Seminar For Brain Sciences

Date: 2nd December (Friday 3PM - 4PM)
Place: Health and Medical Science Innovation Laboratory 8th Floor
University of Tsukuba

12月2日（金）午後3〜4時
筑波大学医学エリア・健康医科学イノベーション棟 8階講堂

Seminar 1 (3PM-3:30PM)

Dr. Stuart Hameroff (University of Arizona, Anesthesiology & Psychology)
“Enigma of consciousness”

Abstract
Consciousness is the ones awareness for its own environment or something within oneself. It can be defined as sentience, awareness, subjectivity, the ability to experience or to feel, wakefulness, having a sense of selfhood, and the executive control system of the mind. The challenge of consciousness is uniquely curious. Still the nature of consciousness, the mechanism by which it occurs in the brain and its place in the universe are unknown. Even if consciousness emerges from brain complexity as believed by most scientists, the very existence of the phenomenon of self-awareness remains a deep mystery. The title of this lecture also suggests that self-awareness involves developments beyond mind; some lower animals can have “minds” but apparently lack a sense of “self.” In other words, lower animals probably have “primary consciousness,” an awareness of their current environment. They may, however, lack the “higher consciousness” of higher animals, that is, those with awareness of self and its relation to the past, present, and future. If this distinction is indeed valid, just where do we draw the line separating higher from lower animals? Most of us think that dolphins, chimps, and dogs are conscious. But to what extent are they conscious and how are humans unique?

Efforts to understand consciousness have evolved in two directions: 1) The brain is a computer, and consciousness emerges from computational complexity among brain neurons. These efforts are driven by ‘brain mapping’, artificial intelligence (‘AI’), and hopes for ‘uploading’ consciousness into silicon. 2) Consciousness is a fundamental feature of the universe, e.g. in panpsychism, Eastern philosophy, Whitehead, quantum physics and cosmology. Some approaches link these two directions, for example the Penrose-Hameroff ‘Orch OR’ theory suggests quantum computations in microtubules inside brain neurons connect brain function to the structure of space-time geometry, the fine scale makeup of the universe. Theoretical underpinnings and experimental evidence supporting Orch OR will be presented. Understanding consciousness would have profound implications in medicine, philosophy and society.

Bibliography
Stuart Hameroff, MD is an anesthesiologist and professor at the University of Arizona who studies consciousness. Focusing on microtubules inside brain neurons, Hameroff teamed with British Physicist Sir Roger Penrose to develop the controversial ‘Orch OR’ theory, linking
consciousness to the fine-scale structure of the universe. Hameroff directs the Center for Consciousness Studies which organizes the well-known conference series ‘The Science of Consciousness’, to be held in Shanghai June 6-9, 2017.

Seminar 2 (3:30PM-4PM)

**Dr. Chi Sang Poon** (MIT, Institute for Medical Engineering and Science)  
“A novel pharmacotherapy for obstructive sleep apnea based on noradrenergic-dependent motor learning”

**Abstract**

Obstructive sleep apnea (OSA), a chronic breathing disorder characterized by repetitive snoring and respiratory arrest and arousal due to blockage of the airway by the tongue during sleep, is a widespread public health problem afflicting ~5% of the general population worldwide with wide-ranging cardiovascular, metabolic, cognitive, and neuropsychiatric sequelae causing decreased quality of life and life expectancy. Current standard of care using a cumbersome breathing machine (CPAP) to keep the airway open during sleep is not tolerated well by many patients. Alternative surgical interventions and a newly FDA-approved electrostimulation intervention are invasive and not suitable for all patients. Currently, no effective pharmacotherapy is available as a treatment option for OSA.

In this talk, OSA is presented as a special case of impaired motor learning and memory precipitated by noradrenergic withdrawal, a sleep state-dependent condition which causes general atonia of virtually all skeletal muscles – including tongue muscle. As a potential therapy, disinhibition of central noradrenergic neurons with an α2-adrenergic antagonist during rapid-eye-movement sleep is shown to effectively restore tongue muscle tone and long-term facilitation of rhythmic breathing-related tongue muscle activity, a novel form of motor learning and memory which protects against OSA. Classical α2-blockers such as yohimbine have long been used as purported herbal supplement for the treatment of various ailments with minimal cardiovascular and other side effects. Therefore, α2-blockers provide a druggable strategy which could potentially transform the management of patients with OSA, in a manner analogous to how β-blockers have transformed the management of patients with hypertension and heart failure.

**Bibliography**

Chi-Sang Poon received the B.Sc. (Eng.) degree in electrical engineering from University of Hong Kong in 1975, the M.Phil. degree in bioelectronics from the Chinese University of Hong Kong in 1977, and the Ph.D. degree in bioengineering from the University of California, Los Angeles in 1981. He was Visiting Scientist at Biologie Fonctionnelle du Neurone, CNRS, France, in 1994. He is currently Principal Research Scientist, Institute for Medical Engineering and Science, Massachusetts Institute of Technology. He is on the Editorial Board of *Behavioral and Brain Functions* and *Frontiers in Neuromorphic Engineering*. Dr. Poon is a Fellow of the IEEE and Biomedical Engineering Society.

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