


Multidimensional analysis of memory mechanisms - nm to mesoscale / msec to days

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	Project Information	Project Number : 22K21353 Project Period (FY) : 2022-2028 Keywords : memory, synaptic plasticity, neuronal circuit

Purpose and Significance of the Research

We can recall experiences of an event even years later. This property of memory has fascinated many scientists. To understand memory, it is necessary to understand the phenomenon across scales, from nm to cm on the spatial axis and from milliseconds to days on the temporal axis. To this end, seven Japanese laboratories and institutions in France and the U.S., which share a common interest in elucidating the principles of brain operation centering on memory, will come together to promote research under a title of "Multidimensional analysis of memory mechanisms - from nm to mesoscale /millisecond to day scale".

The Japanese team includes senior researchers who are currently at the forefront of their field and young researchers in their 40s who are expected to be active in the future but who have extensive international experience. The IINS is the world leader in nm-level analysis of synapses, while the MPFI is highly regarded for its work in systems neuroscience and behavioral neuroscience.

By bringing young researchers together, they will not only collaborate with each other, but will also engage in brain circulation. By bringing laboratories that share common interests but complement each other with unique approaches under one umbrella, we expect synergistic effects, scientific contributions to the field, and global influence. Thus, expanding this collaboration to a new level will undoubtedly continue to have a global impact. Thus, this proposal establishes a powerful platform for mixing technologies, ideas, and researchers to catalyze the creation of new research directions and the development of the next generation of researchers.

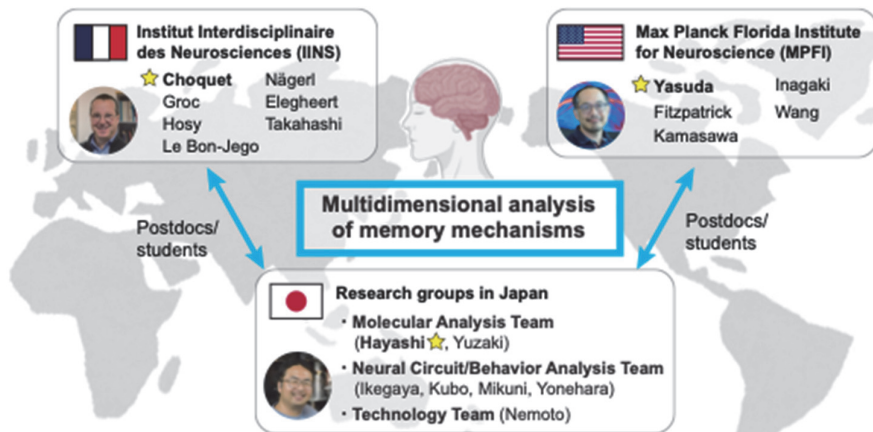


Fig. 1 Scheme of International Collaboration

Organization of the Project Team

Based on the current status and future prospects of memory research, the proposal reflects the multidimensionality of memory, with the spatial axis ranging from nm to meso-scale and the temporal axis from msec to days. The seven laboratories are divided into teams: the molecular analysis team (Hayashi and Yuzaki), the circuit and behavioral analysis team (Ikegaya, Kubo, Mikuni, and Yonehara), and the technology development team (Nemoto). The Molecular Analysis Team will focus on nanoscale molecular mechanisms of synaptic plasticity, while the Circuit and Behavior Analysis Team will provide new molecular analysis techniques. The Neural Circuit and Behavior Analysis Team will analyze the reorganization of neural circuits associated with memory, focusing on synaptic plasticity, while providing ideas for useful probes and manipulation techniques to the Molecular Analysis Team.

IINS has 14 PIs and a total of 150 members, including Daniel Choquet. MPFI, led by Ryohei Yasuda and Fitzpatrick, has eight PIs and about 80 staff.

While these three teams pursue their own research, they also take advantage of the framework of international leading research to interact with domestic and overseas centers to strongly promote new technological development and research.

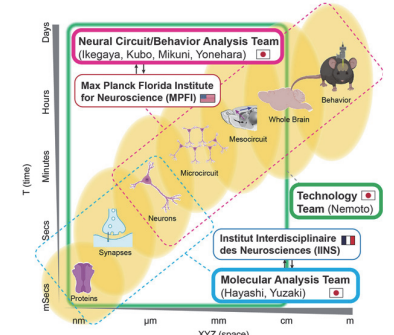


Figure 2. Collaborative Scheme

Plan for Fostering Early-career Researchers

Each year, 2-3 long-term fellows selected from students and post-doctoral fellows from participating laboratories will be dispatched or accepted for two years. A few short-term (six-month) fellows are also dispatched or accepted each year. For doctoral students, we will ensure that they can take courses required for graduation online. Applications will be solicited annually, and selection will be made in consultation with the Steering Committee members. Selection will be based on the applicant's research plan, an interview, a letter of recommendation from the supervisor, and the enthusiasm of the host researcher. At present, the program is designed to last for two years, but it can be extended flexibly according to progress. "Students" here include students, post-doctoral fellows, and non-tenured researchers/faculty members.

Efforts will be made to ensure that students and post-doctoral fellows on the team are employed as independent tenure-track faculty during the project period or beyond and establish independent research programs. Mentors and other senior researchers on the team will be available for advice and consultation on finding employment as tenure-track faculty members in Japan and abroad. Funding for equipment and minimum running costs necessary to set up a laboratory after the researcher becomes independent will be provided. Senior researchers also provide young researchers with access to expensive equipment. The young researcher will receive in-depth mentoring from several senior researchers from the Japanese team and overseas partners during the start-up phase of the laboratory. The mentors and other senior researchers on the team will assist the young researchers in writing papers and grants to help them become scientifically and financially independent.

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