Chapter 4 Social Implementation of "Knowledge" for Innovation Creation

Among the initiatives for the realization of a science and technology nation, those for innovation creation through the social implementation of "knowledge" gained from research are introduced in this chapter. It has been pointed out that one of the issues that Japan faces is that the results of R&D do not always provide solutions to real issues and social implementation. For this reason, the government is promoting programs such as the Cross-ministerial Strategic Innovation Promotion Program (SIP [1]), where cross-sector initiatives are promoted with cross-ministerial cooperation through the industry-academia-government collaboration from basic study to practical application and commercialization. In addition, to address increasingly complex social issues, the government is promoting initiatives that use "Convergence Knowledge" by integrating the "knowledge" in humanities, social sciences, and natural sciences.

Section 1 Initiatives to Implement the "Knowledge" Gained from Research into Society and Thereby Create Innovations

1 Promotion of Research and Development and Social Implementation to Solve Social Issues

(1) Promotion of the Moonshot Research and Development Program

The Moonshot Research and Development Program is a major research program under which the government sets ambitious goals that fascinate people (Moonshot Goals) to address important social challenges, including super-aging society and global warming, and promote challenging R&D. All the goals are set to realize "Human Well-being." To solve social issues in the future, 9 specific goals were determined from the following 3 areas that form the foundation of human well-being and comfortable life (Determined by the Council for Science, Technology and Innovation (Goals 1 – 6: January 23, 2020, Goals 8, 9: September 28, 2021), and by the Headquarters for the Healthcare Policy (Goal 7: July 14, 2020)).

Figure 1-4-1 shows the outline of the 9 Moonshot Goals.

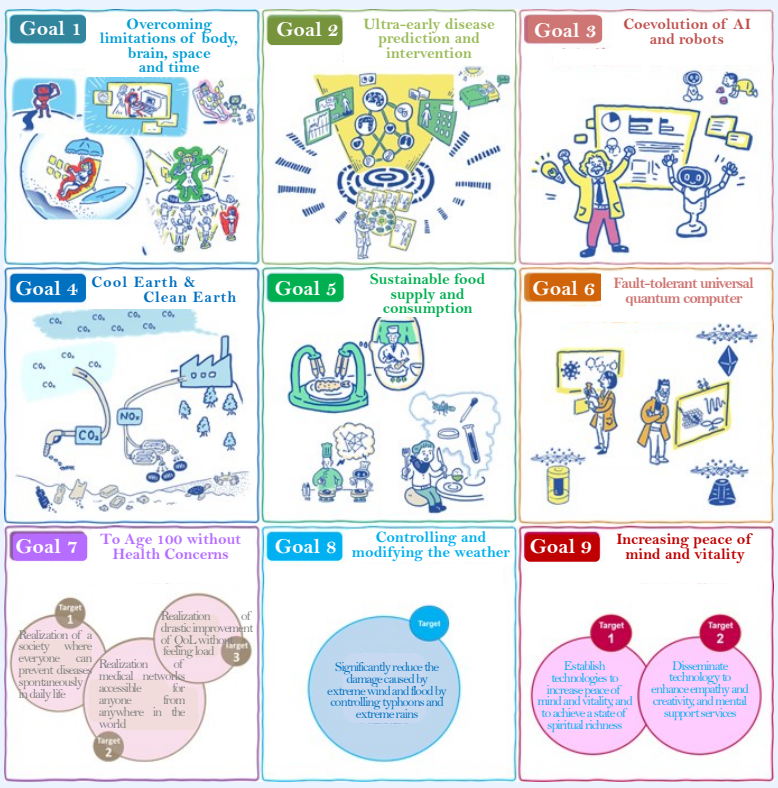
① Society: Turning the aging society into the innovative and sustainable society by harnessing diversity through techno-social transformation
[Challenges: Low birthrate and aging population, declining working population, etc.] (Goals 1, 2, 3, 7, and 9 apply)

② Environment: Recovery for global environment and growth of civilization
[Challenges: Global warming, marine plastic litter, resource depletion, balancing environmental conservation and food production, etc.] (Goals 4, 5, and 8 apply)

③ Economics: Exploring frontiers with science and technology
[Challenges: Increasing demand for computation for the realization of Society 5.0, expansion of human activity area, etc.] (Goals 2, 3, 6, 8, and 9 apply)

1 Cross-ministerial Strategic Innovation Promotion Program

■ Figure 1-4-1/ Moonshot Goals



Provided by Cabinet Office

To achieve each goal, the government has established a portfolio [1] where a program director (PD) is appointed to oversee the goals, and top researchers from within and outside Japan will work under the PD on various R&D projects. In each R&D project, a derivative spin-out of research results keeping in view future social implementation is actively encouraged by setting up stage gates to review the portfolio flexibly. In addition, "Status of collaboration and mediation with the industrial sector" is included from the perspective of evaluating the research and development, aiming to obtain private funding for social implementation.

This section introduces the examples of Goal 8 and Goal 9, which were decided in 2021.

Under this program, goals are added in response to changes in the social environment, and a decision was made in July 2020 that new Moonshot goals will be studied in anticipation of a transformation in the social economy due to the impact of the novel coronavirus infection.

After soliciting applications for teams, mainly of young researchers, to present new ideas and carry out research for the materialization of those ideas, 21 study teams were selected from among 129 applications, who compiled the future issues in social economy and visions, over about 6 months under the guidance and advice of 4 visionary leaders. The visionary leaders conducted a final evaluation of these reports under the cooperation of external experts for each report, and the following 2 goals (Goals 8 and 9) were selected and officially determined as new Moonshot goals at the plenary session of the Council for Science, Technology and Innovation (CSTI) held on September 28, 2021.

○ Moonshot Goal 8: "Realization of a society safe from the threat of extreme winds and rains by controlling and modifying the weather by 2050"

1 A management plan that outlines the project structure (combination) and resource allocation, etc.

The progress of global warming has led to extreme storm and flood damage caused by typhoons and extreme rains, and weather disasters around the world have increased fivefold over the past 50 years, and the death toll from 1970 to 2019 is estimated to be over 2 million. Although there has been research on small-scale artificial rainfall, there has been no progress in research and development for controlling the meteorological phenomena having a large amount of energy that can lead to disasters such as typhoons and extreme rains. This goal aims to make it possible to intervene to change the timing, range and intensity of typhoons and extreme rains, significantly reducing disaster damage and bringing a wide range of benefits to society by 2050.

■ Figure 1-4-2/ Society aimed at by Moonshot Goal 8

Provided by Cabinet Office

○ Moonshot Goal 9: "Realization of a mentally healthy and dynamic society by increasing peace of mind and vitality by 2050"

The number of suicides in Japan began to increase in 2020, the year of COVID-19. Social losses due to suicide and depression are estimated at 2.7 trillion yen per year, and the novel coronavirus infection is further aggravating social problems caused by suicides and mental factors such as depression. This goal aims to develop motivating technologies through extraction and measurement of elements that influence the human mind (present in culture, tradition, art, etc.) and elucidate the mechanism of mental influence. Also, acceptance of diversity and sharing of emotions in communication will be enabled through the collaboration of humanities, social sciences, and technology, and techniques will be created to improve empathy and creativity while emphasizing diversity significantly. By achieving these targets, this goal realizes a mentally healthy and dynamic society by increasing peace of mind and vitality by 2050.

■ Figure 1-4-3/ Society aimed at by Moonshot Goal 9

Provided by Cabinet Office

(2) Cross-ministerial Strategic Innovation Promotion Program (SIP)

Cross-ministerial Strategic Innovation Promotion Program (SIP) is a cross-ministerial initiative in which the Council for Science, Technology and Innovation determines socially essential and critical programs for Japanese economy and industrial competitiveness and promotes cross-sector initiatives with cross-ministerial cooperation through the industry-academia-government collaboration from basic research to practical application and commercialization.

In the first period of the SIP (FY2014 – FY2018), social implementation was realized through, for example, the Shared Information Platform for Disaster management (SIP4D), in which information on disasters is swiftly shared among relevant agencies, based on which activities are implemented by relevant parties, and Dynamic

Maps Platform, in which the information necessary for safe driving is distributed to automated vehicles through an automated driving system.

In the 2nd period of SIP (FY2018 – FY2022), the government is working on 12 programs for solving social problems faced by Japan and strengthening its industrial competitiveness, such as initiatives aimed at the realization of functions for communication, storage and secondary use of important data using quantum encryption and communication technologies, such that the data cannot be deciphered by a third party and AI-enabled hospitals that aim at more meticulous patient care by reducing the burden on medical professionals through maximum utilization of AI, such as accurate image diagnosis and pathological diagnostic support.

In addition, for the next phase of the SIP scheduled to start from FY2023, 15 potential programs (target areas) have been determined in December 2021 by back-casting from the ideal future image (Society 5.0) that Japan aims to achieve. In FY2022, the government is carrying out a feasibility study (FS) on R&D themes in collaboration with relevant ministries under the nominated program director (PD) and developing plans and systems that will lead to social implementation.

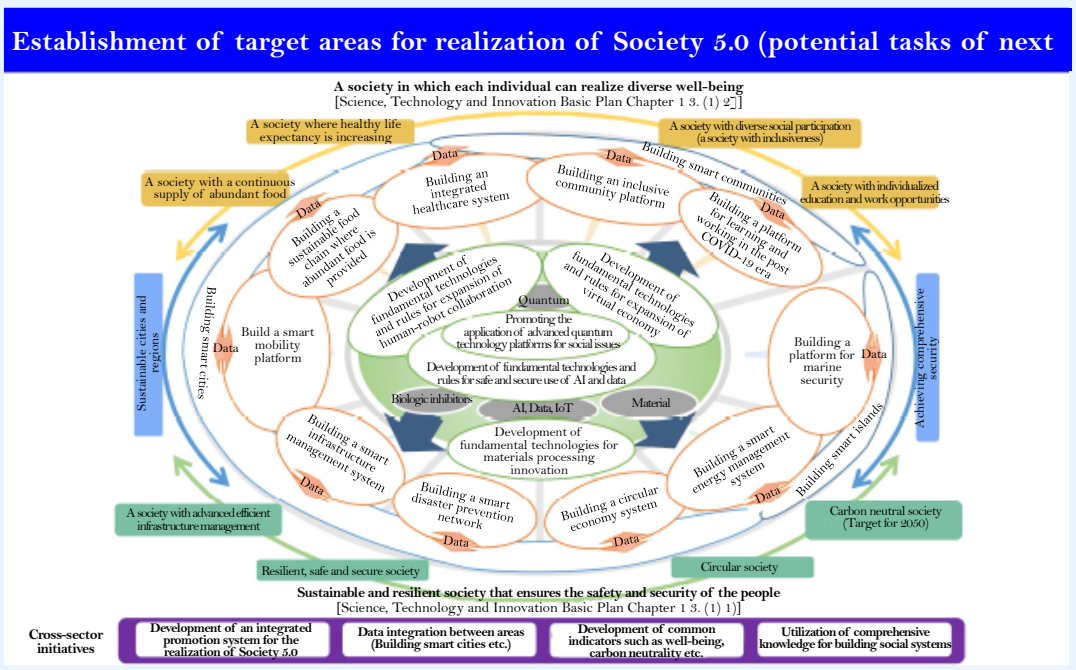
Overview of the 1st term of the SIP Research and Development Plan
URL: https://www8.cao.go.jp/cstp/gaiyo/sip/sipkenkyukaihatu11kadai.pdf
Source: Cabinet Office

Overview of the 2nd term of the SIP Research and Development Plan
URL: https://www8.cao.go.jp/cstp/gaiyo/sip/kenkyugaiyou02.pdf
Source: Cabinet Office

■ Figure 1-4-4/ Dynamic map

Material: Presentation material at the SIP Symposium 2020 held by the Cabinet Office (Automated Driving (Extension of Systems and Services)) (November 17, 2020)

■ Figure 1-4-5/ 15 potential tasks for the next phase of the SIP (target areas)



Provided by Cabinet Office (Determination of Potential Tasks for the Next Phase of the SIP (December 24, 2021, Press Release))

(3) Green innovation fund

The "Green Growth Strategy through Achieving Carbon Neutrality in 2050" (June 18, 2021) portrays the demand and supply of energy to realize the 2050 carbon neutral goal and a decarbonized society as an industrial policy that creates a "positive cycle of economic growth and environment protection," viewing responses to global warming as a growth opportunity, and presents a policy to support initiatives of private companies including budget, taxation, regulatory reforms and standardization, and international collaboration. A "Green Innovation Fund" worth 2 trillion yen was developed in March 2021 as part of the New Energy and Industrial Technology Development Organization to provide continuous support from research and development of innovative technologies to social implementation, particularly in the areas under the 14 key sectors listed in the Green Growth Strategy, that have a significant impact of policies, and that require continuous support over a long term, keeping in view the social implementation.

To ensure that the results of research and development are steadily implemented in society, the fund requires the implementing companies, etc., to commit that their management will persistently work on the details and schedule of initiatives, etc. toward social implementation, as long-term management tasks, which the council will monitor.

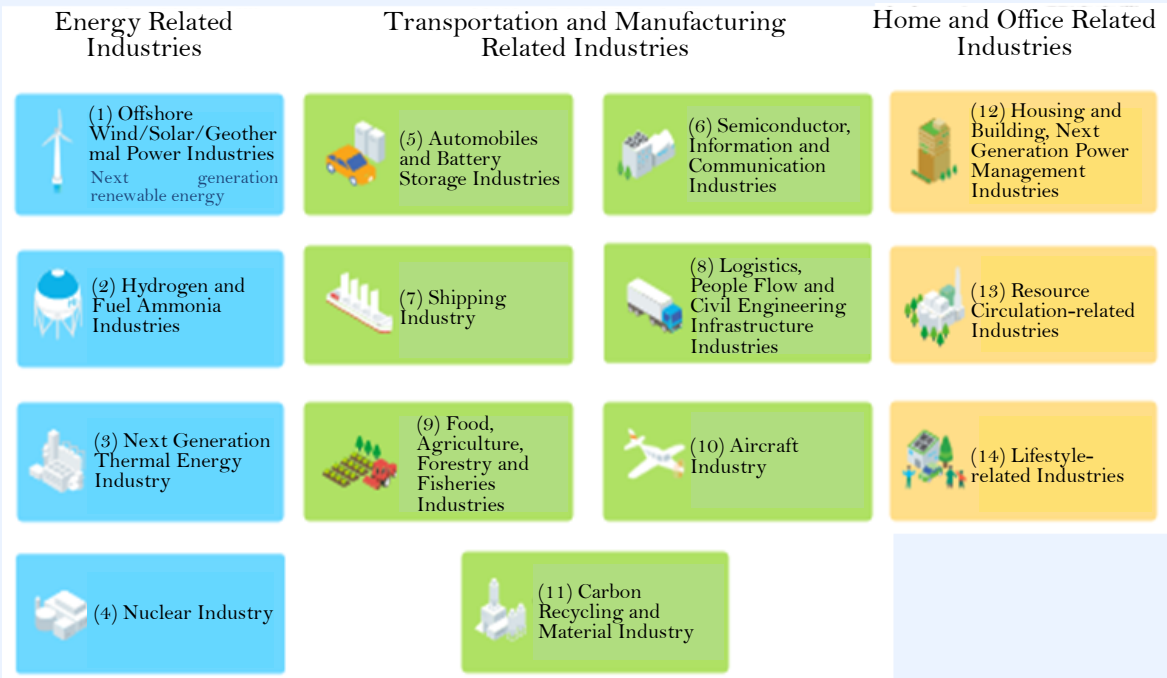
Currently, through discussions, etc., at the council, projects such as offshore wind, hydrogen, fuel ammonia, carbon recycling and storage batteries are being developed and launched one by one through public solicitation of implementing companies by the New Energy and Industrial Technology Development Organization.

Through this, the government aims to induce R&D and capital investments by private companies and attract ESG funds[1] amounting to 3,500 trillion

1 ESG investment refers to investment that takes into account environmental, social, and governance factors, as well as conventional financial information. The concept of evaluating the sustainability of corporate management is gaining popularity, especially among institutional investors such as pension funds that manage large assets over the very long term, and is attracting attention together with the United Nations Sustainable Development Goals as a benchmark for evaluating long-term risk management with climate change, etc.in mind, and opportunities for companies to generate new revenues.

yen worldwide for environmental, social, and corporate governance to domestic projects, creating a virtuous cycle of environment and economy.

■ Figure 1-4-6/ 14 key sectors listed in the Green Growth Strategy



Source: New Energy and Industrial Technology Development Organization

2 Promotion of R&D Projects Aimed at Commercialization, and Corporate Initiatives

(1) Support for startups

Robust economic growth in Japan requires comprehensive support for startups, innovation leaders, the creation of new businesses and industries, and a successful model that generates high added value.

To this end, the government has positioned 2022 as the first year of startup creation and will formulate a 5-year plan by June to create large-scale startups.

To be specific, the government will realize a "second founding period" following Japan's post-World War II period of business startups by boldly strengthening the startup ecosystem, such as by reviewing the listing rules to facilitate fund procurement for listed startups to help them grow further and working on the creation of university-launched venture companies in collaboration with regional SMEs.

❶ Create a startup ecosystem hub comparable to that of the world

In recent years, startups across the world, including giant IT firms represented by GAFA[1], have grown rapidly in a very short period, so much so that they have outperformed large companies and have become a major trend, transforming not only the industrial structure but also the urban structure and lifestyle. Developed countries have been making strategic efforts to create startup ecosystems to create innovative startups.

Aiming at the formation of a startup ecosystem to create startups that expand into the world and

1 An acronym for 4 companies: Google, Apple, Facebook (Meta), and Amazon.

realization of solutions to social problems through innovation, Japan has formulated a "Beyond Limits. Unlock Our Potential – Strategy for the creation of a startup ecosystem hub comparable to that of the world –" in June 2019 and has selected 4 global hubs (Tokyo; Nagoya and Hamamatsu; Osaka, Kyoto and Kobe; and Fukuoka) and 4 promotion hubs (Sapporo; Sendai; Hiroshima; and Kitakyushu) in 2020. To promote the creation of a startup ecosystem hub that is comparable to that of the world, focused support is being provided by the government, government-related organizations, and private supporters, such as the implementation of the "Global Startup Acceleration Program" to encourage startups in the hub cities to enter the global market and attract investment from overseas investors.

❷ Support from the SBIR program, etc.

The SBIR (Small Business Innovation Research) program is being promoted to increase opportunities for disbursement of research and development grants to startups and SMEs and to support the commercialization of the results of such research. The statutory basis for this program has been transferred from the "Small and Medium Enterprises Business Enhancement Act, etc." (Law No. 18, 1999) to the "Act on the Revitalization of Science, Technology and Innovation Creation" (Law No. 63, 2008) to strengthen cross-ministerial efforts as an innovation policy. For example, to increase disbursement opportunities for R&D startups that conduct innovative research and development, the government has set an expenditure target of approximately 53.7 billion yen for FY2021.

In addition, as one of the support measures for startups and SMEs that use public procurement, the "Cabinet Office Open Innovation Challenge" is implemented as an initiative to challenge startups and SMEs with themes set up based on specific issues faced by government ministries and local authorities and to discover and commercialize new ideas and technologies. For approved proposals, opportunities are provided for advice from outside experts arranged by the Cabinet Office and meetings with government ministries and local authorities.

❸ Promote entrepreneurship education

For the creation of startups, it is necessary to develop human resources with an entrepreneurial spirit or the mentality to accept sudden changes in the social environment and create new value. As part of initiatives to expand the base for fostering entrepreneurship nationwide, Japan has launched an online "National Entrepreneurship Education Program hosted by MEXT" from FY2021 for university and graduate school students throughout Japan. In addition, through the Japan Science and Technology Agency, the government is promoting the establishment of platforms in collaboration with universities, local authorities, and the industrial sector in the startup ecosystem hub cities and environmental improvements that enable willing students to attend human resource development programs that include entrepreneurship training, as well as, development and operation of human resource development programs that include practical entrepreneurship training through industry-academia-government collaboration. For example, Kyoto University has taken the lead in establishing the "Keihanshin Startup Academia Coalition," in which Kyoto University, Osaka University and Kobe University play a central role in developing programs that can also be attended by students from other universities and conducting contests for unique entrepreneurial ideas and educational activities for high school students.

❹ Support for various growth phases

Various support measures are taken to encourage the growth of R&D startups with excellent technological seeds through the New Energy and Industrial Technology Development

Organization for startups according to their growth phase, including support for potential entrepreneurs, support for research and development in the initial phases after starting a business, and support for collaboration with business companies. For example, as support for potential entrepreneurs, researchers with an entrepreneurial mindset who wish to start a business based on technological seeds and expand their business significantly are provided with advice on how to improve their business plans and opportunities to find suitable investors through contests on their business plans. Furthermore, the FY2021 supplementary budget is being utilized to strengthen areas that have not received support in the past, such as the utilization of technological seeds that lie dormant in the region and the energy and environment fields that contribute to carbon neutrality.

Japan will continue to take various measures to form "startup ecosystems" where startups will grow, and innovation will be created cyclically and self-sustained.

(2) Promotion of industry-academia-government collaboration

Close collaboration among the government, local public entities, private companies, universities, and R&D agencies is necessary to solve increasingly complex social problems and realize a prosperous and sustainable society through the creation of science, technology, and innovation.

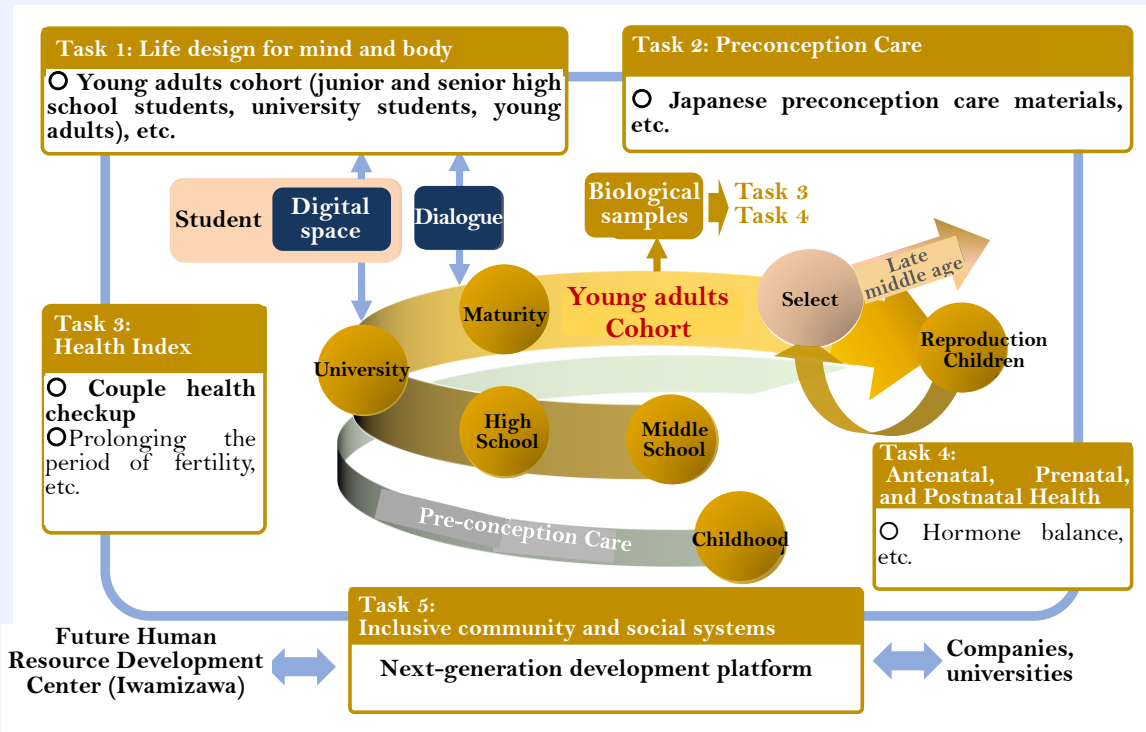
"The Program on Open Innovation Platform for Industry-Academia Co-Creation (COI-NEXT)" is a program where universities, etc., as centers of knowledge and human resources, play a central role in building the future vision for society (vision of the center), along with various stakeholders, including private companies and local public entities and promoting research and development to realize the vision, with the aim to form independent industry-academia-government co-creation centers that can continuously produce results even after the project ends. In FY2021, initiatives through the industry-academia-government collaboration were implemented at 35 sites. For example, in the "Life Design Center for Mind and Body" led by Hokkaido University, over 30 institutions, including local authorities such as Iwamizawa City, universities and companies, participate in conducting follow-up research as a "youth cohort study" on changes in minds and bodies of young people, developing preconception care materials, and conducting research on fertility for young people, with the aim to overcome the declining birthrate in the region by helping young people live as they are with others.[1]

Roundtable discussion for first-year high school students discussing the theme of living as they are in harmony with others

Source: Hokkaido University COI & NEXT "They magazine vol.01"

1 Preconception care is a process by which women and couples think about their lives and health with future pregnancies in mind(National Center for Child Health and Development website).

■ Figure 1-4-7/ Initiatives of the centers



Source: Hokkaido University COI & NEXT

In addition, the "Intensive Support for Young Promising Researchers" is supporting more than 200 young researchers, which was implemented with the expectation that private companies will invest their R&D expenses in young researchers at universities, etc. to provide a catalyst for innovations. In this project, the government provides a subsidy of the same amount as the joint research expenses paid by companies to universities, etc., when they conduct joint research with young researchers to induce companies to invest more in universities. It is expected that this will prove to be a "trigger" for large-scale joint research between companies and young researchers at universities, etc. In addition, to contribute to expanding career paths and mobility in the industrial sector, the project makes it possible to conduct research at universities and companies, etc. The content has also been enhanced from the perspective of human resource mobility through research internships and cross-appointment systems.

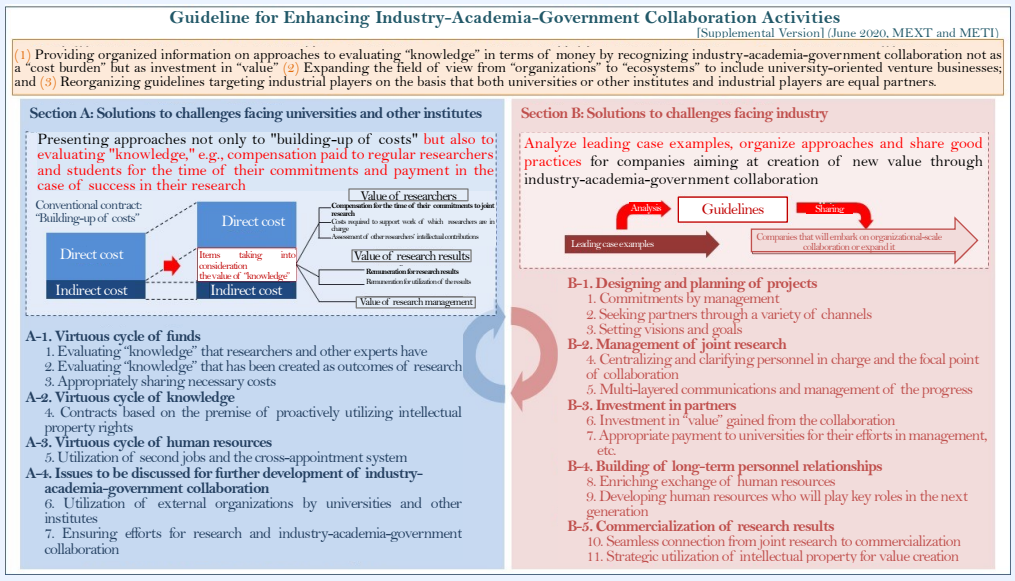
The "Program for Creating a Leading Model Center for Industry-Academia Fusion (J-NEXUS[1])," a project to create centers for industry-academia fusion, currently supports three centers in Hokkaido, Kansai and Hokuriku regions to create a multi-stakeholder network including multiple universities, public research institutions, industrial support organizations, businesses, economic organizations, financial organizations, venture capital and other investment organizations, and local authorities, thereby accelerating the initiatives for R&D and business creation through the fusion of industry and academia generated through this network. In addition, under the "Regional Open Innovation Center Selection System (J-Innovation Hub)," a project to create centers for industry-academia fusion, 17 centers have been selected from universities, etc.

1 NEXt University-Society open innovation initiative

nationwide as centers for industry-academia collaboration and fusion where future growth is expected from the perspectives of international development and regional contribution.

In industry-academia collaboration, there is an increasing need to utilize the "knowledge" of universities, etc., more widely and deeply. To contribute to the creation of new value through the creation of innovation, it is important for universities and companies to recognize each other as equal partners and to deepen collaboration between "organizations" rather than collaboration between individual researchers. To this end, the government formulated the "Guideline for Enhancing Industry-Academia-Government Collaboration Activities" in November 2016, an initiative to transform the current state and challenges in industry-academia collaboration into an ideal state. A [Supplemental version] was compiled on June 30, 2020, explicitly stating the value placed on "knowledge" and solutions for the industrial sector. A database was created to promote further utilization and understanding of the contents of the Guidelines and the Supplemental version in March 2022 as a "Guideline Search Tool" to supplement the Guideline with specific examples of initiatives and to improve accessibility to the contents for those in charge of practical affairs at universities and companies, etc. At the same time, highly effective specific methods and interpretations were organized as "FAQs [1] for Understanding the Guideline." It is expected that all universities will utilize the FAQs as tools to reform their industry-academia collaboration strategies, which will further accelerate full-scale industry-academia-government collaboration.

■ Figure 1-4-8/ [Supplemental version] Overall summary



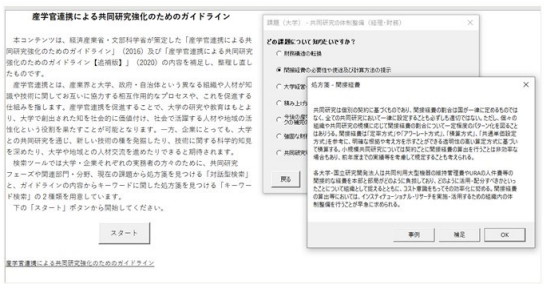
Source: MEXT and METI "Guideline for Enhancing Industry-Academia-Government Collaboration Activities [Supplemental Version] (Summary)" (Published on June 30, 2020)

1 Frequently Asked Questions

■ Figure 1-4-9/ Guideline search tool and FAQ

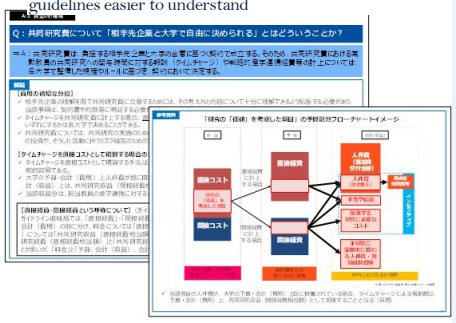
[Guideline Search Tool]

- Reorganizes the contents of the guidelines to meet the needs of practitioners, creates a database corresponding to the issues and solutions listed in the guidelines, and includes additional in-depth information collected through interviews with practitioners of industry-academia collaboration at universities and companies
- Tool that enables search by joint research phase classification by different sectors, related divisions or fields and keywords



[FAQs] for understanding the guidelines

- A question-and-answer format for METI and MEXT interpretations of the challenges faced by the practitioners in understanding the guideline solutions and their descriptions
- Use of plenty of previous examples from universities or companies and specific conceptual diagrams etc. to make the guidelines easier to understand



Document: Prepared by METI and MEXT

COLUMN 1-6

Toward a Society where Everyone can Take Challenges - The Potential of Science, Technology and Innovation -Daredemo Piano (Auto-Accompanied) -

Anyone can try anything they wish to. Science, technology and innovation may be one step toward realizing such a society.

"Daredemo Piano®" (Auto-Accompanied), developed by the COI site, Tokyo University of the Arts, as a joint industry-government-university project by MEXT and the Japan Science and Technology Agency (JST), is one such example. The development began when the team saw a high school student with a physical disability playing a grand piano. They developed an instrument that allows everyone, regardless of disability, to feel the joy of musical expression.

The showcased programs include a program where a visually impaired performer and a performer with no visual impairment play music together in a totally dark space, and the workshop "Sound and Light Zoo," in which live music is played against the background of animation of paper crafts created by children.

Creating Innovation for "Synesensory" through Inspirational Art and Science & Technology
URL:
https://innovation.geidai.ac.jp/en/index.html
Source: COI, Tokyo University of the Arts

COI library, Tokyo University of the Arts
URL: https://innovation.geidai.ac.jp/library
Source: COI, Tokyo University of the Arts

ARTs love ALL project
URL: https://artsloveall.geidai.ac.jp/
Source: Tokyo University of the Arts, Social Co-operation Division, Social Co-operation Section

In "Daredemo Piano," the accompaniment and damper pedals follow automatically to match the timing and tempo of the melody played with one finger. Although it took a lot of hard work to arrange the music and create accompaniment data for each player, the completed "Daredemo Piano" produces brilliant performances, just like a skilled pianist. A piano developed for one high school student with a disability has now become a "Daredemo Piano" that everyone can enjoy, from beginners and children to the elderly.

Anyone can try anything they wish to without any restrictions on time and place. The piano will continue to evolve as an instrument that helps everyone achieve self-fulfillment.

This video shows a physically challenged person giving a brilliant performance like a pianist with the help of "Daredemo Piano" at Yokohama City Hall.

Kodomo Hasshin! Project
~ I want to play "Daredemo Piano" at Yokohama City Hall!
URL: https://www.youtube.com/watch?v=0-nWTQBVG2w

"Daredemo Piano"
Photo by: Taira Tairadate

(3) Specific initiatives

❶ World's Best AI Face Recognition Technology Supporting the Olympic and Paralympic Games

At the Tokyo 2020 Olympic and Paralympic Games held from July to September 2021, NEC Corporation's cutting-edge AI-enabled face recognition technology supported the safe operation of the Games by identifying with remarkable accuracy the more than 15,000 participating athletes, as well as the media and staff who gathered from around the world.

In benchmark testing conducted by the U.S. National Institute of Standards and Technology (NIST), recognized as a worldwide authority, NEC earned the top ranking in the world in recognition accuracy five times. This technology was introduced for the first time in the history of the Olympic and Paralympic Games, with approximately 300 systems deployed at venues, and was used a total of 4 million times, making a significant contribution to ensuring the security of the Games.

Face recognition system in use
Provided by: NEC Corporation

This technology combines face detection technology that searches for the position of faces in camera-captured images at high speed and high accuracy, facial feature detection technology that analyzes facial features, and high-accuracy face matching technology that eliminates false matches, and can instantly and accurately identify people in disguise or even twins, with improved accuracy through deep learning.

Unlike fingerprint identification, etc., this system is non-contact, making it extremely useful from the perspective of countermeasures against the novel coronavirus infection. The system was introduced at the two international airports serving Tokyo, Haneda and Narita, in July 2021 and has become indispensable as a system helping travelers proceed efficiently from check-in to boarding. The system has become a legacy of the Tokyo 2020 Games.

❷ Investment in a New Venture Company from the National Research Institute for Earth Science and Disaster Resilience

It is important to create innovation by utilizing R&D results produced by R&D agencies. This can be effectively achieved by encouraging the creation of ventures which use the results of R&D agencies for practical applications. To this end, R&D agencies, as defined by law, are allowed to invest in ventures.

The National Research Institute for Earth Science and Disaster Resilience (hereinafter referred to as "NIED") conducts fundamental basic R&D to realize a safe and secure society by protecting people's lives and property from natural disasters caused by earthquakes, volcanoes, storm and flood damage, landslide disaster, and snow and ice damages. To protect our lives and property from natural disasters, it is necessary to realize a safe and secure society by rigorously disseminating the results of R&D into society. In particular, to further improve the disaster resilience of the entire society, it is important not only for the government to play its role but also for private companies and individual citizens to become actively engaged in disaster prevention on their own. Keeping this in mind and taking advantage of the newly approved

Face recognition used in various scenarios
URL: https://www.nec.com/en/global/solutions/biometrics/face/index.html

investment system, NIED [1] established "I-Resilience Co., Ltd." (hereinafter referred to as "I-Resilience") through joint investment with Tokio Marine Holdings, Inc., Hakuhodo Inc., ESRI Japan Corporation, and Science Craft, in November 2021.

NIED conducts R&D aimed at creating information products (hereinafter referred to as "information products") that are processed information including observation data to meet needs of users such as the government, private companies, and individual citizens, and encourage them to take necessary and appropriate actions, such as evacuation, to protect their lives and property from natural disasters. By utilizing these R&D products created by NIED. I-Resilience will provide new disaster prevention and mitigation services according to the needs of society. To be specific, I-Resilience will develop its business in three areas: (1) Providing DX solutions that utilize big data for disaster prevention, (2) Providing educational solutions that change awareness and behavior of people, and (3) Providing innovations that reform their lifestyles. It is expected that the realization of a more resilient, safe and secure society against natural disasters will be accelerated through R&D conducted by NIED and the business development of I-Resilience.

I-Resilience

Projects related to information products providing disaster prevention and mitigation solutions and improving disaster prevention capabilities, and awareness-raising projects such as education and training of disaster prevention are implemented utilizing the research and development results of NIED

1 Previously, NIED was not allowed to invest in or provide personnel or technical assistance to businesses (company-launched ventures) that utilized the results of research and development, which became possible by the "Act on the Revitalization of Science, Technology and Innovation Creation (Law No. 63, 2008)" enforced in April 2021.

Section 2 Initiatives to overcome novel coronavirus infections

1 Response to COVID-19

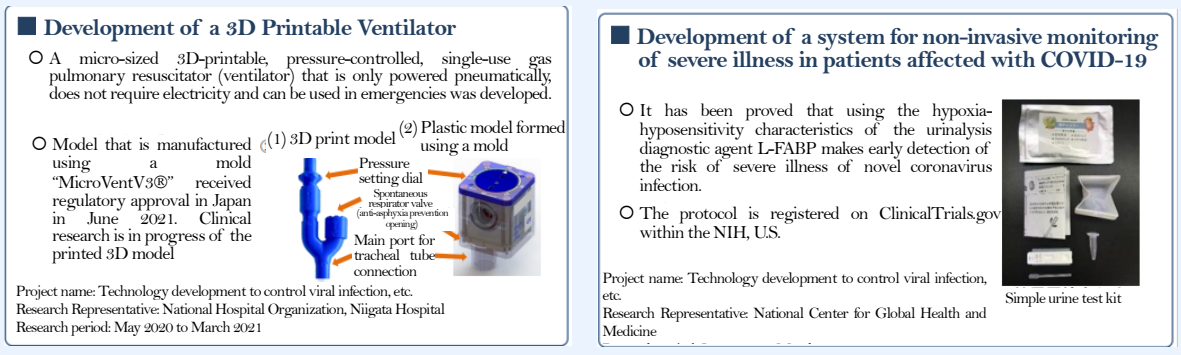
Recognizing that countermeasures against the novel coronavirus infection are a critical crisis management issue, the government established the Government Headquarters on March 26, 2020, based on Article 15, paragraph 1 of the "Act on Special Measures for Pandemic Influenza and New Infectious Diseases Preparedness and Response" (Act No. 31, 2012), and since then, has been steadily implementing various countermeasures against the novel coronavirus infection to protect the lives of people, based on the "Basic Policies for Novel Coronavirus Disease Control by the Government of Japan" decided by the Headquarters on March 28, 2020, and November 19, 2021 (amended on March 17, 2022). Support is provided mainly to research and development, such as the development of therapies, vaccines and medical devices for the novel coronavirus infection.

For medical development, research and development are underway on newly manufactured medicines that can potentially achieve administration methods that are less burdensome to medical facilities and patients and show strong antiviral activity against all epidemic strains.

Numerous studies on vaccines against the novel coronavirus infection are being conducted actively within and outside Japan, and the development is underway faster than usual. In Japan, vaccines from Pfizer Inc., Takeda Pharmaceutical Company Limited/Moderna Inc., AstraZeneca, and Takeda Pharmaceutical Company Limited (Novavax, Inc.) have been approved by the Japanese pharmaceutical affairs authorities (as of May 10, 2022). In addition, the government is providing support for the development of the following 4 vaccines - Recombinant protein vaccine from Shionogi & Co., Ltd., UMN Pharma Inc., and the National Institute of Infectious Diseases, mRNA[1] vaccine from Daiichi Sankyo Co. Ltd. and the University of Tokyo Institute of Medical Science, inactivated vaccine from KM Biologics, the University of Tokyo Institute of Medical Science, the National Institute of Infectious Diseases, the National Institutes of Biomedical Innovation, Health and Nutrition, and Meiji Seika Pharma Co., Ltd., and mRNA vaccine from VLP Therapeutics. These 4 vaccines are currently undergoing clinical trials.

In addition, support was also provided for the development of new instruments and diagnostic methods, such as the development of an ultra-small ventilator for the novel coronavirus pneumonia that does not require electricity and a simple urine testing system for early detection of the risk of severe disease in patients suffering from the novel coronavirus.

■ Figure 1-4-10/Development of new instruments and diagnostic methods for novel coronavirus infection



Source: Japan Agency for Medical Research and Development Website

1 messenger ribonucleic acid

■ Figure 1-4-11/ Progress in the development of novel Corona vaccine (domestic development) <Major Items> (as of May 10, 2022)

Progress in development of novel Corona vaccine (domestic development) <Major Items>

Development company (*1)	Basic information	Status of initiatives	Objective (*2)	Establishment of production system, etc.	Research expenses
(1) Shionogi & Co., Ltd. National Institute of Infectious Diseases/UMN Pharma * Recombinant protein vaccine	Virus proteins (antigen) are created using technology for genetic modification and administered to people	Phase I & II trials started (December 2020) Formulation of adjuvant was changed and Phase I & II trials started in (August 2021) Phase II & III trials started (October 2021) Phase III trial ((1) Verification of effectiveness in preventing the onset of disease: December 2021, (2) Comparison of antibody titers: January 2022) Trials for booster started (December 2021)	- (At present, Phase III trial is in progress)	42.29 billion yen subsidy for emergency development projects such as production systems	・AMED (2019) 100 million yen National Institute of Infectious Diseases ・AMED (2022 primary public offering) 1,309 million yen Shionogi & Co., Ltd. ・AMED (2022 secondary public offering)
(2) Daiichi Sankyo Institute of Medical Science, The University of Tokyo *mRNA vaccine	Administering virus mRNA to humans Virus proteins (antigens) are synthesized in the human body	Phase I & II trials started (March 2021) Phase II trials started (November 2021) Trials for booster started (January 2022)	Phase III trial was planned for the first half of 2022.	29.57 billion yen subsidy for emergency development projects such as production systems	・AMED (2019) 150 million yen Institute of Medical Science, the University of Tokyo ・AMED (2022 secondary public offering)
(3) AnGes Osaka University/Takara Bio Inc. *DNA vaccine	Administering virus DNA to humans In the human body, virus proteins (antigens) are synthesized from DNA via mRNA	Phase I & II trials were started in June and September 2020, followed by Phase II & III trials in December 2020, but the expected results were not obtained. Clinical trials with high-dose formulations (Phase I & II trials) started (August 2021)	Focus on the development of high-dose formulations.	Takara Bio Inc., AGC and Kaneka, etc., have planned for production 9.38 billion yen subsidy for emergency development projects such as production systems	・MHLW Grants System (2019) 10 million yen Osaka University ・AMED (2022 primary public offering) 2,000 million yen AnGes ・AMED (2022 secondary public offering)
(4) KM Biologics Institute of Medical Science, The University of Tokyo/National Institute of Infectious Diseases/National Institutes of Biomedical Innovation, Health and Nutrition/Meiji Seika Pharma * Inactivated vaccine	Inactivated virus is administered to the humans (Conventional vaccines)	Phase I & II trials started (March 2021) Phase II & III trials started (October 2021) Phase III trials started (April 2022) Phase II & III trials for pediatric use started (April 2022)	- (At present, Phase III trial is in progress)	22.8 billion yen subsidy for emergency development projects such as production systems	・AMED (2022 primary public offering) 1,061 million yen KM Biologics ・AMED (2022 secondary public offering)
(5) VLP therapeutics *mRNA vaccine	Administering virus mRNA to humans Virus proteins (antigens) are synthesized in the human body	Phase I trial started (October 2021) Phase II trial for booster is planned to be done within 2022.	The company intends to start Phase II trials for booster by the end of FY 2022.	17.37 billion yen subsidy for emergency development projects such as production systems	・AMED (2022 secondary public offering)

*1 Companies selected for the emergency development projects such as production systems *2 Objectives as told by developers

Source: Website of MHLW

■ Figure 1-4-12/ Main medicines currently in development for novel coronavirus (as of April 1, 2022)

Main medicines currently in development for novel coronavirus (As of April 1, 2022)

Component name (Brand name)	Development company	Classification	Development target	Remarks
Favipiravir (Avigan tablets)	FUJIFILM Toyama Chemical Co., Ltd.	Antivirus drug (RNA polymerase inhibitors)	Mild to moderate I (Phase III)	Approved in Japan for novel or reemerging influenza strains. An application was submitted for approval on October 16, 2020 based on the results of domestic phase III trials in patients with non-serious pneumonia, but the Pharmaceutical and Food Safety Bureau continued deliberations on December 21, 2020. In overseas phase III trials in patients with mild and moderate disease, it was reported that no statistically significant difference was shown. Domestic phase III trials that were ongoing in patients with early onset of disease and who had risk factors for severe disease was completed at the end of March 2022.
S-217622	Shionogi & Co., Ltd.	Antivirus drug (Protease inhibition)	Asymptomatic Mild to moderate I (Phase II/III)	At present, an oral formulation is undergoing global phase II/III trials in asymptomatic patients and patients with mild to moderate disease. An application for conditional approval was submitted on February 25, 2022.
Ivermectin	Kowa Company, Ltd.	Antivirus drug	Mild to moderate I (Phase III)	An oral agent approved in Japan as a parasitic drug. Honorary Professor Emeritus of Kitasato University, Satoshi Omura, received the Nobel Prize in Physiology or Medicine for the discovery of this drug in the year 2015. Kitasato University Hospital conducted investigator-initiated clinical trials on patients with mild and moderate disease and announced the end of recruitment on October 30, 2021. Kowa is currently conducting domestic phase III trials in patients with mild disease.
AZD7442	AstraZeneca	Neutralizing antibody drug	Prevention, Mild to moderate I (Phase III)	Intramuscular formulation consisting of long-acting antibodies of 2 components. A statistically significant difference was reported in overseas phase III trials (pre-exposure prophylaxis) and global phase III trials including Japan (treatment). EUA (Emergency Use Authorization) by the U.S. on December 8, 2021 for pre-exposure prophylaxis.

Source: Website of MHLW

2 Medical Device Developed in Japan Continues to Save Lives of the COVID-19 Patients Worldwide

Amidst the spread of the novel coronavirus infection, there has been a growing demand worldwide for a medical device called "pulse oximeter" to evaluate severe diseases promptly. Did you know that a Japanese researcher invented the principles of the pulse oximeter?

A pulse oximeter is a device that measures the oxygen saturation level in the blood by placing a "probe" shaped like a clothespin onto the fingertip. Lack of oxygen in patients suffering from pneumonia and bronchial asthma due to the novel coronavirus, newborns, and patients under anesthesia, can cause fatal symptoms; however, constant monitoring by measuring the oxygen level through blood sampling is complex. A pulse oximeter can continuously measure whether the patient is getting the oxygen they need without harming the patient's body.

Pulse oximeter

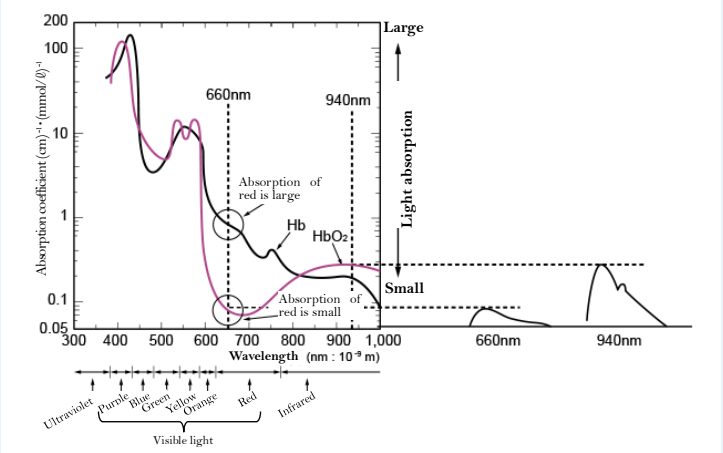
Provided by: Nihon Kohden Corporation

For hemoglobin in the RBCs that transport oxygen in the blood, the "degree of absorption of red light" differs for oxygenated hemoglobin that binds to the oxygen, and for deoxygenated hemoglobin that does not bind to the oxygen, the blood rich in oxygen is bright red. In 1972, Dr. Takuo Aoyagi, a researcher at Nihon Kohden Corporation, discovered that oxygen saturation level in the arterial blood could be measured by exposing the patient's skin to two types of lights with different wavelengths and comparing the degree of absorption of red light with the pulse rate. A product using this principle was launched in 1975. This technology has become widespread in medical facilities worldwide and is saving many patients' lives.

In 2015, the pioneering invention of the pulse oximeter was recognized for its significant contribution to improving the quality of medical care. Dr. Takuo Aoyagi became the first Japanese person to receive the "IEEE [1] Medal for Innovations in Healthcare Technology," an award for innovations in healthcare technology given by the Institute of Electrical and Electronics Engineers (IEEE). Dr. Takuo Aoyagi passed away in April 2020, and the news of his death was widely reported around the world, including in the Washington Post, but the pulse oximeter, a brilliant invention in the history of medical care in the world, will continue to save countless lives in the future.

1 Institute of Electrical and Electronics Engineers

■ Figure 1-4-13/ Light absorption spectrum of hemoglobin (Hb)



Light absorption spectrum of hemoglobin (Hb)
Provided by: Nihon Kohden Corporation

Dr. Takuo Aoyagi
Provided by: Nihon Kohden Corporation

The life of Dr. Takuo Aoyagi who invented the principles of pulse oximeter and the history of pulse oximeter from the discovery of the principles to its development and popularization have been introduced in detail with photographs of the time.

Dr. Takuo Aoyagi and the pulse oximeter
URL: https://www.nihonkohden.com/topics/aoyagi.html
Source: Nihon Kohden Corporation

3 Development of Technology to Overcome COVID-19

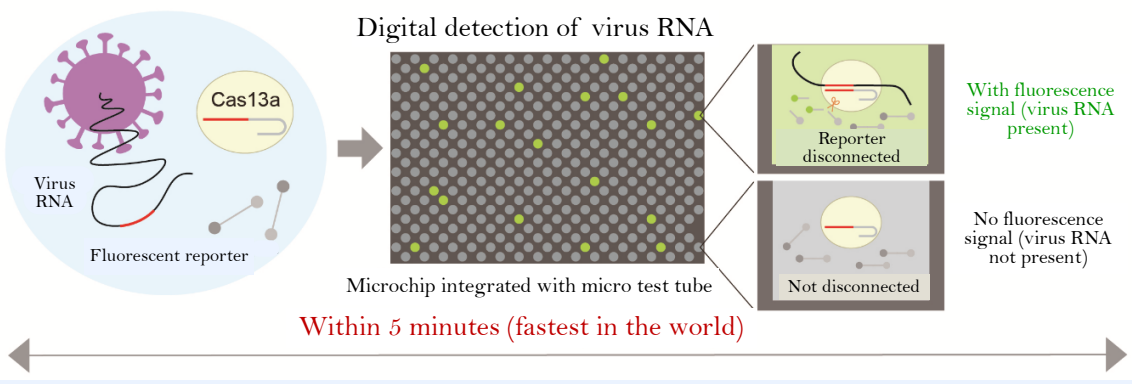
(1) Ultra-sensitive and world's fastest detection technology for novel coronaviruses

Currently, an antigen test and PCR test[1] are the main diagnostic platform for novel coronavirus infection (COVID-19).

The antigen test can detect viruses rapidly and easily within 5 to 30 minutes, but the disadvantage is its lower detection sensitivity compared to the PCR test. On the other hand, the PCR test has excellent sensitivity, but the disadvantage is its longer testing time (1-5 hours). Therefore, there is a need to develop a new diagnostic platform for COVID-19 that combines the speed of the antigen test with the high sensitivity of the PCR test.

A joint research group comprising of RIKEN Cluster for Pioneering Research; the Research Center for Advanced Science and Technology, the University of Tokyo; the Graduate School of Science and Faculty of Science, the University of Tokyo; and the Institute for Frontier Life and Medical Sciences, Kyoto University, has developed an innovative, ultra-sensitive, and world's fastest detection technology for SARS-CoV-2 that enables the detection of viral RNA at the single molecule level, within 5 minutes, the fastest in the world. Combination of femto-liter chamber array and CRISPR-Cas13a (Cas13a) enables highly sensitive, accurate, and rapid digital detection of target viral RNA in specimens. This method is expected to become a next-generation diagnostic platform for infectious diseases that can rapidly and accurately diagnose various types of viral infections.

■ Figure 1-4-14/ Digital detection technology for viral RNA



Source: RIKEN

(2) COVID-19 vaccine from flavor enhancers/umami seasonings?

Umami is one of the five basic tastes brought about by glutamic acid, inosinic acid, guanylic acid, etc., contained in food. Dr. Kikunae Ikeda first discovered umami ingredients, and since then, flavor enhancers that use these ingredients in cooking have enriched cuisines worldwide. Did you know that the COVID-19 vaccine is made from pseudouridine, produced from studies on such flavor enhancers?

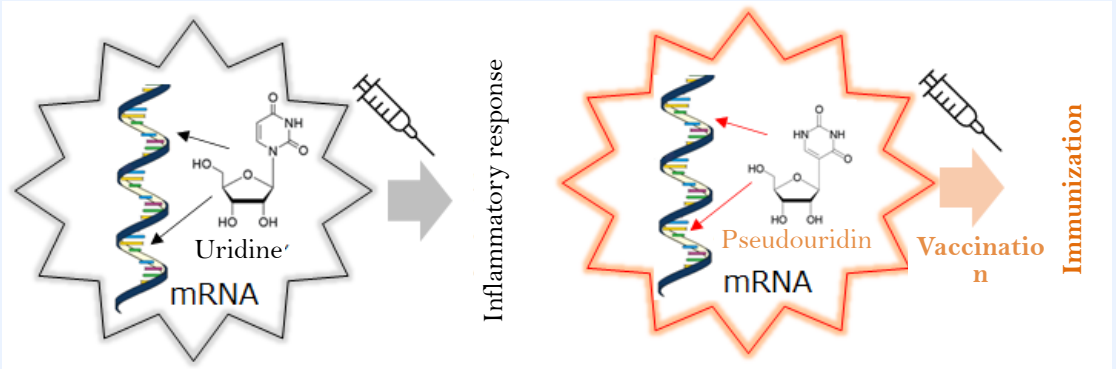
Vaccination is progressing worldwide intending to prevent the severity of novel coronavirus infection and the spread of infection. The vaccine

1 Polymerase Chain Reaction

for novel coronavirus infection currently offered in Japan is the mRNA vaccine created using a new method that differs from the method used for other vaccines, such as the influenza vaccine. mRNA is a copy of the information found in the genetic material called DNA[1], and this information is used to make proteins, the building blocks of life. By injecting the mRNA of the novel coronavirus into the body, part of the protein of the virus will be produced in the body, and the body can create antibodies to fight it, thus creating immunity against the virus. However, mRNA cannot be used as a vaccine because it breaks down quickly inside the human body.

Therefore, mRNA, in which uridine, a component of normal mRNA, is replaced with pseudouridine, is used for the vaccine. Since pseudouridine is very similar to uridine, mRNA replaced with pseudouridine synthesizes the same proteins as normal mRNA. However, since mRNA incorporated with pseudouridine is less likely to break down, the COVID-19 vaccine allows the synthesis of enough viral proteins to trigger an immune response in the body.

■ Figure 1-4-15/ Mechanism of mRNA vaccine



Source: Processed and prepared by MEXT based on documents provided by Yamasa Corporation

Pseudouridine- A raw material for mRNA synthesis
URL: https://www.yamasa-biochem.com/business/20211012.html

1 deoxyribonucleic acid

Umami ingredients such as inosinic and guanylic acids are substances classified as nucleic acids, the same as mRNA components. Yamasa Corporation has researched flavor enhancers and has produced a variety of nucleic acid substances, one of which is pseudouridine, now an indispensable raw material for the COVID-19 vaccine. While flavor enhancers and COVID-19 vaccines may seem to have nothing in common at first glance, research that was begun to enrich our tastebuds has also helped protect lives.

Section 3 Economic Security

As science, technology and innovation become central to the intensified competition between nations, state-of-the-art critical technologies (AI, quantum, etc.) that could also impact national security have emerged. Major countries are intensely promoting the identification of key technologies, information gathering, countermeasures against the issue of technology leaks, and R&D of critical technologies as security measures for their nation and citizens. Competition between nations is intensifying in areas that cut across security and economics, and Japan's STI policies must also consider economic security. For Japan to enhance its technological superiority and ensure its indispensability in the international community, it is essential that the government aggressively promote and foster R&D of critical technologies. To realize the safety and security of the nation and its citizens, it is necessary to strengthen scientific and technological capabilities as the basis for comprehensive security while considering the diverse nature of science and technology. To this end, the government is promoting the following initiatives.

1 New Think-Tank Functions for Safety and Security

To enhance initiatives toward monitoring, observing, forecasting and analyzing trends in threats to citizen's lives and the socio-economy, understanding domestic and international R&D trends, and analyzing issues based on knowledge of the humanities and social sciences, a new think-tank function system for safety and security will be established to make proposals that contribute to policies regarding critical technologies that must be developed on a priority. A trial project for think-tank functions has been underway since FY2021, intending to launch a full-fledged think-tank function in FY2023.

2 Key and Advanced Technology R&D through Cross Community Collaboration Program (K Program)

From the perspective of ensuring and maintaining economic security, the government is considering a program for developing state-of-the-art critical technologies (such as artificial intelligence and quantum) for economic security that will provide strong support for a wide range of civil and public applications of state-of-the-art critical technologies, which will be essential elements for Japan to maintain a firm position in the international community over the medium- to long-term, while also utilizing the think-tank functions described above.

Specifically, R&D projects that realize the country's needs (R&D Vision) will be implemented. Emphasis will be placed not only on the use of research results for civil but also on linking them to public applications by relevant government ministries and agencies that are expected to utilize the results, as well as on social implementation and market inducement of research results under the leadership of the national government.

3 Act on the Promotion of Ensuring Security through Integrated Implementation of Economic Measures (Economic Security Promotion Bill)

In May 2022, the government of Japan enacted a law for the formulation of basic policies to comprehensively and effectively promote economic measures for ensuring security and establish necessary systems as economic measures for ensuring security (ensuring the stable supply of critical commodities, ensuring the stable provision

of key infrastructure services, supporting the development of state-of-the-art critical technologies, and keeping patent applications private).

The system for supporting the development of state-of-the-art critical technologies includes measures such as financial support, the establishment of a council to support public-private partnerships, and outsourcing of research study work (1 think-tank functions) to promote R&D of state-of-the-art critical technologies and appropriate utilization of their results.

By utilizing the framework of this council in the 2 Key and Advanced Technology R&D through Cross Community Collaboration Program (K Program), etc., a new framework for public-private partnership support with appropriate information management will be established, including the sharing of sensitive information held by the government that is useful for R&D, enabling more effective R&D, which has been difficult up to now.

Section 4 Status of Science, Technology and Innovation Policies Utilizing Convergence Knowledge(So-Go-Chi)

- Reasons for the Need for "Convergence Knowledge(So-Go-Chi)" and Utilization of Convergence Knowledge(So-Go-Chi) to Solve Social Issues -

Although the rapid advances in science and technology in recent years have brought many benefits to our lives, they have also significantly impacted the state of human beings and society. The advancement of science and technology has become inseparable from the state of human beings and society, and there is a growing awareness that developed technologies and research results should share a closer relationship with humans. Furthermore, to examine the status of science, technology and innovation policies, including the solving of increasingly complex social challenges, it is necessary to comprehensively utilize "knowledge" from the natural sciences as well as the humanities and social sciences and to consider a desirable future for human beings and society and the various forms of the well-being of each person.

1 Why Is It Now Necessary to Examine the Convergence Knowledge(So-Go-Chi)?

(1) Position of the Convergence Knowledge

The Basic Act on Science, Technology and Innovation, which went into effect in April 2021, now also covers the humanities and social sciences (the study of the state of human beings and society, such as philosophy, sociology, and law), which were not previously covered by the law, and policies for addressing social challenges by comprehensively utilizing the Convergence Knowledge were presented. This refers to the necessity and direction of science, technology and innovation policies to contribute to a comprehensive understanding of human beings and society and to address challenges through the "Convergence Knowledge," the fusion of knowledge in the humanities, social sciences and natural sciences.

Hence, the 6th Science, Technology and Innovation Basic Plan ("the 6th Basic Plan") stipulates that the basic concept of Convergence Knowledge and strategic promotion measures must be compiled by the end of FY2021. An Interim Summary of the same was released in March 2022.

(2) Social context in which Convergence Knowledge is required

Japan faces several social challenges, such as addressing issues on a global scale like climate change, building a resilient, safe and secure society, declining birth rate and graying population, urban overpopulation and rural depopulation, and resource problems. Society and citizens have high expectations for science, technology, and innovation policies.

Major social reforms are underway in other countries, not only as emergency response measures to COVID-19 but also in the creation of future industries such as so-called "green recovery" and large-scale investment in R&D from the perspective of security. However, Japan's research capacity and innovation capabilities, especially in implementing advanced technologies in society, are insufficient, and its international competitiveness in science, technology and business is declining. Furthermore, issues related to next-generation human resources, such as low self-esteem among the youth, are also being brought to the forefront.

To address these challenges, Japan's STI policies must have a perspective of policy contribution to solving global challenges and a domestic perspective of what benefits they can bring to every citizen. Therefore, the creation of diverse

knowledge that includes not only the natural sciences but also the humanities and social sciences, redesigning existing society as a whole through Convergence Knowledge, and the development of human resources who will be responsible for these tasks have become a necessity.

(3) International trends

The importance of transdisciplinary cooperation between the natural sciences and the humanities and social sciences to solve increasingly complex social issues is also pointed out overseas. For example, the Organisation for Economic Co-operation and Development (OECD) compiled a report on the initiative "Addressing Societal Challenges Using Transdisciplinary Research" in June 2020. The report suggests that for diverse

stakeholders to achieve a common goal when society is rapidly changing with the development of science and technologies, it is important that researchers of various disciplines and nonacademic stakeholders, including community residents, companies and governments, make transdisciplinary efforts. It also pointed out the need for better integration of the natural sciences and the humanities and social sciences, a more direct relationship between science and society, and the inclusion of nonacademic stakeholders in research processes at all stages.

(4) Utilization of Convergence Knowledge

There is a need to utilize the Convergence Knowledge from various perspectives both in Japan and overseas and engage in research and technological development with an aim to build a "society that is sustainable and resilient, ensures the safety and security of the people, and enables each and every one of them to realize well-being" by addressing various social challenges.

For the progress of science, technology and innovation, it is also necessary to consider Japan's strengths (e.g., the concepts that Japan has nurtured, such as collaboration, sharing and co-creation). Japan must comprehensively utilize all knowledge to enhance its superiority and competitiveness to realize the safety and security of its citizens and the well-being of every person. Through such systematization of knowledge, it will be possible to find a "path to victory" for Japan in research and technological development and innovation based on those results.

(5) Environmental improvements for utilizing Convergence Knowledge

To use the Convergence Knowledge, researchers need to go beyond the "norms" of the organization they are affiliated with and bring together diverse knowledge without being limited by the boundaries of their area of expertise. However, this alone is not enough. An approach that brings knowledge revitalization by creating new value and new ways of seeing and perceiving things by spending sufficient time discussing issues (problems) and organically utilizing various "knowledge." It is said that creating this "Revitalization of Knowledge" (including approaches) is what the Convergence Knowledge is all about. Based on this perspective, Japan must consider environmental improvements where the Convergence Knowledge can be utilized.

To this end, the Council of Experts of the Council for Science, Technology and Innovation (CSTI) discussed the basic idea of the Convergence Knowledge and strategic promotion measures for the development of human resources who will utilize the Convergence Knowledge, utilization and career paths (evaluation) for the developed human resources, and the establishment of "places" that promote exchange, collaboration, fusion and training, and compiled the "Basic Concept and Strategic Promotion Measures for Convergence Knowledge (interim summary)." The

report also notes that "specialized knowledge" should not be neglected, that there should not be a "superficial" Convergence Knowledge from the humanities and sciences, and that measures should be designed for environmental improvements step by step and enable them to respond to current trends. The government aims to promote environmental improvements for the utilization of convergence knowledge so that in 10 years, Japan will become a society in which it is natural for all human resources engaged in science, technology and innovation to utilize Convergence Knowledge.

2 Examples of Initiatives to Solve Social Challenges through Fusion of "Knowledge"

This section introduces three specific examples of the initiatives to realize the well-being of each person by utilizing "Convergence Knowledge " to address social challenges, including support for people with dementia or developmental disorders.

(1) Initiative toward solving social challenges through Cybernetic Avatar technology that produces physical co-creation

Goal 1 of the Cabinet Office's Moonshot R&D Program, "Realization of a society in which human beings can be free from limitations of body, brain, space and time by 2050," involves developing Cybernetic Avatar Technologies that allow people to maximize their abilities and to share the diverse skills and experiences of diverse people. This project will bring together the diverse knowledge of the participating research groups, utilize the support system of the Japan Society for the Promotion of Science for ELSI[1], etc., and consider the social and ethical issues involved in the mutual utilization of physical skills and experiences, with a view of establishing a social infrastructure for the distribution of skills and experiences that fits well with humans and society. The project aims to realize a large-scale remote mutual aid society in which diverse human resources can swiftly solve challenges in times of emergency such as natural disasters and infectious diseases, a remote mutual society where users can engage in various social activities without constraint and a skills distribution society where skills and experience are shared with many other people to expand capabilities. By 2050 the inter-distribution of skills and experiences will allow people to produce physical co-creations and help realize a society in which everyone can freely engage in physical activities and challenges through cybernetic avatars.

(2) Initiative toward active participation in building a future society led by researchers in the fields of humanities and social science

In the "Project for the Co-Creation of Academic Knowledge centered on the Humanities and Social Science," researchers in the human and social science fields play a central role in building an environment in which various stakeholders, that include industry and civil society in addition to researchers in the natural science fields, pool their knowledge and expertise to create research subjects and research teams under the various issues that will be faced by future society ((1) The state of society and human beings with an eye on future demographics, (2) Overcoming divisions in society, and (3) Creating values that will shape a new human society). In FY2021, a discussion was held concerning smart cities currently being constructed worldwide, asking what smart cities are and whether they are the trump card for the realization of sustainable societies. The discussion

1 Ethical, Legal and Social Issues

intersected the perspectives of IT engineers and humanities sociologists regarding Asian views of people and society that do not fall back on Western values.

(3) Initiatives aimed at building social systems through the participation of researchers in the humanities, social sciences and natural sciences, as well as stakeholders

The RISTEX of JST promotes R&D involving researchers and stakeholders from diverse fields in the humanities, social sciences and natural sciences to solve social issues, including the SDGs and ELSI in science and technology. One good example is the RISTEX's contribution to the achievement of the SDGs through the "disaster risk reduction (DRR) that leaves no one behind" project. R&D has been conducted to improve individualized evacuation and sheltering assistance planning (i.e., provision of reasonable accommodation) for people with disabilities and older age. Standard operation procedures were developed in order for social services professionals to make "disaster care plans" and for local government's administrators to conduct the community-based coordination meetings. These works have been the product of the collaborations with disaster sociologists, DRR engineers, information scientists, local governments' disaster risk reduction and social service administrators, private social service providers, local social welfare councils, residents' associations and their community disaster response teams as well as concerned NPOs/NGOs. After the 2019 Typhoon Hagibis, the Cabinet Office initiated the "Sub-Working Group Concerning Evacuation of Older and Other People with Functional Needs Based on Typhoon Hagibis in 2019 (2019)" (June to December 2020). The group examined further measures to promote the effective evacuation measures for older and other vulnerable groups. Based on the good practice case examples provided by the RISTEX project, the Sub-Working Group made recommendations that led the Disaster Countermeasures Basic Act amendment (effective May 20, 2021), making it obligatory for every municipality to strive to create individualized evacuation plans as was outlined by the RISTEX project for those who really need outside help.

COLUMN 1-7

2022 Edition of the annual S&T poster for everyone "One S&T Poster for Every Household - Glass: The Most Universal Modern Material"

Since fiscal 2005, MEXT has published the annual S&T poster for everyone, titled "One S&T Poster for Every Household" in conjunction with Science & Technology Week that takes place in April. This initiative is to increase opportunities for the public to obtain more a accessible, deeper understanding about modern advancements in science and technology . The theme of the 18th edition is "Glass: The Most Universal Modern Material." This poster was produced in conjunction with the year 2022, which the United Nations have adopted as the International Year of Glass. Glass, a material that supports society in every sphere of culture, art, daily life, healthcare, science, and technology, is introduced with examples of its use in a wide range of fields - from its relationship with the history of human evolution and scientific development to its contribution to cutting-edge science and technology.

The annual S&T poster for everyone, titled "Glass: The Most Universal Modern Material," was distributed in March 2022 to elementary, junior, and senior high schools, universities and science museums throughout Japan, with the PDF version of the poster being made available on the MEXT website. To access digital platforms, a dedicated page with more in-depth information about the poster has also been launched.

2022 Edition of "One S&T Poster for Every Household - Glass: The Most Universal Modern Material"
Provided by: MEXT

MEXT Study Material "One S&T Poster for Every Household"
https://www.mext.go.jp/stw/series.html

Further information on the 2022 Edition of "One S&T Poster for Every Household - Glass: The Most Universal Modern Material"
https://glass-poster.iyog2022.jp/