

Working Group 2

Realizing a human life that “continues to improve both physically and psychologically” through complete understanding of biological functions such as the nervous system and related tissues



Chair: Prof. Gen Sobue, Sub-Chair: Prof. Shigeo Okabe

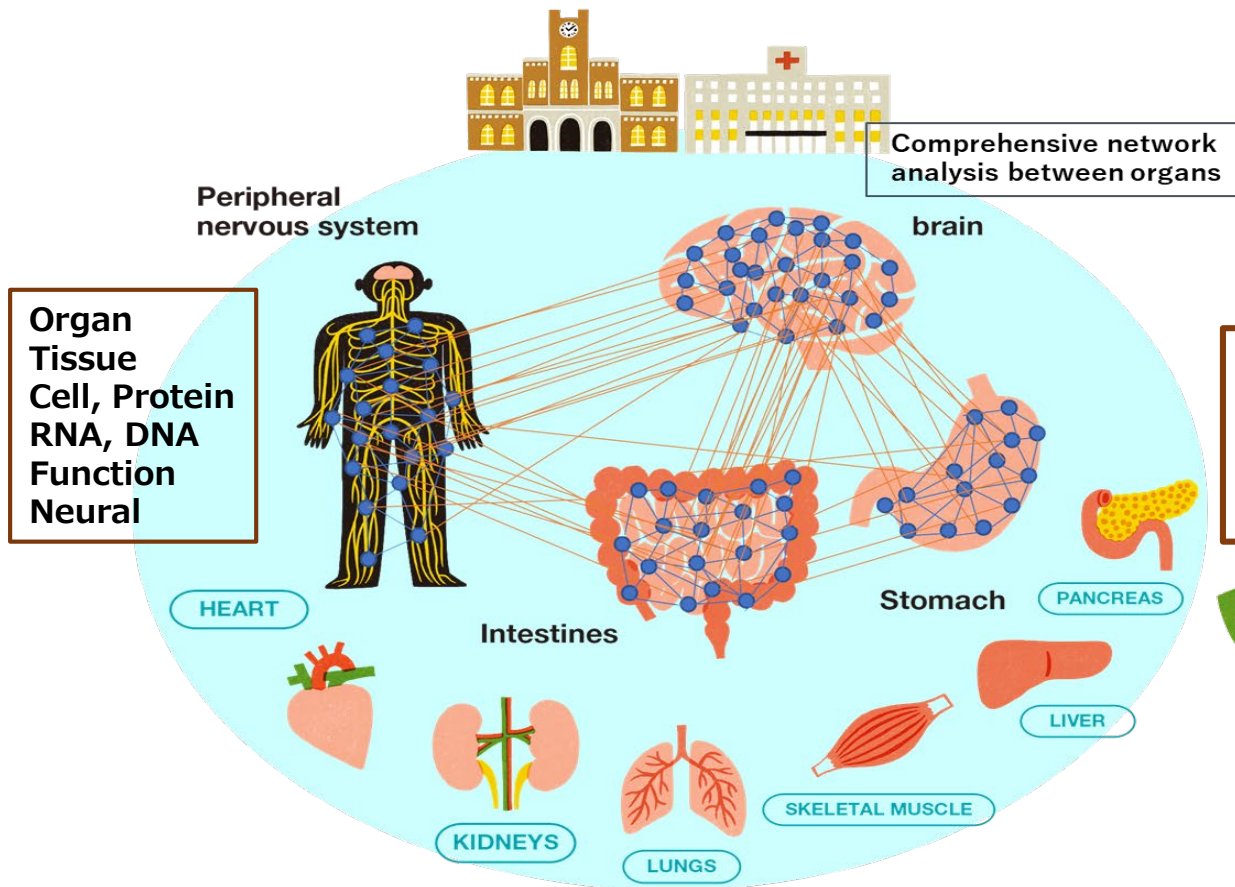
[The Moonshot [Area], [Vision] for setting MS [Goal] candidate]

- [Area]**
 - Leveraging the Aging Society.
- 2 Areas**
 - Turning the aging society into the innovative and sustainable society by harnessing diversity through techno-social transformation
- Exploring frontiers with science and technology
- [Vision]**
 - Society without health anxiety: everyone can enjoy life until 100 years old (achievement of well-aging)
- 3 Visions**
 - Reproducing and controlling key biological processes (biotech)
 - In-depth understanding of neural and associated systems (brain/nerve system)

By 2050, realization of ultra-early disease prediction and intervention based on the Whole Body Network Atlas for longer, fuller and happier lives

Comprehensive network analysis between organs

Longer, fuller and happier lives by 2050



Whole body network simulator

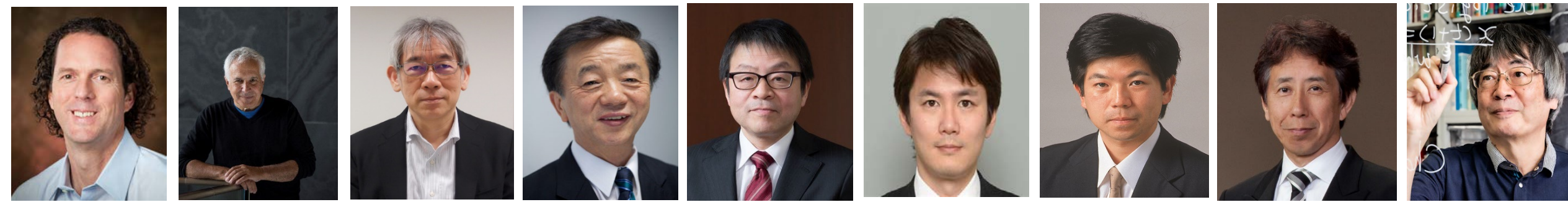


Whole-body Network Simulator



- **By 2050, we establish a system for disease prediction and evaluation of the pre-symptomatic states.**
This will be achieved by integrated analysis of the entire functional network between human organs and will ultimately realize the suppression and prevention of disease.
- **By 2050, we establish a strategy that enables the conversion of a pre-symptomatic state to a healthy state.**
Functional changes in human physiology along life course will be clarified from the viewpoint of a comprehensive network between organs.
- **By 2050, we identify disease-related network structure, including molecular targets as its component, and establish innovative prevention, diagnosis, and treatment methods.**
- **We establish non-invasive techniques applicable to human subjects for observing and manipulating organ networks, etc.**

○ Strategy of the process for R&D projects



Prof. Lein Prof. Lichtman Prof. Okabe Principal Fellow Prof. Taniguchi Prof. Yoneda Dr. Nishikawa Prof. Tsunoda Prof. Kawato Prof. Aihara

Human
cell
atlas

Brain
initiative

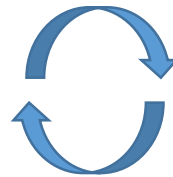
Understanding on comprehensive network
between human organs

Biological approach

Molecular cytological approach and
Biochemical approach

Mathematical approach

Mathematical modeling approach



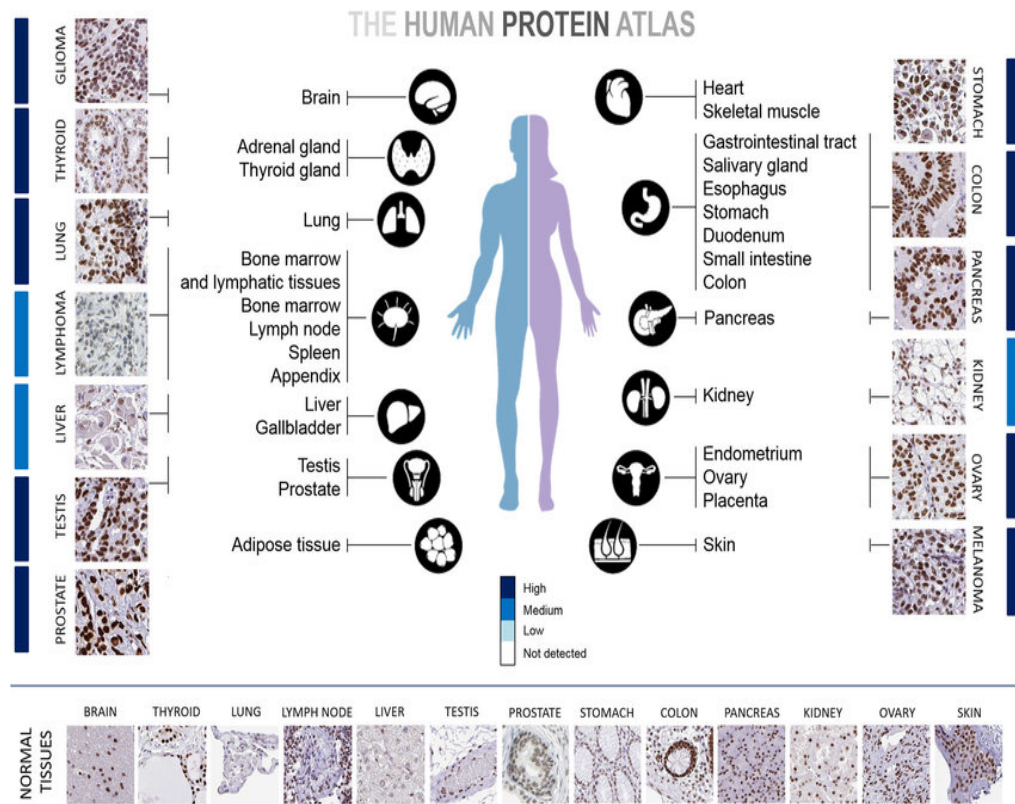
Biological approach: High-resolution in vivo imaging,
Human cell atlas, Human protein atlas,
Gut-brain communication analysis,
Metabolic information highway analysis, etc

Mathematical modeling approach: Dynamical network
biomarker analysis, Trans-omics analysis,
Structural sensitivity analysis,
Structural bifurcation analysis, etc

**To develop the technology for network analysis is highly expected particularly
in collaboration with company**

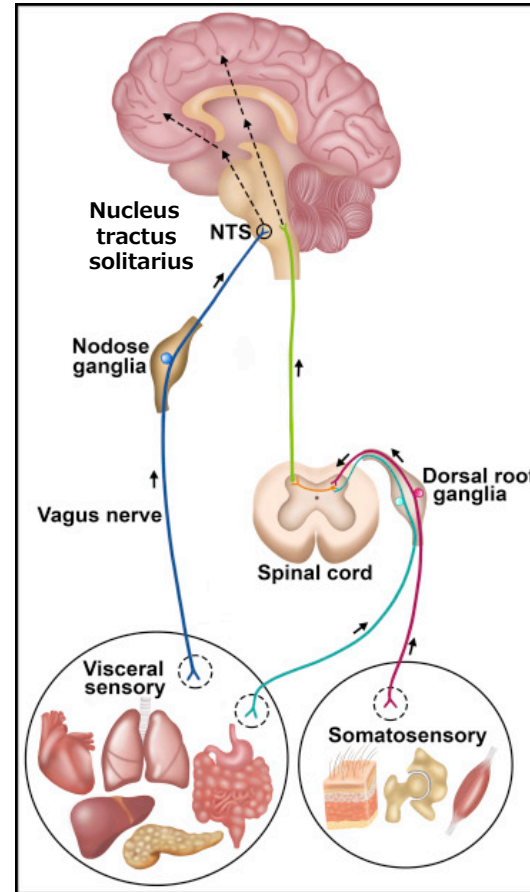
Examples of biological approaches are presented

Human protein atlas in physiological and pathological states Basic data for networks



Biomedical Science 2017

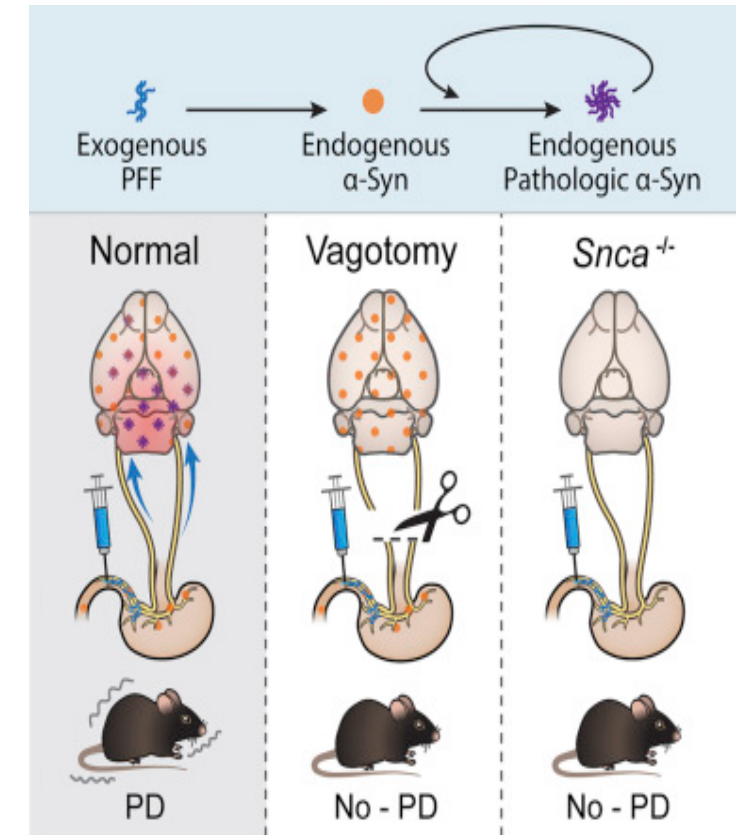
Neuro-immune Communication analysis



Immunity 2017

Gut-derived Parkinson's D pathogenesis analysis

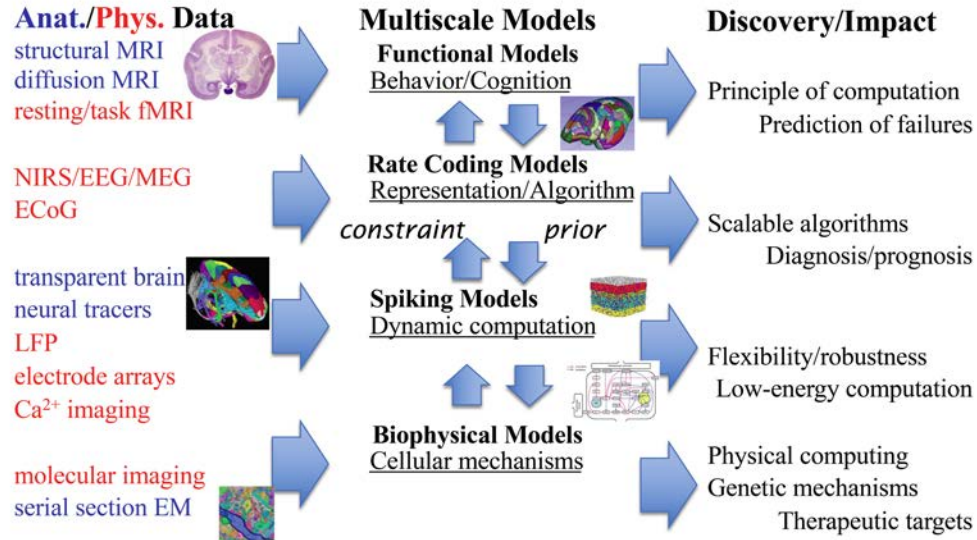
Animal model experiment



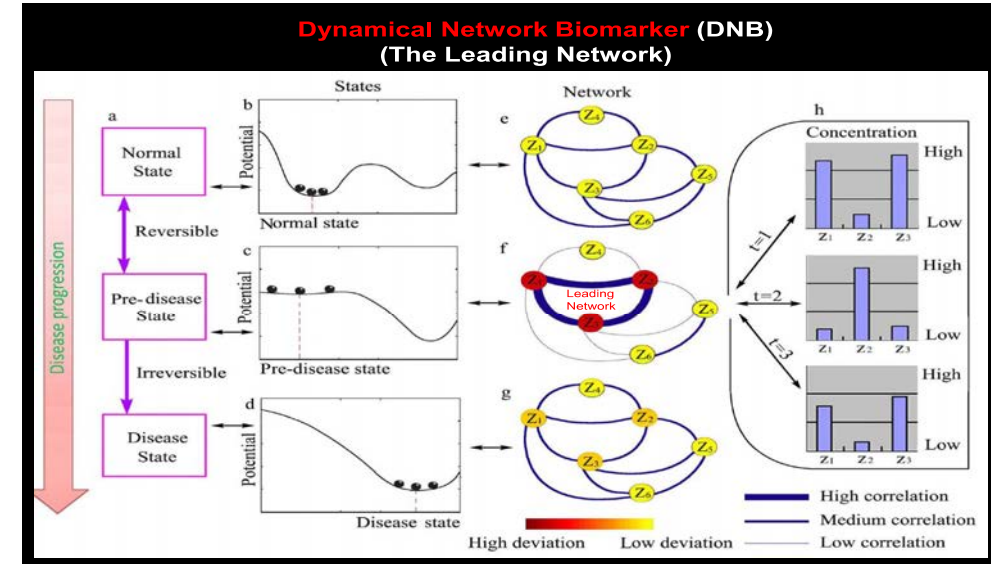
Neuron 2019

Examples of mathematical modeling approaches are presented

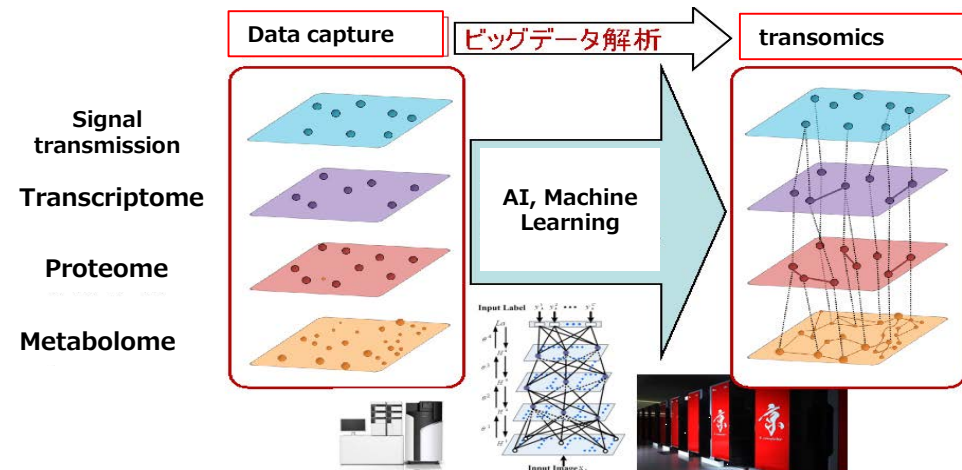
Multimodel analysis



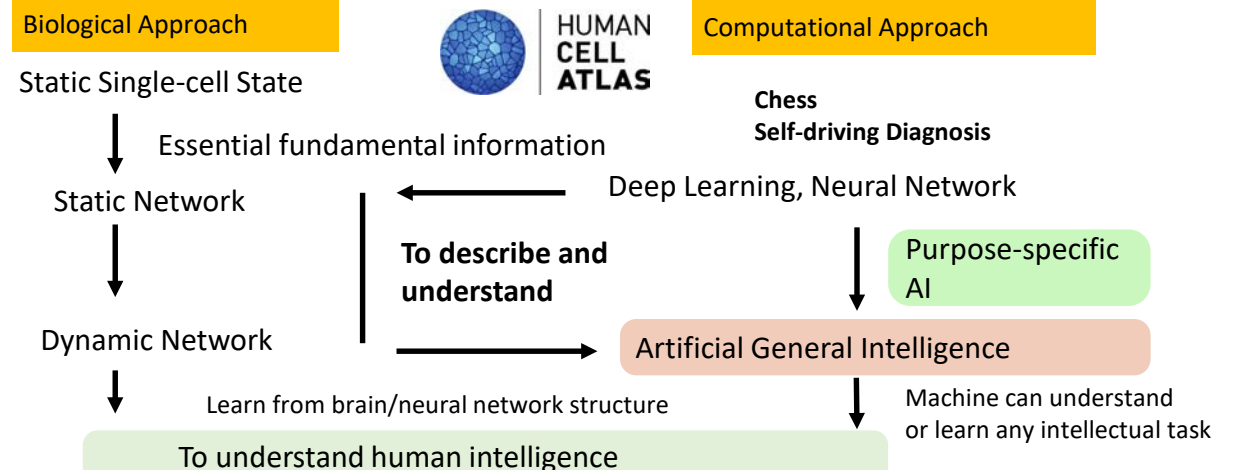
Dynamical Network Biomarker analysis



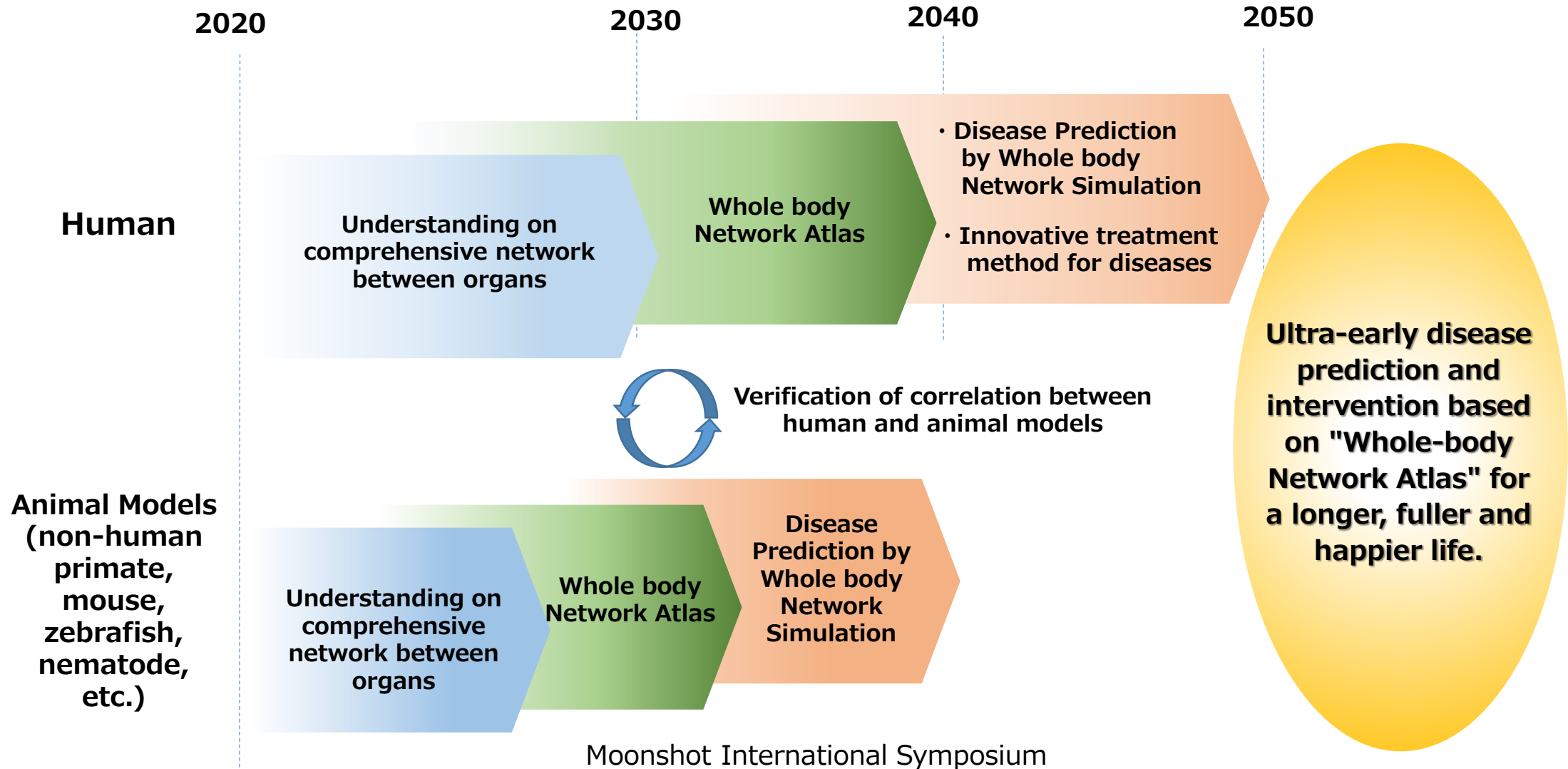
Intra-/inter-organ trans-omics approach



Static/dynamic network analysis by purpose specific AI



○ The Milestone of Innovative Approaches for Ultra-early prediction and prevention for healthy society



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Conclusion

MS Goal candidate

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