



## Lecture

# ISTA Lecture: Erwin Neher

## Erwin Neher

Max Planck Institute for Multidisciplinary Sciences

Host:

We are pleased and proud to invite you to our first ISTA Lecture in 2022 with our special guest, the Nobel Prize laureate Prof. Dr. Dr. h.c. Erwin Neher. 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 priming states under resting conditions, thereby blurring the distinction priming and exocytosis. Our approach holds promise for a better mechanistic dissection of the roles of various presynaptic proteins in the sequence of SV docking, two-step priming, and AP-induced SV 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. About Erwin Neher: Erwin Neher, (born March 20, 1944, Landsberg, Germany), German physicist who was a corecipient, with Bert Sakmann, of the 1991 Nobel Prize for Physiology or Medicine for their 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) How to get herePublic transportation. By showing the invitation to this lecture, participants can use the ISTA Shuttle (Bus #142) from Heiligenstadt for free. Depart from the Heiligenstadt bus stop at 15:57 and arrive at 16:24. Please see the shuttle timetable. Private transportation. Parking options for the lecture will be communicated via email to registered participants. Coronavirus: 3G policy for the Raiffeisen Lecture HallEntry 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. REGISTRATIONClick here to register for the attendance in the Raiffeisen Lecture Hall (limited capacity!). Refreshments will be served after the lecture.

**Thursday, March 17, 2022 05:00pm - 06:00pm**

Raiffeisen Lecture Hall

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