardize, accelerate, and automate the entire process of synthetic biotechnology (designing, building, testing, and learning) so that useful artificial cells or bio-materials can be developed and produced through biofoundry which is the core infrastructure.

O (Building a public biofoundry specialized by sector) A regional public biofoundry that provides specialized infrastructure and services to sectors including food and agriculture, ocean, advanced new drugs, and energy will be constructed (from 2027) in order to facilitate its industrial utilization based on each region.

* The national biofoundry (“hub”) will secure leading technologies and function as the core, while the regional biofoundries (“spoke”) will carry out demonstration projects in collaboration with their regions and support their industrial use.

O (Expanding the biofoundry into the private sector) By transferring the public sector's know-how on the establishment and operation of biofoundry infrastructure to the private sector, and by providing support for the development of key equipment and parts, the government will facilitate the emergence of specialized service companies and help them build and utilize their own infrastructure.

* Bio-manufacturing innovation network through public-private collaboration will be completed by 2030.

② The MSIT will spur innovation in bio-manufacturing by utilizing biofoundry.

O (Facilitating the transition into bio-manufacturing) The Ministry will provide support to existing industries such as bio-health, chemicals, environment, food, and materials in transitioning into manufacturing processes based on synthetic biology. (from 2027)

* (Tentatively named) 'Synthetic-biology-based bio-manufacturing demonstration project' will be conducted to support the industry with manufacturing process simulation, bio-material production optimization, mass-production platform design and pilot production.

O (Supporting the establishment and growth of innovative biotechnology companies) The Ministry will discover future entrepreneurs and innovative start-ups, and provide them quick support packages to help plan and commercialize ideas that utilize biofoundry. (from 2027)

O (Promoting private investment) The Ministry will alleviate the private sector's obligatory contribution in the matching funds of national R&D projects related to biofoundry. Also, institutions such as new technology certification, designation of innovative companies, and prioritized purchase from public procurement will be utilized to promote investment in private research and infrastructure.

* A legal basis is being established through the legislation of (tentatively named) *Act on Synthetic Biology Research Promotion and Support* (to be set in motion in 2023).

【Ⅲ】 Creating a Sustainable Ecosystem

① The MSIT will reinforce domestic and international cooperation and consolidation.

O (Building governance of innovative domestic synthetic biology) The Ministry will clarify the roles of different ministries related to synthetic biology and coordinate relevant policies and projects by utilizing review boards on S&T and biotechnology. Also, the Ministry will establish a system to foster and develop synthetic biology in collaboration with the Korea Synthetic Biology Association (KSBA)*, a private-led cooperative body.

* KSBA is a consortium of 50 industry-academia-research organizations, launched on July 20, 2022, with a mission to concentrate domestic synthetic biology expertise. Currently, it is in operation with 3 departments of technology & industry, network & education, and policy & institutions.

O (Strengthening Global Cooperation and Partnership) With KSBA as the focal point of international cooperation, Korea will secure footholds for cooperation in major countries, strengthening strategic research collaboration and partnership in order to jointly address environment, security, and other international issues.

* US: Agile Biofoundry, UC Berkeley, MIT

UK: London Biofoundry, University of Edinburgh, Imperial College London

Japan: Kobe University, Kyushu University

China: Shenzhen Institute of Advanced Technology (SIAT)

Australia: The Commonwealth Scientific and Industrial Research Organisation (CSIRO)

2 The MSIT will build an enabling foundation for synthetic biology

O (Establishing the legal system and raising social awareness) Legislate a law for promoting innovation in the development of synthetic biology technologies and commercialization; establish a research system that allows objective risk evaluation and securing accountability that reflects the characteristics of synthetic biology that accompany the potential for innovation and risk; raise social awareness and expand the basis through technology assessment and technology contests

* (Tentative name) To enact an Act on the Promotion and Support for Synthetic Biology Research (legislation to be proposed in 2023)

O (Fostering synthetic biology talent) Train 1,000 synthetic biology professionals through developing and establishing a multidisciplinary course and departments* that converge biology, AI, and engineering to respond to the rapidly growing research demand for synthetic biology, and operating education programs** that integrate theoretical education and field training to enlarge the pool of industry professionals in fields such as supervising biofoundry production process (until 2030)

* To establish a new graduate school specializing in synthetic biology in KAIST College of Life Science and Bioengineering (in 2023)

** Provision of theoretical education and field training to respectively utilize the Synbio-Hub, and public biofoundry

For further information, please contact the Public Relations Division (E-mail: msitpress@korea.kr) of the Ministry of Science and ICT.