


Deciphering the mysteries of sleep: creating a global network of sleep neurobiologists

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Purpose and Significance of the Research

● Necessity of creating an International Joint Research network

Major objective to organize the International Joint Research we plan is to solve mysteries of sleep, i.e., *raison d'être* of sleep and its regulatory mechanisms, by creating a global network of neurobiologists, with the International Institute for Integrative Sleep Medicine (IIIS) as its core.

Sleep is a behavior that everyone experiences daily and takes up as much as one third of one's entire lifetime. Although desiring to sleep is a fundamental instinct, its functions and mechanisms of regulation remain yet fully uncovered. Sound sleep is essential to maintain physical and mental health. Accumulation of sleep insufficiency, so-called sleep debt, increases risks for depression, obesity/metabolic syndrome, dementia and even cancer. Sufficient sleep is requisite also for efficient daytime performances. A lack of sleep in Japanese working population is the worst among advanced nations, costing the economy up to \$138 billion a year. In order to crack the medical and social problems related to sleep, the fundamental questions about sleep should be answered urgently. To continue our challenge towards the mysteries of sleep, large-scale and long-term supports and commitments are necessary, only by which this multi-center project can be feasible (Figure 1).

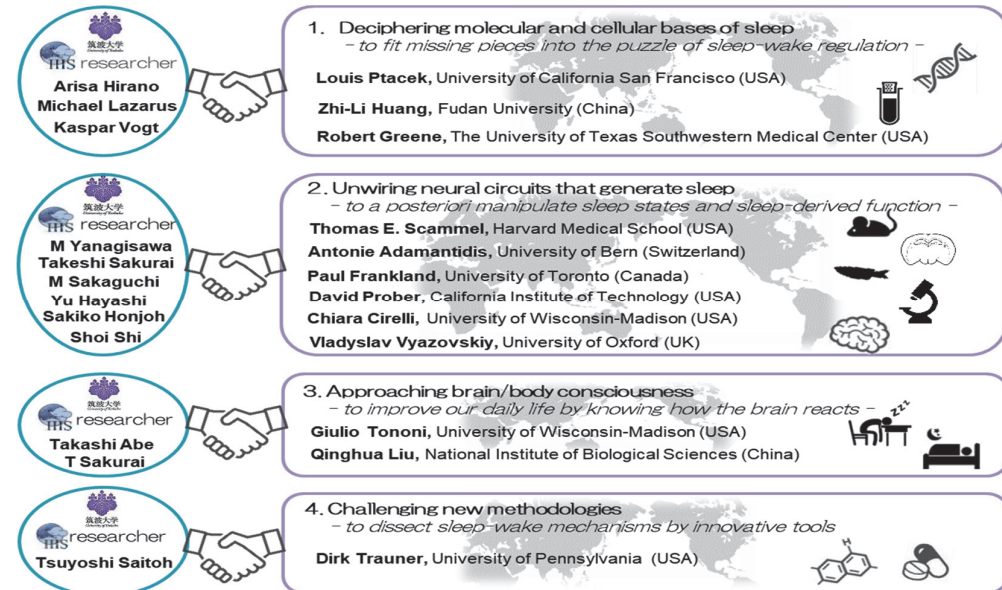


Fig.1 Global network of collaborations in sleep neurobiology

Organization of the Project Team

● Participating overseas researchers and their roles

In order to solve these mysteries of sleep, i.e., to answer the questions stubbornly resisting scientists' challenges for decades as well as the questions newly generated by our recent findings, we plan to construct an international research team collecting all required expertise of the global community of sleep science. Figure 1 shows the planned global network of joint research between PIs in IIIS and their overseas partners in the collaboration. The joint research would be comprised of 4 regions of neurobiology, i.e., i) molecular and cellular neurobiology, ii) neural circuits and systems neurobiology, iii) cognitive and behavioral neurobiology, and iv) chemical neurobiology, to address the questions at the multiple levels of subjects, such as genes, proteins (neuropeptides, receptors, kinases, phosphatases, adaptors, transcription factors, etc.) signal transduction pathways, cells (neurons, glia, etc.), neural circuits in and between nucleus and regions in the brain, behaviors, chemical probes and drugs. The multi-layered International Joint Research network will be conducted by vigorous exchanges with young researchers sent to overseas partners, while IIIS encourages frequent visits by them to our weekly work-in-progress meetings and annual symposia in order to facilitate our collaborations to expand scopes of our studies and achieve our goals.

Plan for Fostering Early-career Researchers

● Outline of international exchange promotion

(i) Each year up to 4 young researchers will be newly sent to overseas counterpart research teams after 2023. In 2022, young faculty members (co-Is) may pay a short visit to candidate labs to prepare exact research plans for the joint research. Young researchers who intend to join the candidate labs will receive interviews via online and decide which lab would be suitable for their further skill/knowledge development.

(ii) In the second year (2024), 8 researchers should be working on research projects in overseas, then in 2025 the total number of young researchers abroad would be at maximum 12 who would implement the long-term exchange. However, some of 12 researchers may return to Japan after 1.5 - 2.5 years. In case of shortening their stay, both mentors (Tsukuba side and overseas partners) consider the next candidate to avoid delaying/discontinuing the joint research.

(iii) PhD students are allowed to make a short visit (up to a few months) to any overseas counterpart research teams for future collaborations, although the number and duration of stay might be limited due to the cost required in specific years. During next years, already 23 young researchers are willing to participate in the program (Fig. 2).



Fig.2 Brain circulation plans with the world-leading teams