We are pleased to invite you to the next IST Lecture, which will take place on the IST Austria campus and online.

Abstract

Chemical synapses – the fundamental units for neural information processing – change their strength during repetitive use in a synapse type-specific and activity-dependent manner. Such modifications can occur on several time scales and are held to underlie memory formation and adaptive learning. Glutamatergic synapses display large heterogeneity in initial strength and short-term plasticity (STP), even for a given type of connection. Such heterogeneity has recently attracted great attention due to the recognition of its importance for maximizing the capacity of information processing of neuronal networks. We analyzed a large set of data from the Calyx of Held Synapse, using a combination of non-negative tensor factorization (NTF) and conventional kinetic modelling. We found that both basic synaptic properties and STP, including their heterogeneity, can be reproduced by a simple kinetic scheme for synaptic vesicle (SV) priming and fusion, which distinguishes between two sequential and reversible steps of priming (the buildup of the release machinery) and a final step of SV fusion. Surprisingly, such an analysis indicates that functional heterogeneity among synapses is not primarily due to variability in release probability. Rather, differences between synapses are caused by the relative abundance of SVs equipped with a mature release machinery. We conclude that traditional analysis methods for determining the size of the so-called ‘Readily-Releasable Pool’ of SVs and their, Release Probability’ do not necessarily report the fusion probability of SVs with a mature release machinery. Such estimates rather reflect both fusion probability and the distribution between mature and immature states of the release probability, thereby blurring the distinction priming and exocytosis. Our approach holds promise for a better mechanistic dissection of the presynaptic proteins in the sequence of SV docking, two-step priming, and AP-induced fusion. We hypothesize that heterogeneity in both synaptic strength and STP is largely due to the influence of modulatory domains of the priming protein Munc-13.
research into basic cell function and for the development of the patch-clamp technique, a laboratory method that can detect the very small electrical currents produced by the passage of ions through the cell membrane.

Neher earned a degree in physics from the Technical University of Munich and then attended the University of Wisconsin at Madison, where he obtained a master of science degree in 1967. From 1968 to 1972 Neher did graduate work and postdoctoral work at the Max Planck Institute for Psychiatry, Munich. He first developed the idea of the patch-clamp technique in his doctoral thesis and earned a Ph.D. from the Technical University of Munich in 1970. (Britannica, 2022)

Registration

To register for attending in the Raiffeisen Lecture Hall (limited capacity!), click here.

To register for the online stream, click here.

Refreshments will be served after the lecture.

Coronavirus: 3G policy for the Raiffeisen Lecture Hall

Entry to the Raiffeisen Lecture Hall is only possible with a valid 3G certificate (vaccinated / tested / recovered). Please have your certificate at hand. Nonetheless and in the light of recent developments, such policy might be lifted soon.