

Moonshot Goal #7

Program Introduction

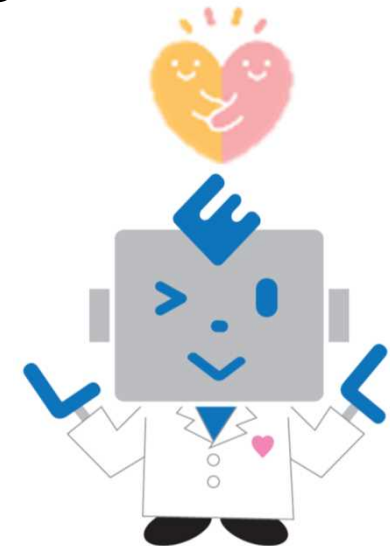
June 26, 2021



Director of Moonshot Program

Toshio Hirano

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1. Introduction of the Program Director (PD)

Goal #7



Dr. Hirano Toshio

President, National Institutes for Quantum and Radiological Science and Technology (QST)

Hydrogen fusion energy, Quantum materials, Laser science. R&D for radiation safety

Aim for no cancer death and a society of health and longevity without senility

immunology and life science; PhD.

Discovered Interleukin 6 and opened new ways to treat autoimmune diseases.

Draws on deep and wide-ranging knowledge and experience, from work promoting cutting edge multidisciplinary research to basic medical research to medical applications; served as head of Osaka University and of QST.

【International Prize】

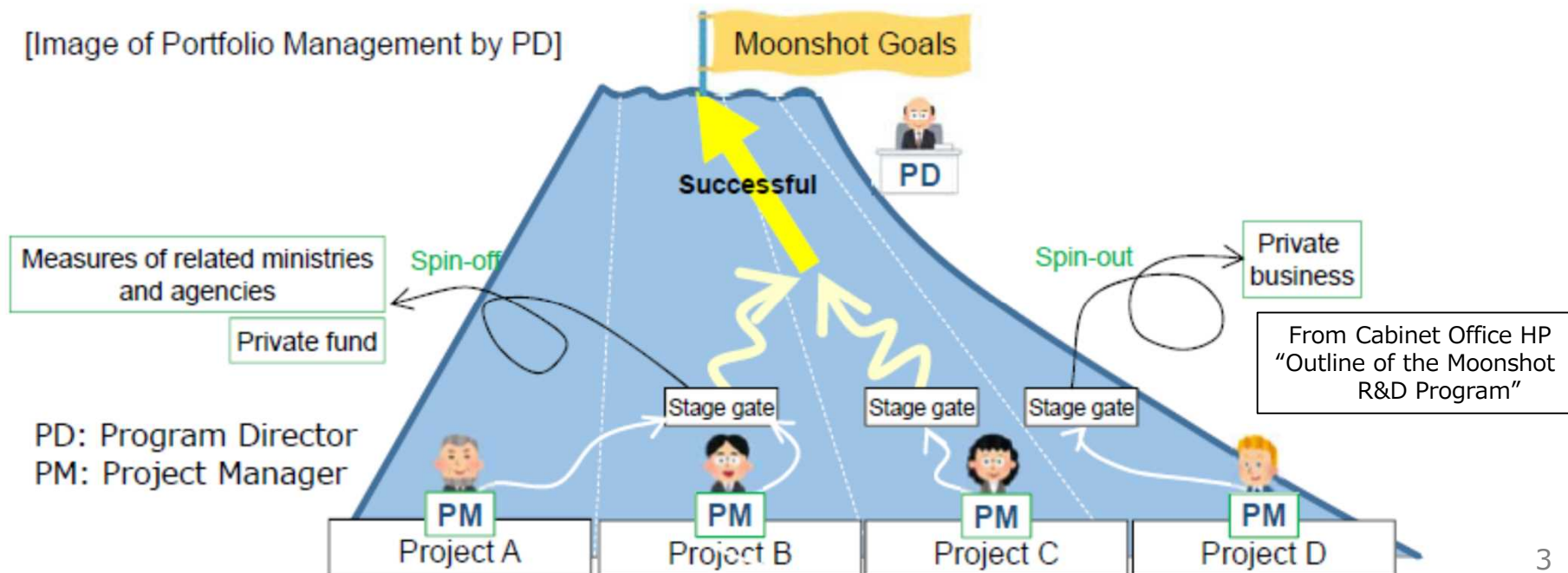
- The Sandoz Prize for Immunology (1992)
- The Crafoord Prize (2009)
- The Japan Prize (2011)

2. The Moonshot Research and Development Program

The Feature of the Moonshot Research and Development Program

- (1) The government sets ambitious goals and concepts for societal issues that are difficult to tackle but will have profound impact once resolved.
- (2) Opens call for domestic and foreign top-class researchers as PM's under the direction of the PD's who oversees multiple projects. *1 Project Manager, *2 Program Director
- (3) Builds a portfolio overlooking the program and promotes challenging R&D without fear of failure.
- (4) Reviews a portfolio flexibly by stage-gates and actively encourages utilization of the R&D results.
- (5) Establishes the most advanced research support system by utilizing a data management infrastructure.
- (6) 100 billion yen was appropriated in the supplementary budget for FY2018, and a fund was created. 15 billion yen was appropriated in the supplementary budget for FY2019.
- (7) Supports the program up to 10 years.

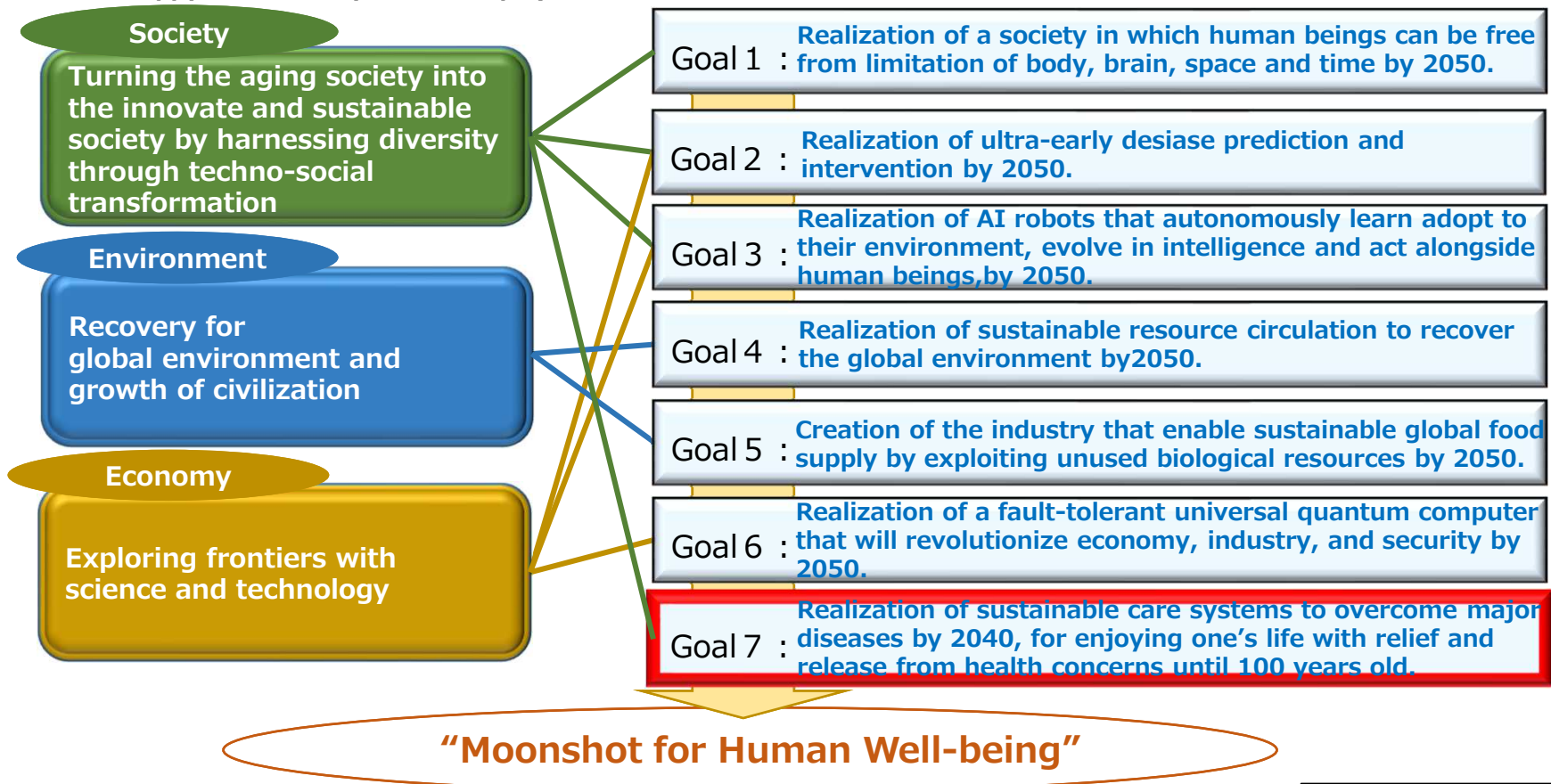
[Image of Portfolio Management by PD]



2. The Moonshot Research and Development Program

3 Fields for Goal Setting

(Fields of "Society, Environment, Economy",
Base for Happy and Wealthy life of People)



From Cabinet Office HP
"Outline of the Moonshot
R&D Program"

※Goals 1 ~ 6 : Other FAs(JST,NEDO,and BRAIN) promote the Moon shot R&D.
Goal7: AMED promotes the Moonshot R&D.

3. Moonshot (MS) Goal # 7

“Realization of sustainable medical and nursing care systems to prevent and overcome major diseases by 2040, for everyone to enjoy life without health concerns until 100 years old.”

【Target of Moonshot Goal】

1. Realization of a society where everyone can prevent diseases spontaneously in daily life.

- Establish infrastructure to maintain good health physically and mentally by developing technologies, in order to keep good health and prevent the onset and aggravation of diseases by control of immune systems or sleep, etc.; to visualize individual physical and mental state in daily life and to urge people to voluntarily take healthy maintenance actions most suitable for them by 2040.
- Develop technologies to monitor all living body trends with lower physical and mental load by 2030.

2. Realization of a medical network accessible for anyone from anywhere in the world

- Establish a medical network to provide the same level of medical care as a normal time regardless of region and even upon disasters and emergencies by developing diagnostic and treatment devices for simple tests and treatments at home, etc. and diagnosis- and treatment-free technologies for part of chronic diseases by 2040. In addition, develop methods for radical treatment and earlier intervention for diseases such as cancer and dementia by substantially reducing the development period of drugs and medical devices, etc. through establishment of data science and evaluation systems by 2040.
- Establish a technology platform to provide quality medical and nursing care suitable for each individual appropriately even with less providers by developing compact, speedy and high-sensitivity diagnostic and treatment devices as well as technologies to further enhance doctors' medical opinion and diagnostic capability by 2030.

3. Realization of drastic improvement of QoL without feeling load (realization of an inclusive society without health disparity)

- Establish a social infrastructure to enable self-reliant life at home without depending on nursing care by developing such technologies as the recovery of body function with rehabilitation without feeling load, normalization of ailing biocontrol systems, regeneration or substitution of weakened organs and so forth by 2040.
- Develop technologies to improve body function through load-reducing rehabilitation and support self-reliant life at home and to improve ailing living biocontrol systems by 2030.

(Reference: Future Visions to be achieved)

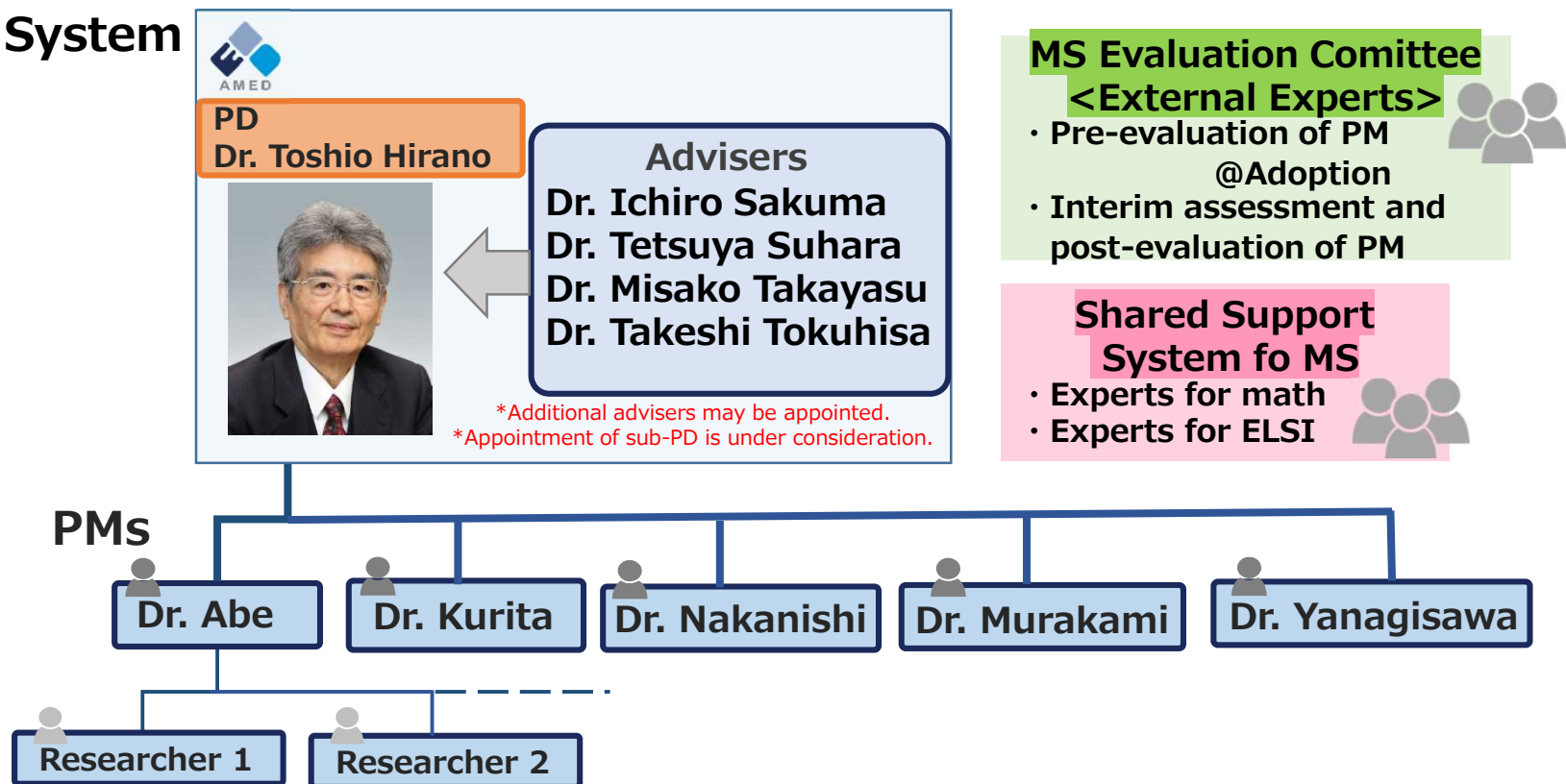
Sustainable care system for enjoying one's life until 100 years old



The Main Role of Moonshot Program Director(PD)

1. Construct strategy of the R&D portfolio, and promote the R&D with systematic and aggressive way.
 2. When we construct the R&D portfolio, we will combine some projects with different ways of study considering innovativeness, originality, and socio-economical effects of the R&D.
 3. Manage the progress of the R&D based on the portfolio.
 Command and control the PMs who supervise their projects, and review the projects with watching their progress.
- From "Guideline for Operational Evaluation, the 3rd item"

【Support System for PMs】



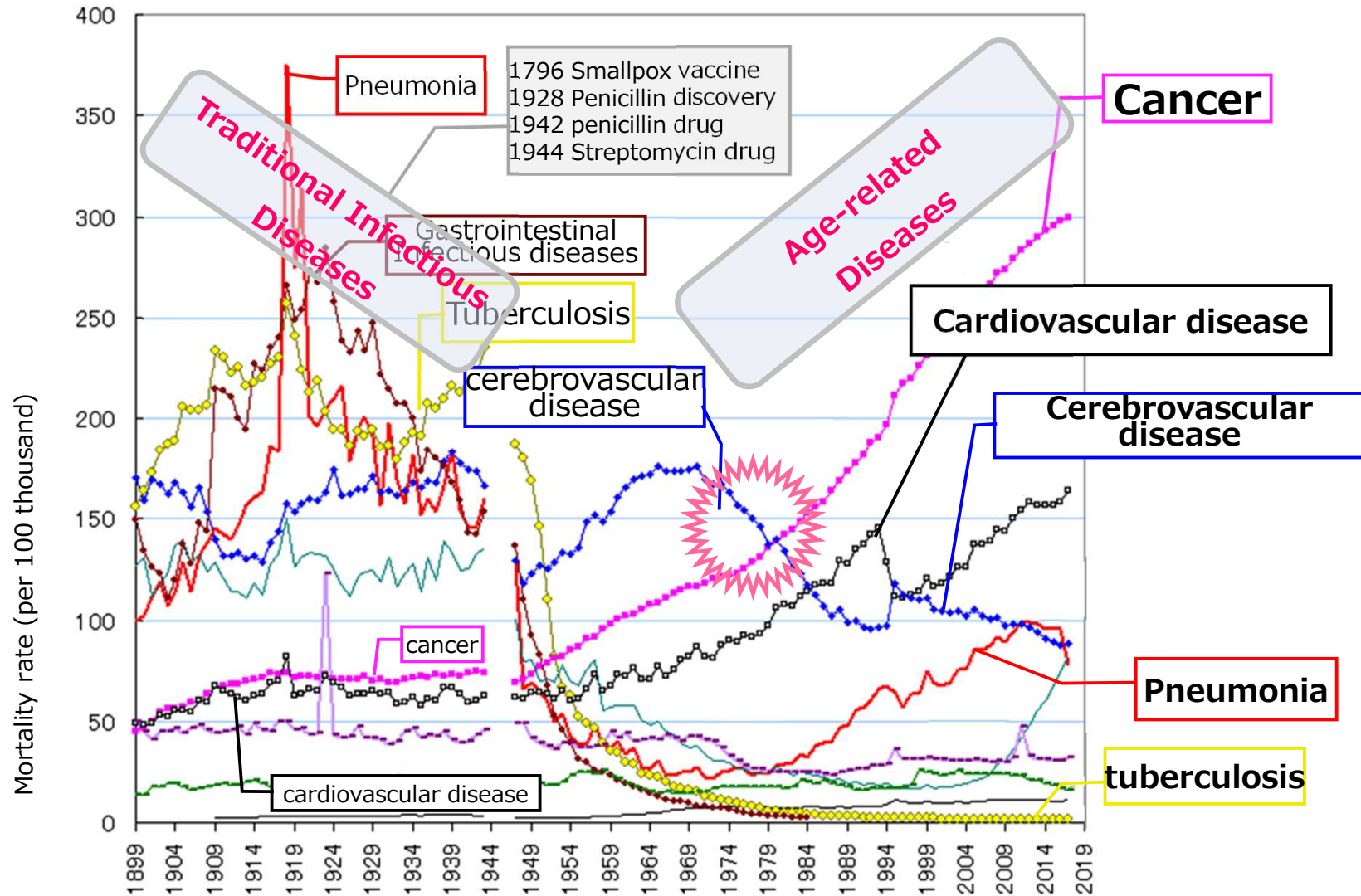
Message from PD

- Your proposal must be based on innovative and groundbreaking concepts, as opposed to efforts targeting **incremental progress**.
- Achieving a society characterized by health and longevity will require medical care that **maintains QoL** and goes well beyond mere treatment of disease.
- The keyword or concept in lifestyle diseases appears to be **chronic inflammation**. Crucial perspectives in achieving a society characterized by health and longevity will include controlling inflammation and controlling immunity and sleeping. We seek innovative perspectives that address the problem of **lifestyle diseases** while maintaining QoL and the problem of controlling the homeostatic mechanisms that cease to function effectively with age.
- Ideally, you are willing to pursue R&D in **partnership with overseas institutions** (universities, government or nonprofit organizations, academic societies, and companies)

from "Strategy Promotion 3rd Meeting (Dec.25, 2020)"

Announced as "Supplementary information from the PD" at calls for proposal

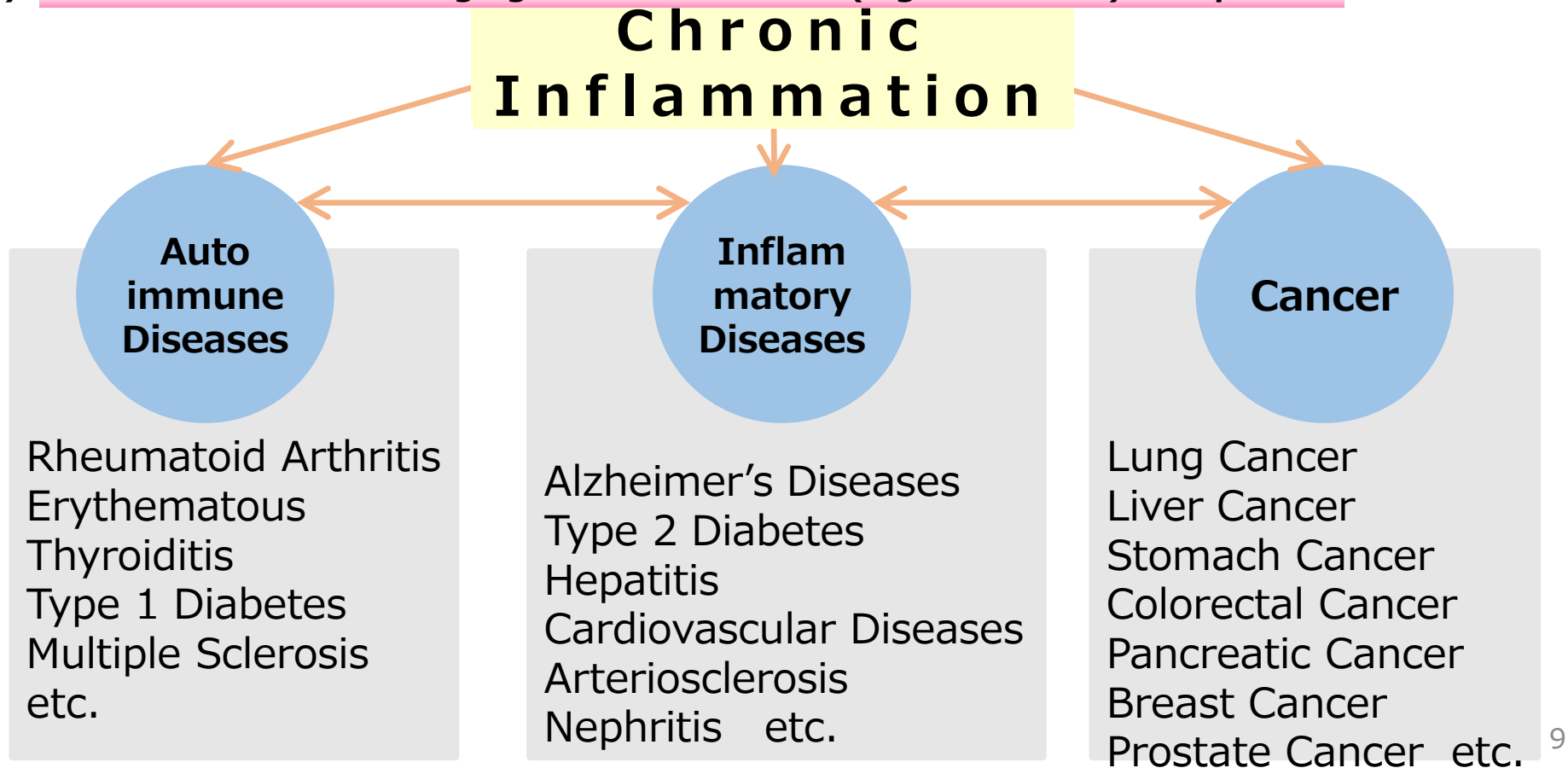
(Background) Change in Cause of Mortality



(Source) Made from MHLW "demographic statistics"

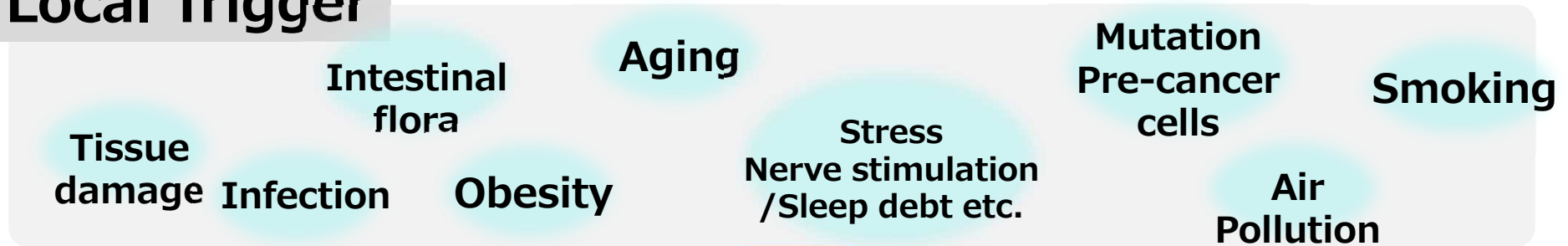
Approach with Chronic Inflammation

- 1) The difference between average life expectancy (ca. 84 years old) and healthy life expectancy (ca. 73 years old) is about 10 years.
⇒ We should make unhealthy period almost zero.
- 2) Unhealthy period will become almost zero. ⇒ Average life expectancy will be almost same as biological life expectancy (about 120 years old).
- 3) Prevention of main diseases with aging is important.
- 4) Countermeasure to emerging infectious disease (e.g. COVID-19) is important.



Approach with Chronic Inflammation

Local Trigger



Chronic Inflammation

Diseases with aging

Cancer, Rheumatoid Arthritis, Cardiovascular Diseases, Diabetes, Dementia etc.

The control of chronic inflammation is important to realize a society with health and longevity.

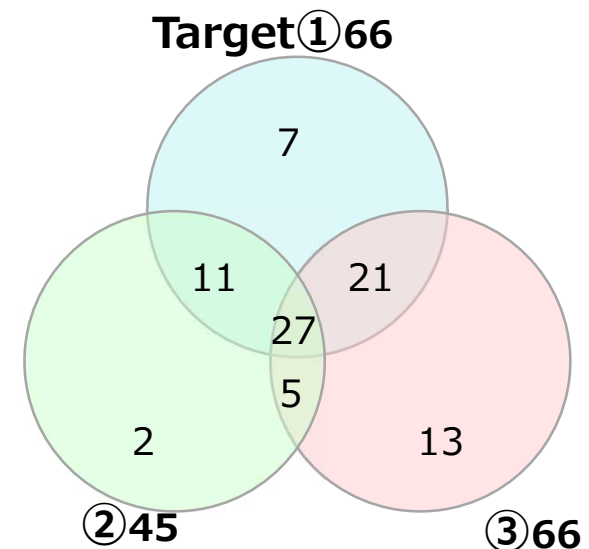
4. Basic Information on Call for Proposal

1) Solicitation Period of Project Manager (P M)
2020.9.1 - 2020.10.27

2) Number of Proposals : **86**

3) Distribution of proposal themes
by target of MS Goal # 7

| Target of MS Goal # 7 | No. of Proposals* |
|---|-------------------|
| ① Realization of a society where everyone can prevent diseases spontaneously in daily life | 66 |
| ② Realization of a medical network accessible for anyone from anywhere in the world | 45 |
| ③ Realization of drastic improvement of QoL without feeling load (realization of an inclusive society without health disparity) | 66 |



*Overlap between targets exists

4. Basic Information on Call for Proposal

**4) No. of participants in the proposals : 1,158 persons
(PM & Contributing participants)**

5) Status of proposals from overseas research institutions

No. of Contributing participants 32 persons

Ratio of overseas researchers 3%

Overseas research institutions : 28

(to which the contributing participants belong)

Aravind Eye Hospital

Blantyre Institute of Community Outreach

Beyond 700

Dong A University

University of Glasgow

Johns Hopkins University

La Trobe University

University of Manchester

University of Michigan

National Chung Hsing University

National Yang Ming University

Neuroscience Research Australia

SIRION Biotech GmbH

Technical University of Munich

University of Texas

University College of London

University of Delaware

University of New South Wales

Western University

Oxford University

University of California, Los Angeles

Case Western Reserve University

Stanford University

New York University

Harvard University

University of Leicester, UK

Japan International Eye Hospital

National Institutes of Health (NIH)

5. Outline of R&D Projects

| PM | Affiliation / Position | R&D Project | Outline of R&D Project |
|-------------------------------|------------------------------------|---|---|
| Dr. YANAGISAWA Masashi | University of Tsukuba Professor | Development of new-generation medical care systems through customizing sleep and hibernation | Through elucidating the neurophysiological roles and regulatory mechanisms for two immobile modes of animal behavior, sleep and hibernation, we will develop technologies to control sleep and induce hibernation in humans, transforming the future medicine. Induced hibernation will be a step forward to space expedition, a dream of humankind. |
| Dr. ABE Takaaki | Tohoku University Professor | Mitochondrial Medicine | To perform a comprehensive and integrated analysis of the "mitochondrial-gut flora association" to clarify which mitochondria and gut microbiota regulate the host, and develop non-invasive diagnostic methods and new therapeutic agents. We aim to achieve healthy longevity by detecting mitochondrial dysfunction at an early stage by intervening and treating it by 2040. |
| Dr. MURAKAMI Masaaki | Hokkaido University Professor | Quantum technology and neuromodulation medicine for new therapeutic strategies to suppress microinflammations | Tissue-specific disease-related microinflammation develops around blood vessels during presymptomatic disease. Currently, there is no method to detect and eliminate this microinflammation. In this proposal, we aim to establish two novel technologies to reset the presymptomatic disease state to the healthy state: quantum measurements and AI-based information integration analysis. First, we will detect a weak but minimal level of IL-6 amplifier* activation that leads to the development of tissue-specific microinflammation. Then, we will establish neuromodulation technologies** to eliminate the microinflammation via specific neural circuits including gateway reflexes. |

5. Outline of R&D Projects

| PM | Affiliation / Position | R&D Project | Outline of R&D Project |
|---|--|---|--|
| Dr. NAKANISHI Makoto | University of Tokyo Professor | Realization of innovative medical systems that extend healthy lifespan to 100 years old by eliminating tissue inflammation-inducing cells | This research project aims to develop innovative technologies that eliminate senescent cells (senolysis) which cause tissue microinflammation as a common pathogenesis of aging and age-associated disorders. Thereby, we will establish medical systems for the extension of healthy lifespan through which various age-associated tissue dysfunctions and disorders will be dramatically improved. In addition, we will also develop technologies that measure senility and establish medical networks that can be easily accessed by everyone and everywhere. |
| FS Dr. KURITA Masakazu | University of Tokyo Research Associate | Development of method for complex tissue regeneration via tissue embryonization | Based on engineered gene transfer, the present research project targets the recovery of damaged compound tissues and organs that are generally considered impossible to regenerate, by means of induction of multiple adult cells into precursor cells similar to embryonal cells. We seek to develop a method for regenerating lost limbs and restoration from age-related tissue degeneration using a substantially feasible method for clinical settings. |

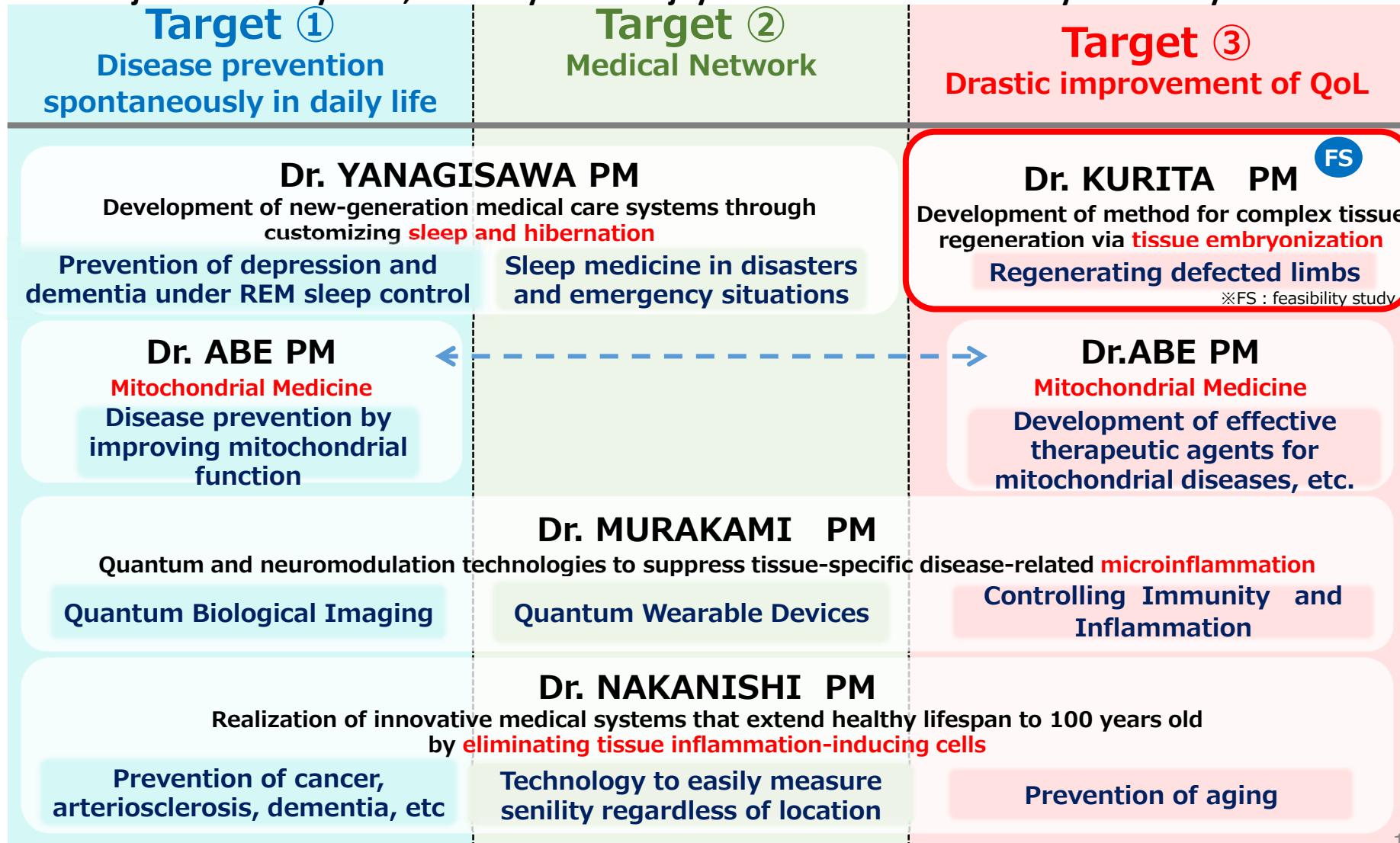
※FS : Feasibility study

6. Key Concept of R&D promotion (Project Component)

Moonshot Goal #7

from Strategy Promotion Meeting (Dec.25, 2020)

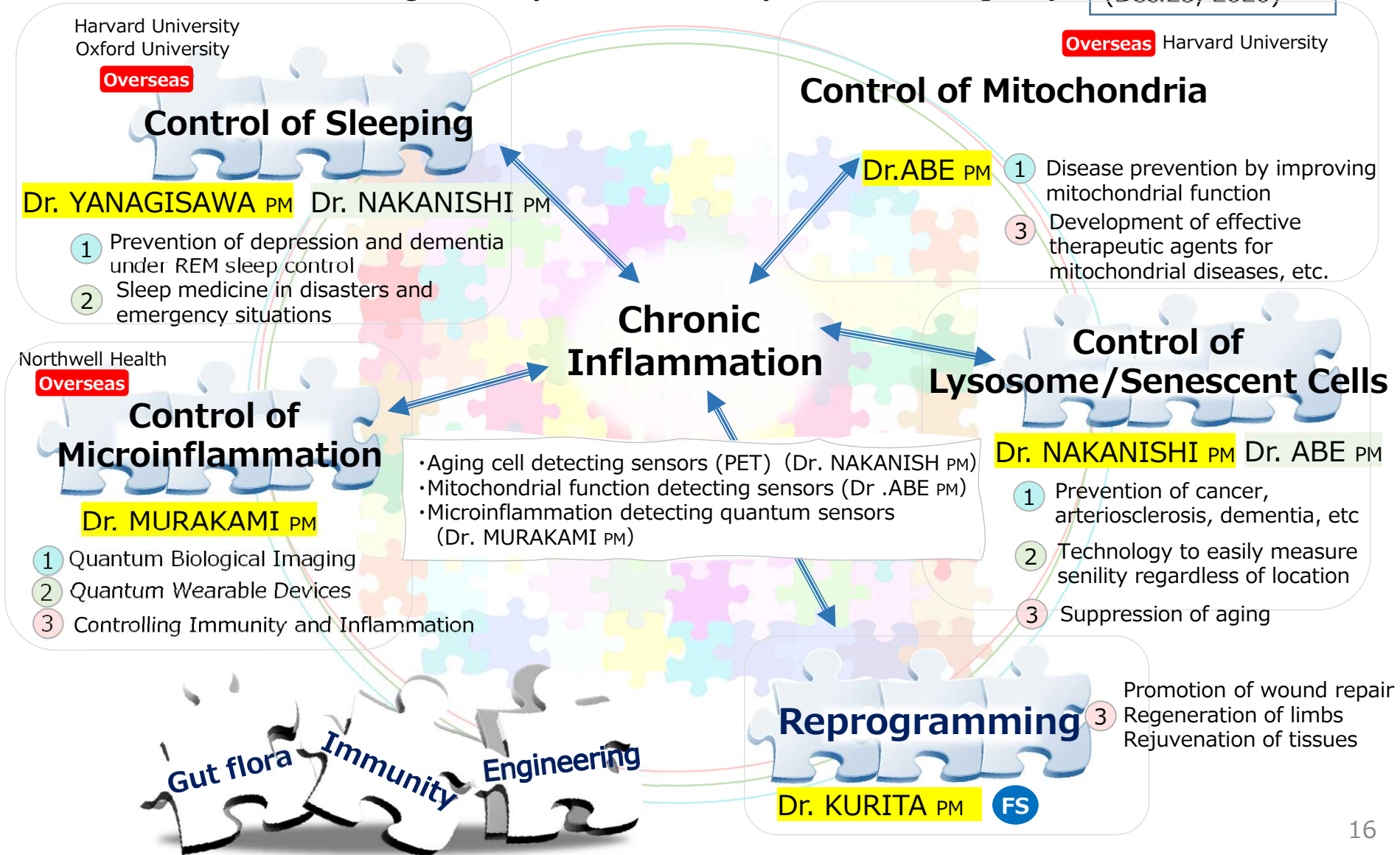
“Realization of sustainable medical and nursing care systems to prevent and overcome major diseases by 2040, for everyone to enjoy life without health anxiety until 100 years old.”



6. Key Concept of R&D promotion (Project Component)

Control of Chronic Inflammation achieving a society characterized by health and longevity

from Strategy Promotion Meeting (Dec.25, 2020)



6. Key Concept of R&D promotion

Fund allocation (Approval/Advice item)

from Strategy Promotion 3rd Meeting (Dec.25, 2020)

- ✓ In order to achieve the goals, the PDs and others will take the initiative in understanding the progress and other aspects of the project, and will **implement a flexible and agile fund allocation plan** accordingly.
- ✓ In addition, we will conduct effective and efficient allocation of funds to further achieve MS goal by carefully examining application amounts and thoroughly **eliminating overlap of R&D details and activities among PMs.**
- ✓ The project of candidates for **FS(feasibility study) adoption will start with a small start.** Thereafter the allocation of funding will be fluctuate according to the progress. In case of poor progress, **the project will be terminated after three years.**

Practical use of the R&D results in society (Advice item)

- ✓ We will promote **the development of measurement technologies for catching slight changes in health status with ultra-high sensitivity,** and develop methods (test analysis systems, drug discovery, various materials, etc.) to support the maintenance and improvement of health based on the obtained information on health status, and verify **the possibility of out-licensing to companies and application to daily life.**
- ✓ In the collection and utilization of biometric and medical information, **legal, ethical, and institutional issues will be resolved** with the support of **ELSI** researchers.
- ✓ Researchers in the fields of **mathematics, AI, and data analysis** will participate as contributing participants to **analyze the vast amount of biometric information and develop AI technologies.**
- ✓ **Appropriate management and utilization of research data** will be conducted based on the **data management plan** prepared by each PM.

6. Key Concept of R&D promotion

from Strategy Promotion 3rd Meeting (Dec.25, 2020)

International cooperation (Advice item)

- ✓ Leading overseas researchers will be participate in the project as contributing participants, and we are also planning to accept international advisors. In addition, we will collaborate with international research groups and utilize the human networks of PMs and contributing participants.
- ✓ We hope to collaborate with MS Goal #2 in the areas of high sensitivity inflammation detecting technology, acquisition of time-series information up to the onset of inflammation, and integrated analysis with biological information.

7. Summary of Moonshot Goal #7

- ❑ Not decrease the quality of life significantly before and after sickness.
(Aim for medical treatment with emphasis on the quality of life.)
- ❑ Control chronic inflammation which has a central role of diseases with aging.
- ❑ Enjoy a healthy life during the almost period of our life span.



We will promote the R&D programs disclosed hereafter.
We will try to achieve

“Realization of sustainable medical and nursing care systems to prevent and overcome major disease for everyone to enjoy life without health concerns until 100 years old”
by 2040.

Yahoo News (Search for the word “Toshio Hirano”.)

The 5th wave (4) “Be healthy in a 100-years-old life”
“Before the dawn in the birth of homo sapiens 2.0”

<https://news.yahoo.co.jp/byline/kimuramasato/20210618-00243529/>₁₉

