Realization of common platform technologies, facilities and equipment that create innovative knowledge and products

R&D Project Title: Elucidation of Hub Factors of Dementia Leading to Its Robustness in terms of Mathematical Models Focusing on Nonlinear and Complex Systems

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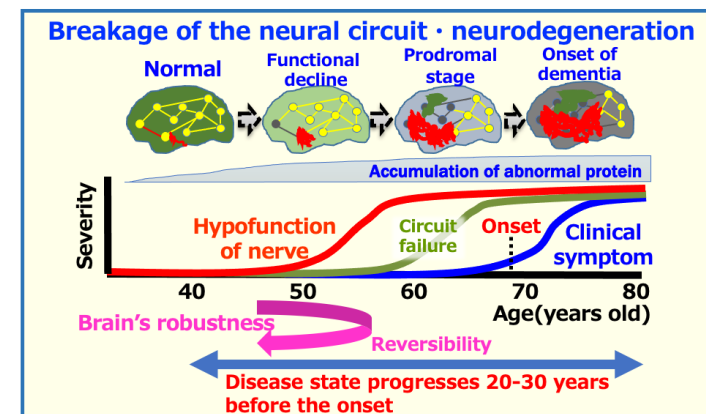
Summary :

We hypothesized that the root cause of dementia is the senescence-associated secretory phenotype (SASP) caused by aging.

To prove this hypothesis, we will extract the characteristics of the cellular aging process and identify its information structure using mathematical models and AI technology.

Furthermore, we will develop a system that can capture the dynamics of changes in the pathological layer before symptoms appear (before reaching an irreversible critical point) and realize early diagnosis and prediction of the onset time of dementia.

Through this research, we will provide a medical treatment support system based on mathematical science for dementia, which has become a cause of social and economic loss.

Ultimately, we aim to realize a society in which brain aging is controlled, i.e., a society in which the brain never ages, and a society in which people can rejuvenate even after aging.

Breakage of the neural circuit · neurodegeneration

Normal | Functional decline | Prodromal stage | Onset of dementia

Accumulation of abnormal protein

Severity — Hypofunction of nerve | Circuit failure | Onset | Clinical symptom

40 50 60 70 80 Age(years old)

Brain's robustness — Reversibility

Disease state progresses 20-30 years before the onset

Optimization of aging in dementia based on cellular senescence and SASP regulation

(Conceptual diagram)

Initial Differentiation

α-synuclein

Pathophysiological branching — Tau TDP-43 — Cancer pathology Cell proliferation

Pathological layer branching — amyloid-β

Pathology A (Alzheimer)

Pathology B (Parkinson)

Pathology C (Frontotemporal dementia)

Predictive model