College of Science and Engineering

Department of Biomedical Sciences

Seminar

Memory Encoding in the Brain

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Mechanisms of Sensory Learning in the Cortex

Dr. Geoffrey Lau

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Date: 11 December 2017 (Monday)

Time: 12:00 nn – 1:30 pm (Reception with light sandwiches at 11:45am, talks start at 12nn. To facilitate the order of sandwiches, please register through email chchung33@cityu.edu.hk.)

Venue: B6605, Academic 1, City University of Hong Kong

Two Presentations of 30 min each, followed by a 30 min discussion on collaboration activities

Learning and Memory

1. Memory Encoding in the Brain

We investigated whether visuoauditory association can be artificially implanted in rodents and then retrieved in a behaviorally relevant context. Rats were trained to approach the left or right hole of a behavioral apparatus to retrieve a reward depending on the side of electrical stimulation of the auditory cortex (EAC) they received and mice were fear-conditioned to EAC. Next, an irrelevant visual stimulus (VS) was repeatedly paired with EAC in the presence of cholecystokinin (CCK) or with activation of terminals of entorhinal CCK neurons in the auditory cortex. In subsequent behavioral testing with VS, rats approached the hole associated with reward availability and mice showed a freezing response to the VS. A CCK antagonist blocked the establishment of visuoauditory association, whereas a CCK agonist rescued the deficit of association. Our findings provide a scientific foundation for "memory implantation" and indicate that CCK is the switching chemical for formation of visuoauditory association.

Biography

Prof. He obtained a B.Eng. and M.Eng. degree in Engineering at the Harbin Institute of Technology, a Doctoral Degree in Medical Science at the University of Tokushima, and a second Doctoral Degree in Engineering at the University of Tokyo, Japan. Before joining the Department in September 2013, Prof. He had worked at RIKEN (Japan), University of Tokushima, and Advanced Research Laboratory of HITACHI Ltd altogether for 5 years, and The Hong Kong Polytechnic University (PolyU) for 15 years.

Prof. He combines electrophysiological, anatomical, and engineering approaches to answer fundamental questions of hearing, and learning and memory. Prof. He's lab has focused their energy on investigating the mechanism of memory encoding in the neocortex. Besides Neurobiology, Prof. He has developed an electronic "bat ear" for people with visual impairments and a "motolink" for bypassing the spinal cord injury. Prof. He is directing a collaborative team between CAS and CityU for developing a memory drug.

Seminar

2. Mechanisms of Sensory Learning in the Cortex

Sensory learning in the brain involves two different processes that are seemingly at odds with each other: breaking down the stimulus into features and building percepts by linking features and value. Although sensing and learning can occur in separate brain areas, recent studies challenge this notion by showing that odor features such as identity, concentration, and value are multiplexedly represented in the same brain region: the primary olfactory cortex. How are neurons and circuits wired up to extract distinct odor features in the same brain region? In layer 2 of the anterior piriform cortex (APC), one of the largest regions of olfactory cortex, our group and others have recently identified two main principal neurons that differ in input and output connectivity patterns: semilunar (SL) and superficial pyramidal (SP) cells. SL cells are better activated by direct sensory inputs while SP cells are preferentially activated by associative inputs. Hence, SL and SP cells are parallel output channels that extract and represent different odor features. However, the neural mechanisms that gate the activation of SL vs. SP cells are unclear. We propose that GABAergic interneurons differentially gate neural activity of SL vs. SP cells, thereby separating the features into these two channels. In this seminar, I will discuss our ongoing efforts in identifying the inhibitory circuits that mediate perceptual learning in the primary olfactory cortex.

Biography

Dr Lau received his Bachelor of Technology degree (Biomedical Science) with First Class Honours from the University of Auckland in 2001. He received his Master of Science in 2004 and PhD in 2007 from the Albert Einstein College of Medicine (New York) under the guidance of Suzanne Zukin and Michael Bennett. His graduate thesis work focused on the cellular and molecular mechanisms of glutamate receptor regulation in synaptic plasticity. Having attended the Neural Systems and Behavior at Marine Biological Laboratory, Woods Hole, Dr Lau decided to pursue systems neuroscience research in the lab of Venkatesh Murthy at Harvard University. His postdoctoral work surrounded the theme of genetic regulation of homeostatic plasticity at the synaptic and circuit level. In recognition of Dr Lau's work, he received a NARSAD Young Investigator Award in 2010. His teaching of an undergraduate tutorial entitled "Synapses: molecules, networks and behavior" earned him a Certificate of Distinction in Teaching from Harvard in 2014. His research work has garnered more than 1100 citations (Google Scholar). Dr Lau joined CityU as an Assistant Professor in March 2016.

**** All ARE WELCOME ****

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