



Kick-off Symposium for Moonshot Goal 7
"To Age to 100 without Health Concerns "
210626 13:55-15:50

Curing Diseases by Quantum Technology and Neural Pathways!



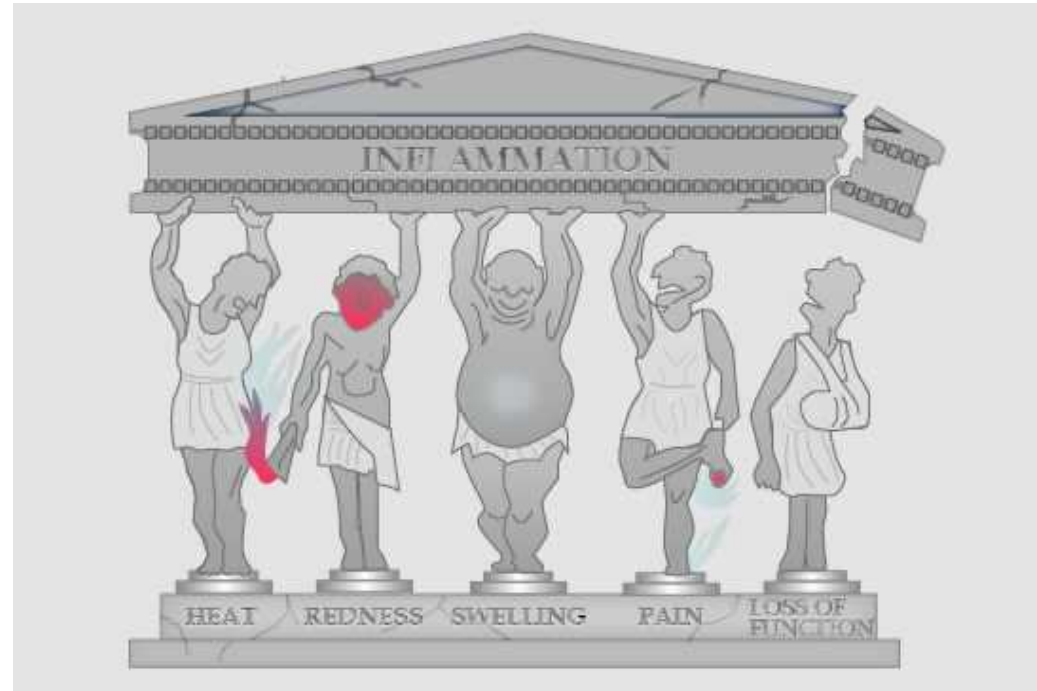
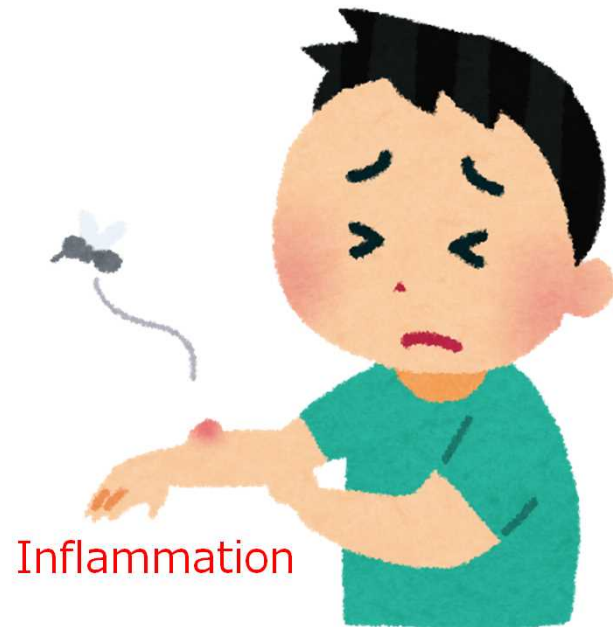
**Hokkaido University
Institute for Genetic Medicine
MURAKAMI Masaaki**

Transforming our world: 2040

By 2040,
we will realize a society
with a long and healthy life expectancy
by developing quantum and
neuromodulation technologies
to control the onset of diseases

Inflammation ?

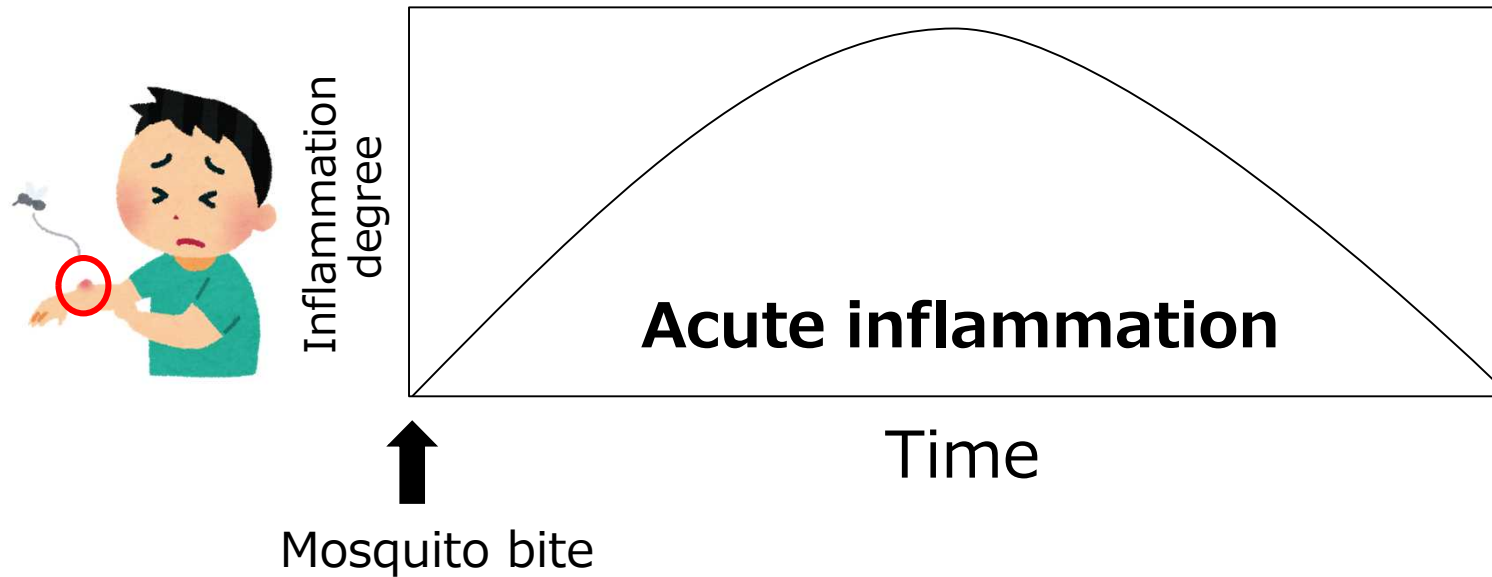
Heat, Redness, Swelling, Pain, Loss of function



<https://www.jst.go.jp/crest/inflam/en/illust/index.html>

Inflammation is associated with various diseases and disorders.

What is happened in the inflammation lesion ?



1. Heat, Redness, Swelling, Pain, Loss of function

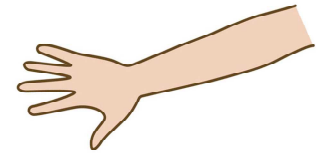
2. Dysregulation of tissue homeostasis

● 3. Accumulation of Immune cells from the blood

● 4. Chemokines, Cytokines, Growth factors

Chemokines accumulate immune cells

Acute inflammation



Diseases

Chemokine expression

Persistent chemokine expression

Chronic inflammation



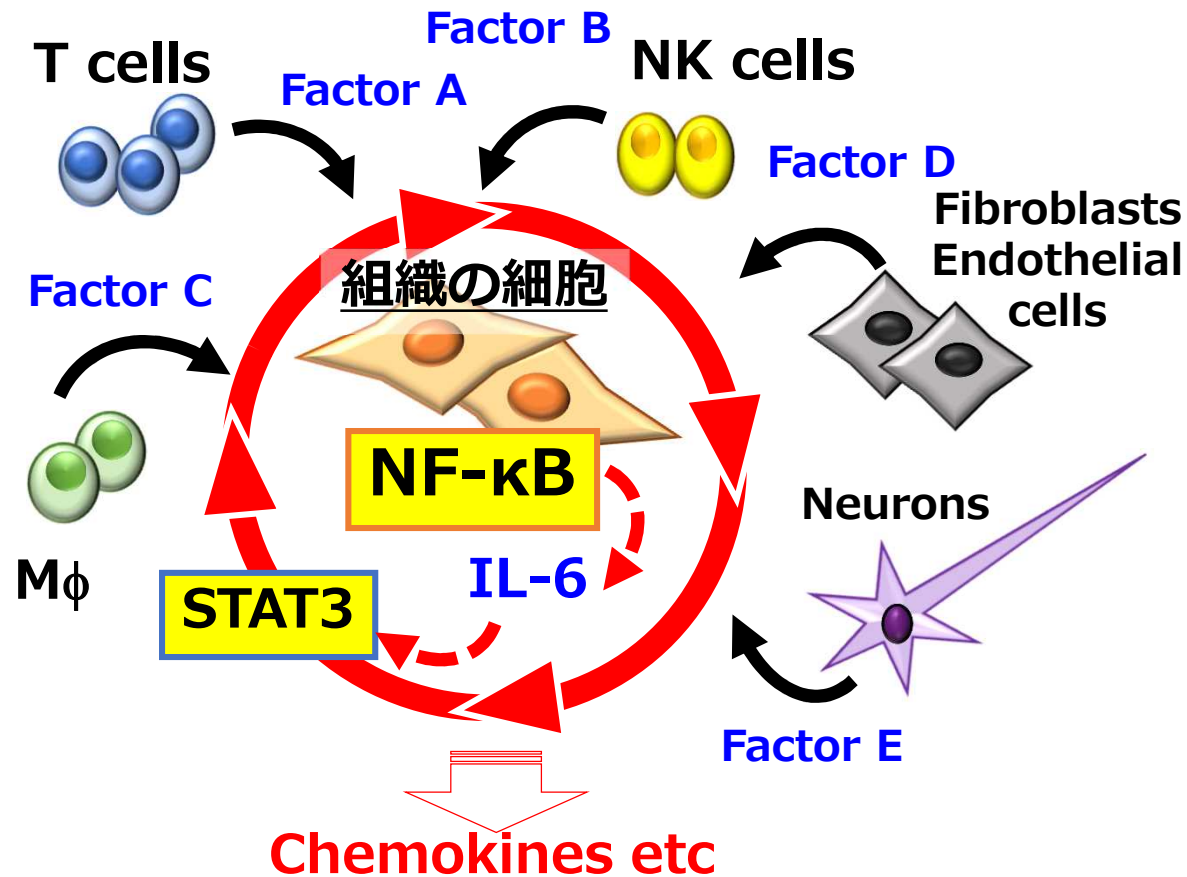
Accumulation of immune cells
chemokine-dependently

Chemokine concentration

Direction of chemotaxis →



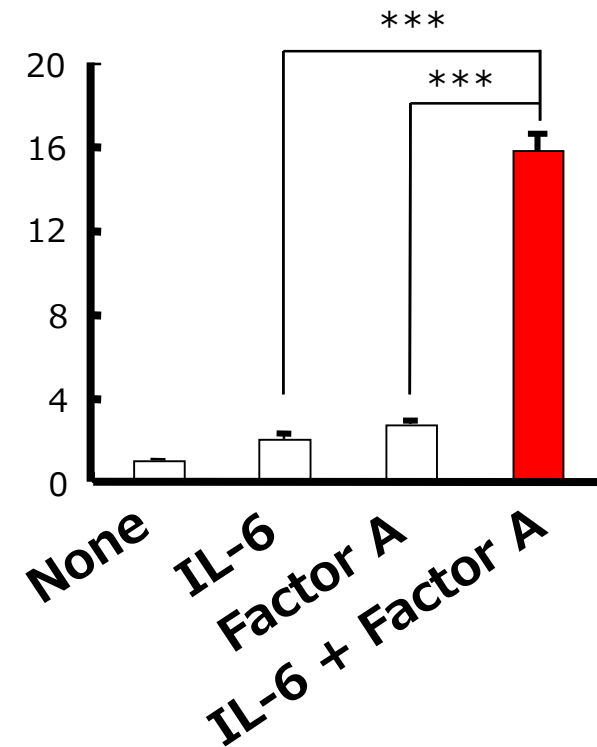
IL-6 amplifier, a mechanism of chemokine inducer



Accumulation of immune cells
Growth of surrounding cells
Loss of tissue functions

Chronic inflammation= diseases

Chemokine expression



○ Microinflammation induces chronic inflammation

Project brief

Chronic inflammation is directly linked to major diseases

- Dementia such as Alzheimer's disease
- Immune diseases such as rheumatoid arthritis and multiple sclerosis
- Cerebrovascular and cardiovascular diseases caused by atherosclerosis



[Our solution for curing chronic diseases]

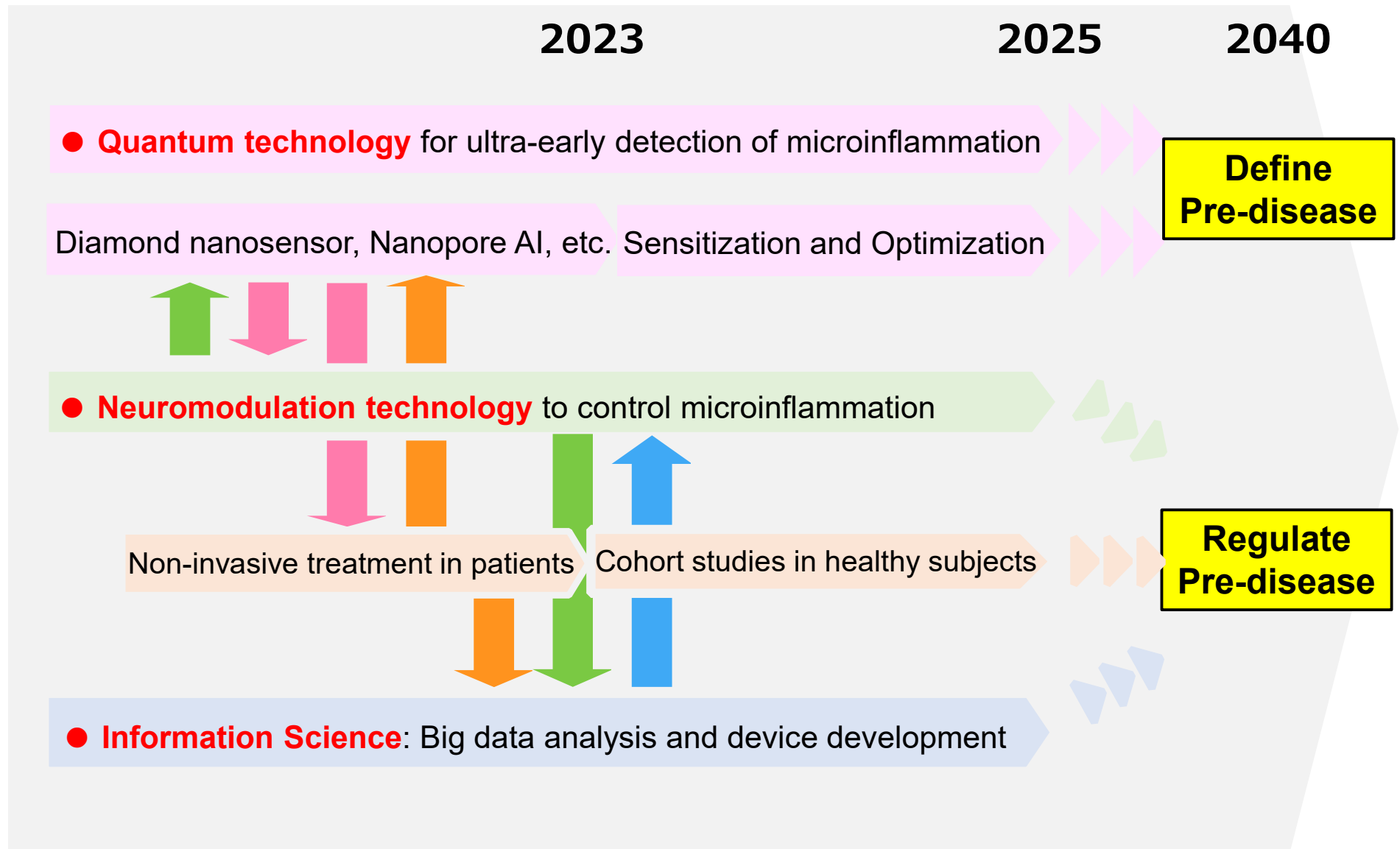
Understanding the state of "pre-disease"
by analyzing the gateway reflex and IL-6 amplifier

Development of innovative quantum and neuronal technologies
to detect and control tissue-specific microinflammation



Realization of a healthy and long-living society

Annual planning



Annual planning

SDGs

2023

2025

2040

- **Quantum technology** for ultra-early detection of microinflammation

Define

3 GOOD HEALTH
AND WELL-BEING



● **Cure pre-disease by controlling micro-inflammation**

A healthy and long-living society
where people can enjoy life without health concerns until they are 100 years old

9 INDUSTRY, INNOVATION
AND INFRASTRUCTURE



● **Social implementation: Creation of an innovative medical industry**

Ultrasensitive quantum technology and neuromodulation technology
for detection and removal of microinflammation

- **Information Science**: Big data analysis and device development

Project team members

Project manager: MURAKAMI Masaaki (Hokkaido Univ.)

① Understanding of the nature of pre-disease

Performer: Yasui (Nagoya Univ.), Tokeshi (Hokkaido Univ.), Igarashi (QST), Fujiwara (Okayama Univ.), Murakami (Nagoya Univ.), Taniguchi (Osaka Univ.), Higuchi (QST), Ogawa (Hokkaido Univ.), Yanagida (Tokyo Univ.)

② Quantum power for finding the onset of pre-disease

Performer: Chamoto (Kyoto Univ.), Fagarasan (RIKEN), Kozono (Tokyo Univ. Science), Tsumoto (Tokyo Univ.), Okochi (Tokyo Tech), Fujio (Tokyo Univ.), Atsumi (Hokkaido Univ.), Iwasaki (Hokkaido Univ.), Sata (Tokushima Univ.), Isobe (Kyusyu Univ.)

③ Neuromodulation technology for regulating the onset of pre-disease

Performer: Miwa (Hokkaido Univ.), Minami (Hokkaido Univ.), Ueno (Niigata Univ.), Sasaki (Tokyo Univ.), Tainaka (Niigata Univ.), Takeuchi (Osaka City Univ.)

④ Big data analysis with AI and device development

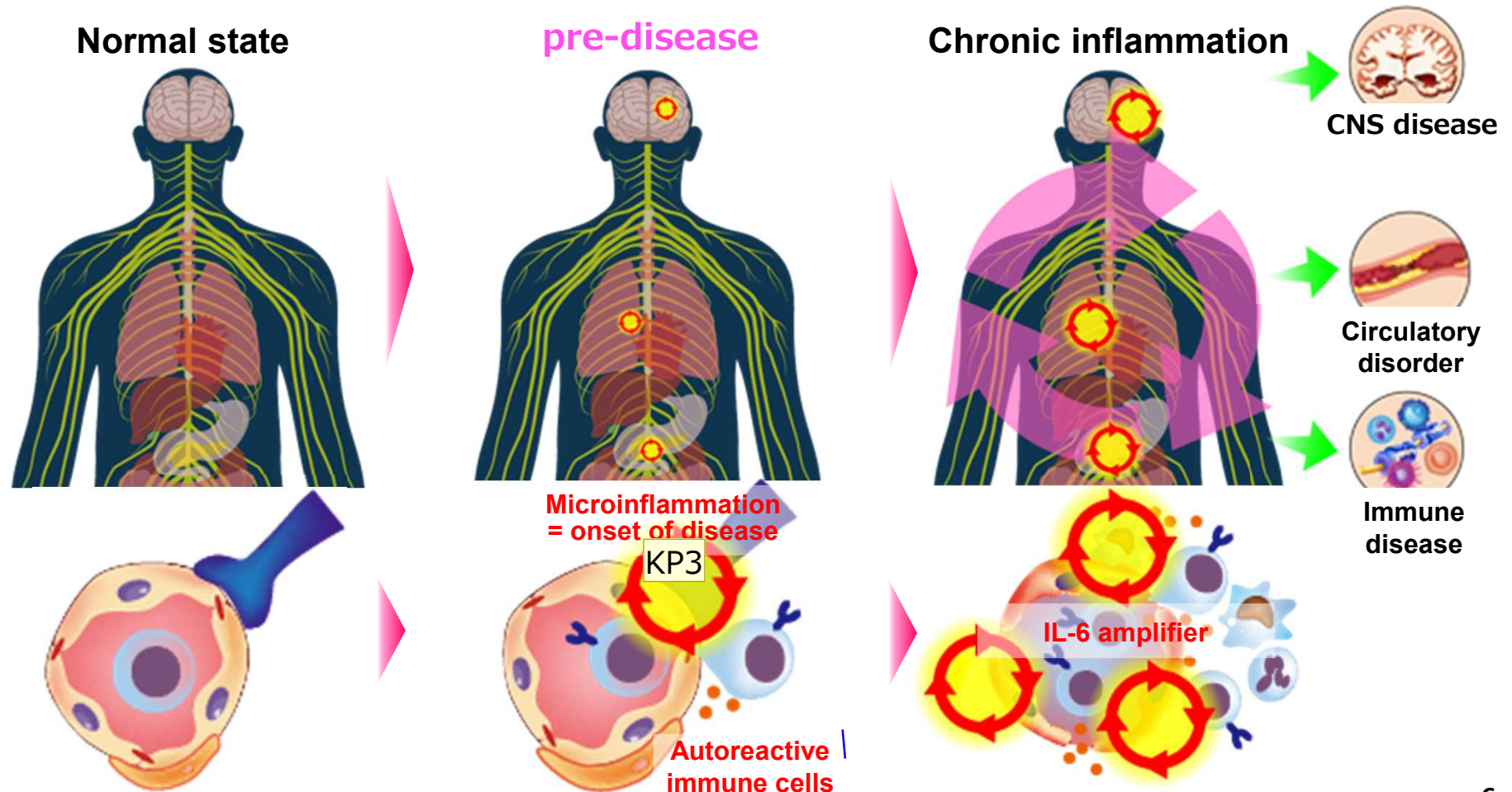
Performer: Haseyama (Hokkaido Univ.), Washio (Osaka Univ.)

Breakthroughs to be achieved in this project

1. Quantum Technology
for **detecting the onset of pre-disease**

2. Neuromodulation Technology
for **removing the onset of pre-disease**

From pre-disease to normal !



スライド 11

KP3

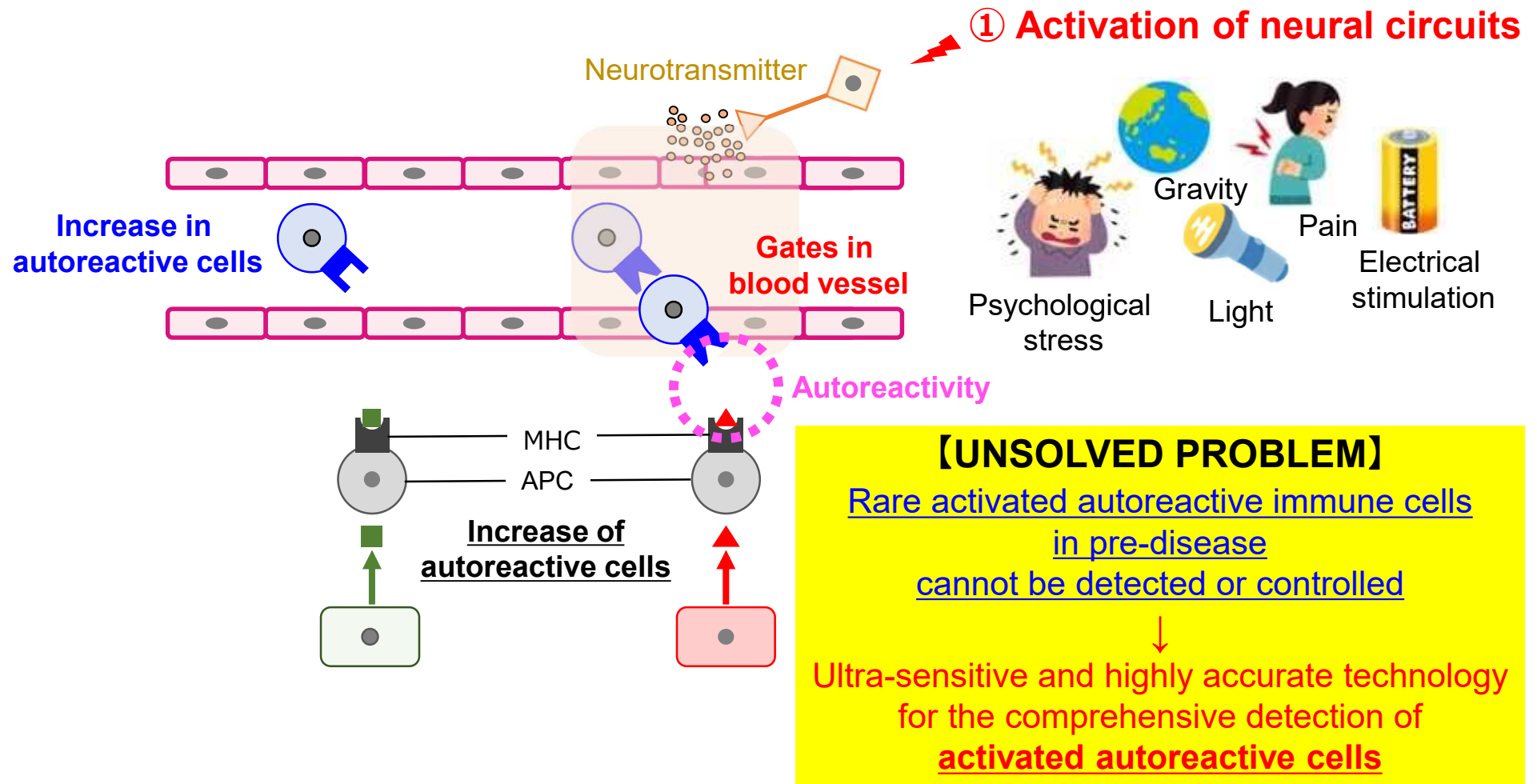
what do you mean by "sprout". Perhaps "beginning"?

Karagiannis Peter, 2021/06/14

Microinflammation development by autoreactive cells

○ Inevitable state: Increase in autoreactive immune cells with age

Causes of diseases : 1. **Presence of activated autoreactive immune cells in the blood**
2. **Formation of immune cell gateways**

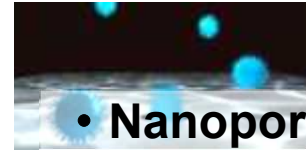


Quantum Technologies for Microinflammation

○ Diamond nanosensors and Nanopore-AI



- A special diamond to detect the onset of disease in a small amount of blood or urine

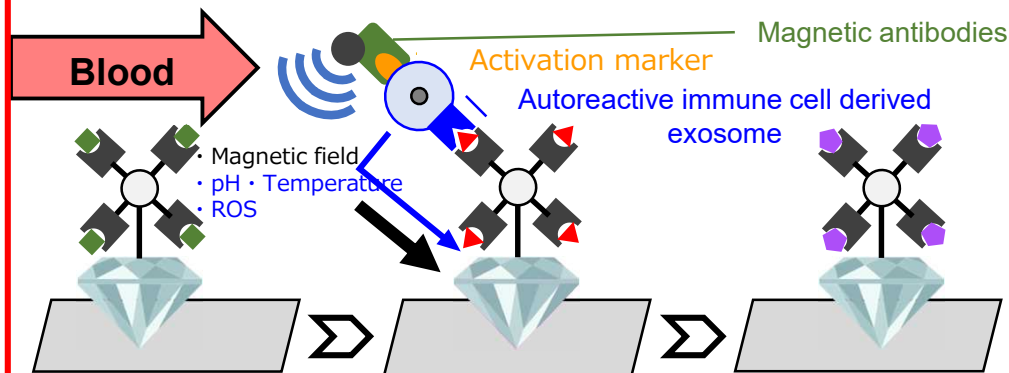


- Nanopores on silicon films to detect the onset of disease

KP4

● Multidimensional analysis of autoreactive immune cells

Strategy 1: Diamond nanosensor

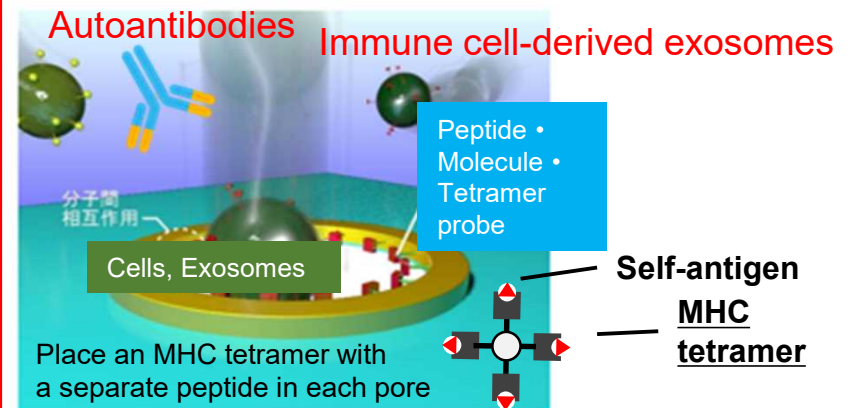


- Nanodiamonds + microfluidic device

• 10^8 < higher sensitivity than existing technologies

KP6

Strategy 2: Nanopore-AI



- Set various probes around pore

• 10^3 < simultaneous analysis of multiple samples

スライド 13

KP4

Do you mean AI technology passes the objects through the nanopores or it detects them?

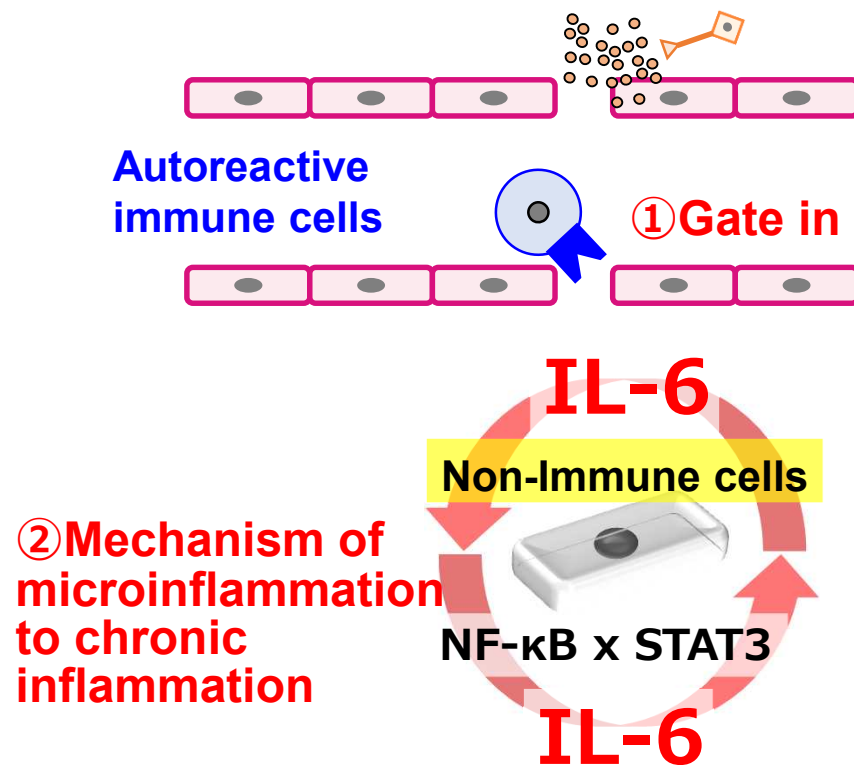
Karagiannis Peter, 2021/06/14

KP6

this means the sensitivity is 10^8 times better than the best technology. Did you mean, the sensitivity is 10^8 , which is better than any other technology?

Karagiannis Peter, 2021/06/14

Detection of Microinflammation by IL-6 Amplifier



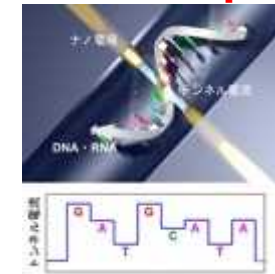
Autoimmune disease, Metabolic syndrome, Neurodegenerative disease, Psychiatric disorders, Atopic dermatitis, Allergies, Infection disease, Graft rejection, Rheumatoid arthritis, Multiple sclerosis, Pneumonia, Nephritis, Dermatitis, Cancer, Keloid, Osteoarthritis, etc.

We have proven:

“Each organ and disease has cells that are easily started IL-6 amplification”

Specific factors

• Quantum technologies:
Diamond nanosensor and Nanopore



• Quantum Imaging
Next Gen. PET • MRI



Technologies for detecting The onset of disease

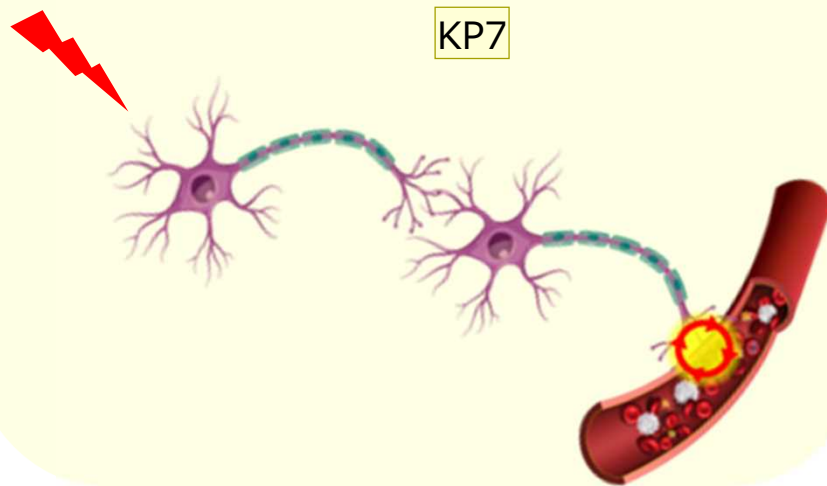
**Technologies for removing the onset of pre-disease:
Utilization of the neuronal network**

Novel Neuromodulation Technology

● Gateway Reflex

Discovered in Japan

- Mechanism of neuronal activation-mediated immune cell gateways

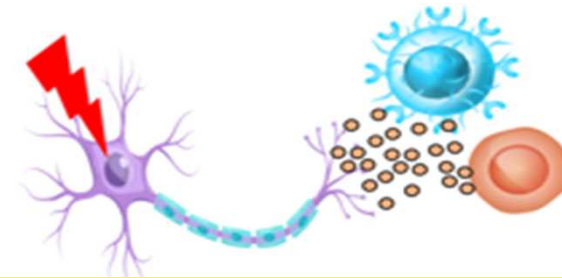


By the neuronal power,
we prevent the formation of blood vessel gate
and the entry of autoreactive immune cells.

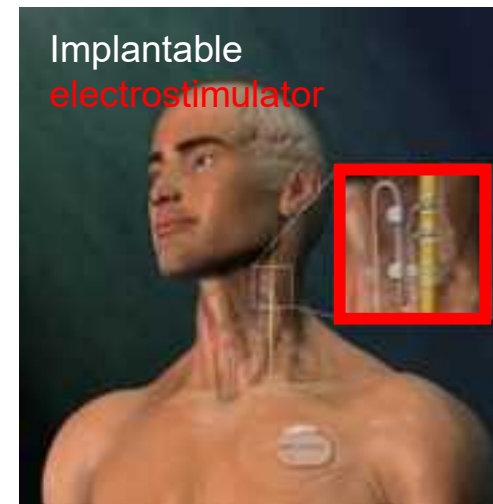
● Inflammation Reflex

Discovered in USA Dr. K. J. Tracey

- Vagus nerve-mediated inflammation suppression



- Collaboration with Epilepsy Center in Hokkaido Univ.



KP7

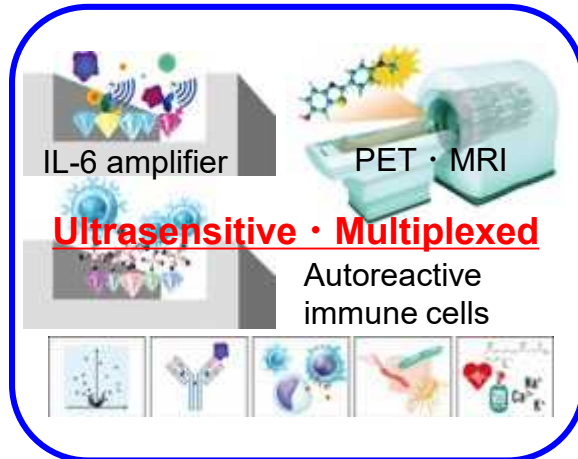
not sure what you mean by "nerves in gate-forming nerves". There are no nerves in nerves. Maybe you mean "nerves in gate formation"?

Karagiannis Peter, 2021/06/14

Neuromodulations for Microinflammation

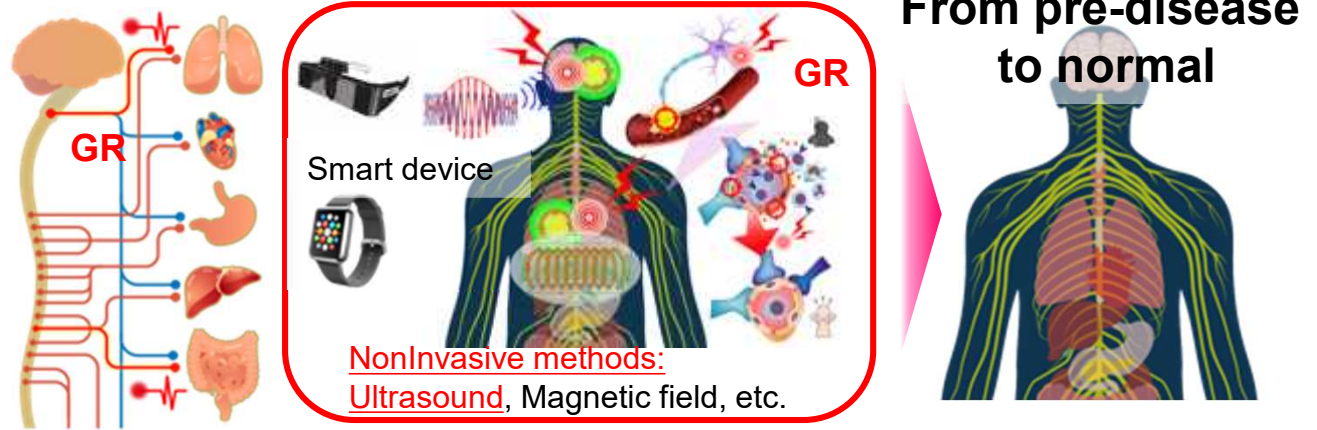
Our strong points:

Quantum technologies for the onset of pre-disease



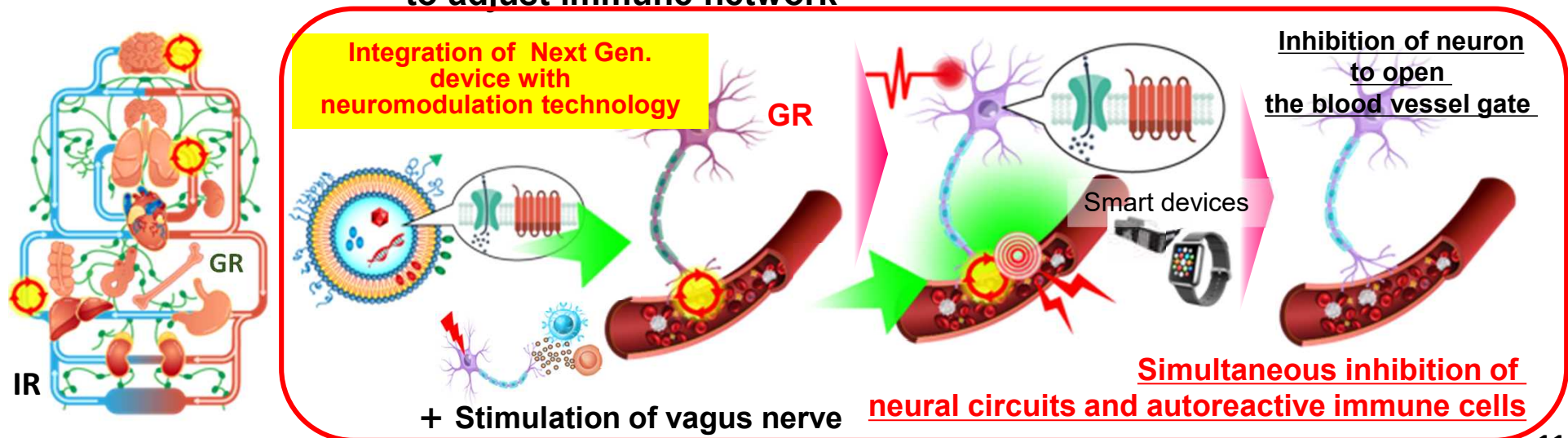
● Treatment strategy 1

From pre-disease : Removal of the onset of pre-disease by the neuronal power to close the blood vessel gate



● Treatment strategy 2

High risk of disease : Removal of the onset of pre-disease by the neuronal power to adjust immune network

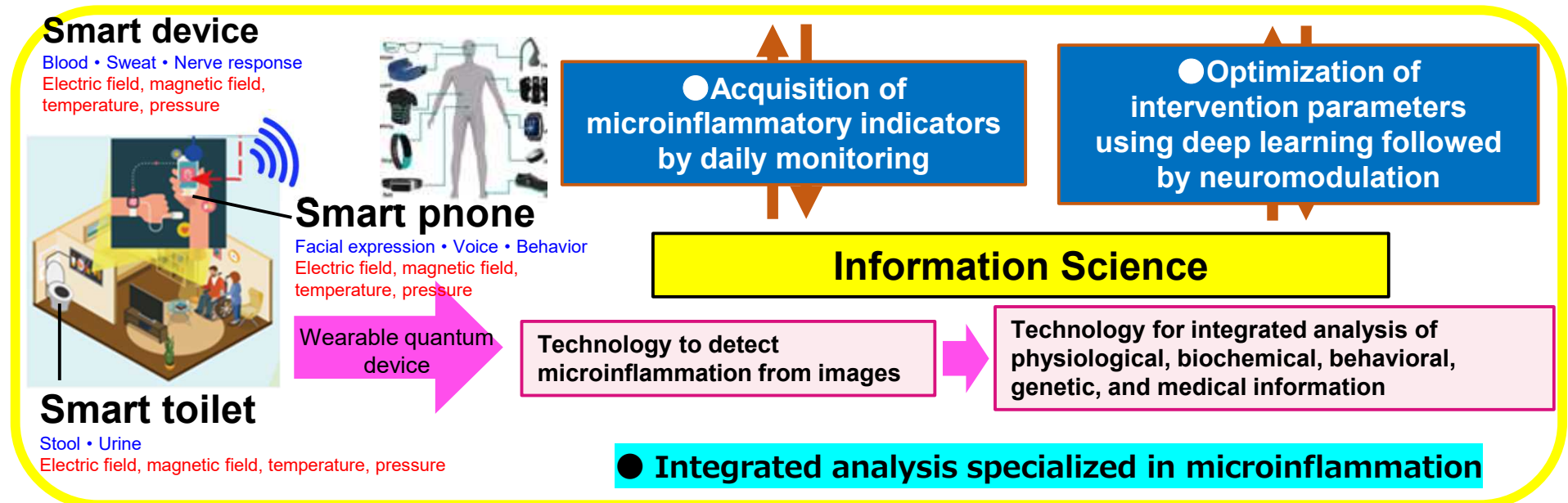


Collaboration with Information Science

**Quantum Technology:
To define pre-disease**

**Neuronal Technology:
To regulate pre-disease**

● **Detection and regulation of
the onset of pre-disease
by quantum and neuronal technologies**



Two Breakthrough Innovations

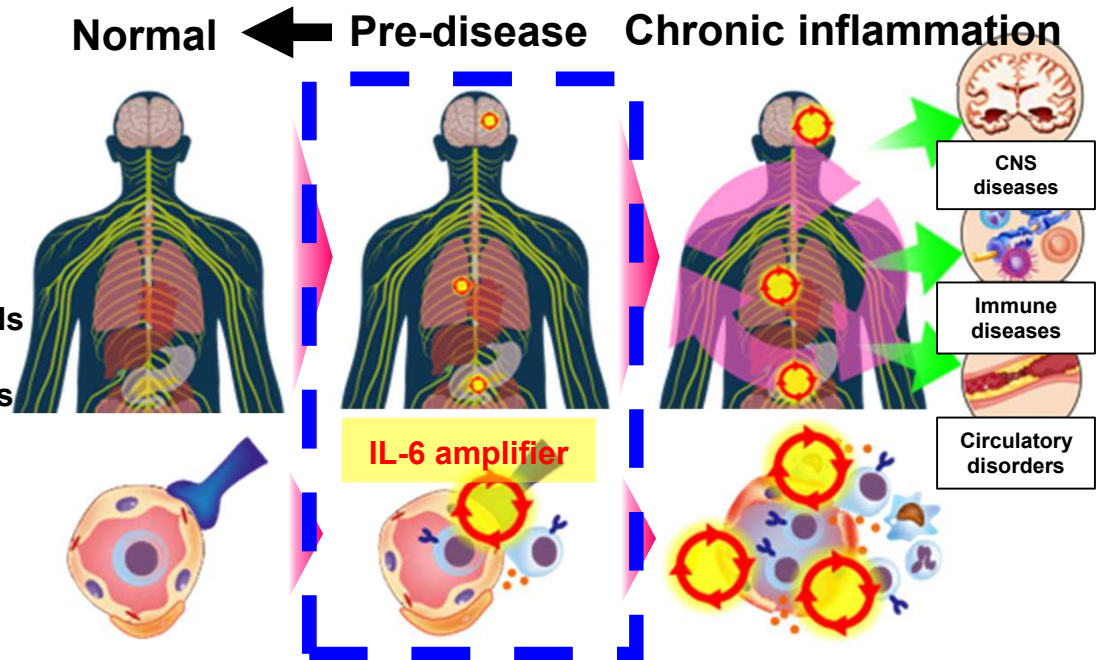
● Development of two technologies to restore "pre-disease" to "normal" in the very early stage of chronic inflammation

1. Technology to define pre-disease : Quantum technologies

- (i) Comprehensive analysis of autoreactive T cells
- (ii) Identification of IL-6 amplifier markers using nanodiamonds, nanobodies, and microfluidics
- (iii) Super-sensitive quantum imaging

2. Technology to regulate pre-disease : Neuromoduration technologies

- (i) Two neuromodulation technologies specific to Gateway Reflexes
- (ii) Inhibition of autoreactive T cells and tissue-specific IL-6 amplifier



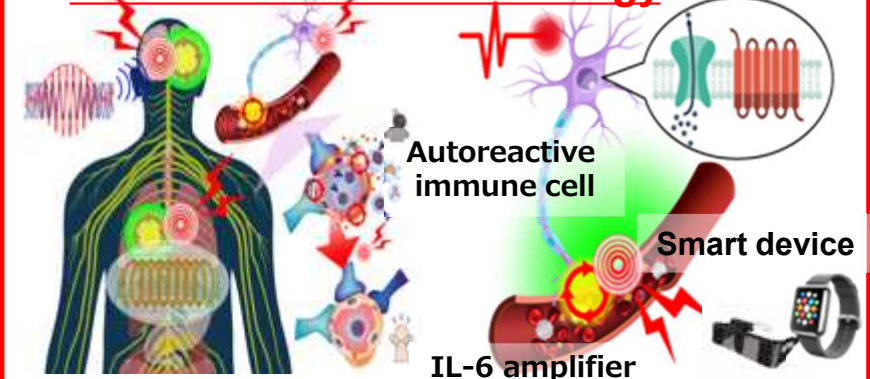
1. Define pre-disease

Cutting-edge quantum technology



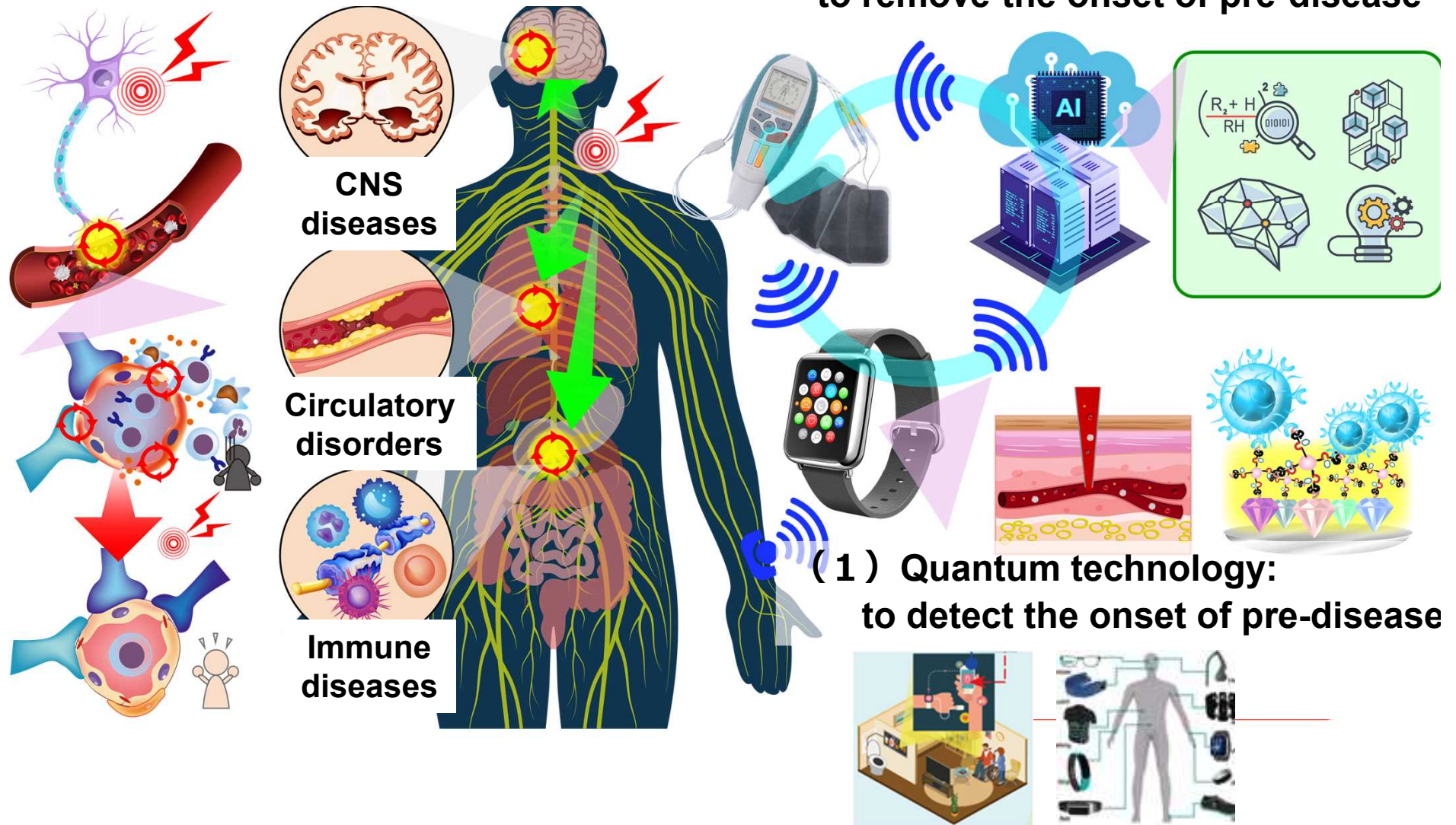
2. Regulate pre-disease

Neuromodulation technology



Summary

- Free from major diseases by removing microinflammation



(3) Wearable neuromodulation and quantum technology

Future plan

9 産業と技術革新の
基盤をつくろう



- **Social implementation: Creation of an innovative medical industry**
Ultrasensitive quantum technology and neuromodulation technology
for detection and removal of microinflammation

2023-25 年



**Clinical
research**

2028 年



**Preemptive
medicine**

2030 年



**Preventing disease
in daily life**

2040 年



Healthy longevity

3 GOOD HEALTH
AND WELL-BEING



- **Cure pre-disease by controlling micro-inflammation**
A healthy and long-living society
where people can enjoy life without health concerns until they are 100 years old

Transforming Our World: 2040

We establish technologies for detection and remove the onset of pre-disease, which make free from major diseases.

We ensure good health and promote well-being for all ages in 2040.