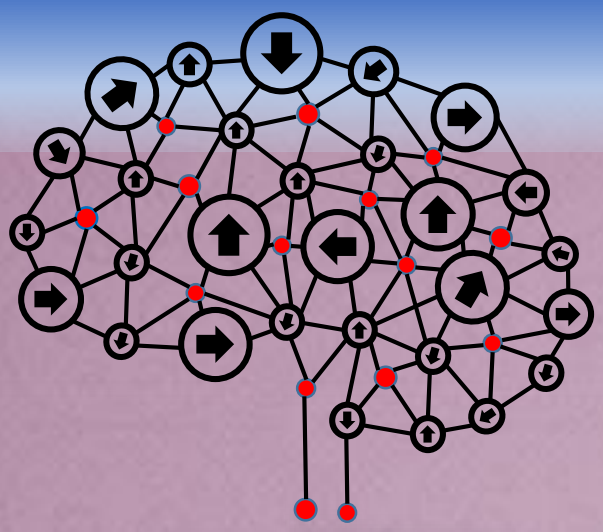
# Memory Network Programme

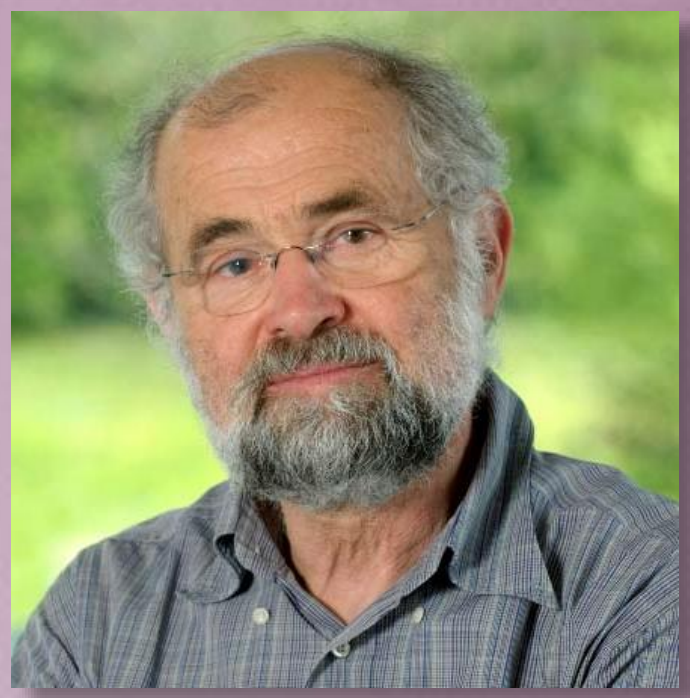


## Mini Symposium

## Plenary Lecture by



# Nobel Laureate



## Department of Physiology

Integrating the Life Sciences
PHYSIOLOGY
National University of Singapore

24 May 2016
1.00 p.m.
Centre for Life Sciences Auditorium

## Professor Erwin Neher

*Max Planck Institute for Biophysical Chemistry, 37077 Goettingen, Germany*

### Modulation of Short-Term Plasticity and Post-tetanic Potentiation at the Calyx of Held Synapse

Short-term plasticity is highly modulated by second messengers, such as Ca++ and diacylglycerol (DAG). Many well-studied forms of modulation act via changes in Ca++-currents. Some forms of modulation, however, such as induced by phorbol ester (mimicking the effect of DAG) and post-tetanic potentiation (PTP), increase both synaptic strength and Short-Term-Potentiation (STP) with little change in Ca++-currents. Here, it is shown, that both PTP and modulation by PdBu share important properties with each other, as well as with natural heterogeneity between individual synapses. These are: i) increased EPSC-amplitude going along with stronger depression, ii) Disappearance of differences and potentiation within a few EPSCs during high-frequency stimulus trains, and iii) conversion of short-term depression into paired-pulse facilitation by a few conditioning stimuli at low frequency. These features are conveniently explained by a simple model, which posits, that at rest a small fraction of vesicles is in a 'superprimed' state with high release probability (around 0.4), while the majority of vesicles are normally primed with release probability of about 0.08. Modulation comes about through variations in the proportion of superprimed vesicles. The explanation of the kinetic features of STP-modulation requires that normal priming is fast (200 to 500msec), while superpriming is slow (seconds range), being modulated in its on-rate by [Ca++] and other modulatory signal pathways. Superprimed vesicles mediate enhanced synaptic strength at the onset of burst-like activity, the impact of which is subject to modulation by slow transmitter systems.

Erwin Neher has been Director of the Membrane Biophysics Department at the Max Planck Institute for Biophysical Chemistry in Goettingen, Germany from 1983 to 2011. He received his Ph.D. in Physics from the Institute of Technology in Munich and did postdoctoral research in the Physiology Department at Yale University. In 1989 he spent a sabbatical at the California Institute of Technology. His research interests have focused on studies of ion channels and neuronal signaling. More recently he concentrated on mechanisms of hormone- as well as neurotransmitter-release and synaptic plasticity.

For his develo p.m.ent of the patch clamp technique for recording of ion channel activity he received the 1991 Nobel Prize in Physiology or Medicine (together with Bert Sakmann). He is a member, or foreign member, of several national and international academies, among them the National Academy of Sciences (USA), and the Royal Society, London. In 2005 he was awarded the title 'Einstein Professor' by the Chinese Academy of Sciences.

## Host: Professor Soong Tuck Wah

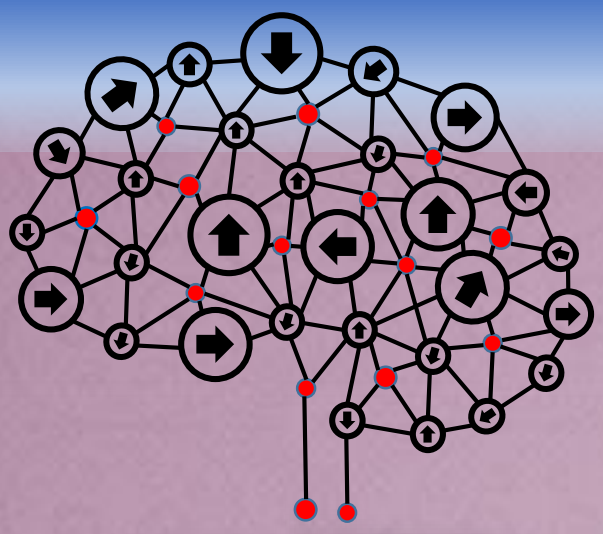
NUS National University of Singapore | Department of Physiology Yong Loo Lin School of Medicine

NUS National University of Singapore | Life Sciences Institute

NUHS National University Health System

# Memory Network Programme

## Mini Symposium



24 May 2016
11.30 a.m. – 5.00 p.m.
Centre for Life Sciences Auditorium

## Department of Physiology

11.30 a.m. - 1.00 p.m. - *Registration and lunch*

1.00 p.m. - 1.05 p.m. - Introduction
Professor Soong Tuck Wah, *Co-ordinator, Memory Network Programme, HoD, Department of Physiology, NUS.*

1.05 p.m. - 2.00 p.m. - **Modulation of Short-Term Plasticity and Post-Tetanic Potentiation at the Calyx of Held Synapse**
Plenary Lecture by Professor Erwin Neher, *Nobel Prize in Physiology or Medicine (1991), Max Planck Institute for Biophysical Chemistry, Goettingen, Germany*

2.00 p.m. - 2.20 p.m. - **Fine tuning of synapses by dopaminergic D4 receptors and its implications in synaptic plasticity**
Dr. Sheeja Navakkode, *Ion Channel and Transporter Laboratory, Department of Physiology, NUS.*

2.20 p.m. - 2.40 p.m. - **Expression and function of synaptic genes in microglia**
Dr. Parakalan Rangarajan, *Department of Anatomy, NUS.*

2.40 p.m. - 3.00 p.m. - **Plasticity and associativity: New insights from CA2 hippocampal pyramidal neurons**
Dr. Sajikumar Sreedharan, *Synaptic Plasticity and Memory Lab, Department of Physiology, NUS.*

3.00 p.m. - 3.30 p.m. - *Tea Break*

3.30 p.m. - 3.50 p.m. - **Medial septum in experimental neuropathic pain**
Dr. Mohammed Zacky Ariffin, *Neurophysiology Lab, Department of Physiology, NUS.*

3.50 p.m. - 4.10 p.m. - **The road less travelled, the hippocampus, and spatial navigation**
Dr. Cullen Owens, *Singapore Institute for Neurotechnology (SiNAPSE), NUS.*

4.10 p.m. - 4.30 p.m. - **Bayesian model reveals latent atrophy factors in Alzheimer's Disease with dissociable preclinical and clinical trajectories**
Dr. Thomas Yeo, *Singapore Institute for Neurotechnology (SiNAPSE), NUS.*

4.30 p.m. - 4.35 p.m. - Concluding Remarks by Professor Soong Tuck Wah.

Organizing Committee:
Dr. Sajikumar Sreedharan & Dr. Thomas Yeo, Memory Network Programme

NUS National University of Singapore | Department of Physiology, Yong Loo Lin School of Medicine
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