INSIGHT SEMINAR: Synaptic transmission in time and space

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March 13, 2025
12:00 to 13:00
Elements Room

ABSTRACT:
Neurons couple to one another at synapses and can track action potentials firing at 100-1000 times a second. How do synapses fire at these rates with high temporal fidelity? And al o remain robust under high frequency stimulation? To explore membrane dynamics at synapses we are pursuing a genetic strategy using the nematode C. elegans, and validate our findings in cultured rodent neurons using superresolution fluorescence microscopy, time-resolved electron microscopy, and electrophysiology.?

Exocytosis. Synaptic vesicles dock and are poised to fuse with the plasma membrane. Fusi n is initiated by calcium influx into the synapse. The speed of fusion is maintained by ti ht coupling of synaptic vesicles to calcium channels at docking sites 33 nm, so that calc um reaches the fusion site within microsecond

. Endocytosis. Synaptic vesicle proteins and membrane must be recovered after fusing to the synaptic membrane. To capture images of endocytosis in a living organism, we comb ned optogenetics, high-pressure freezing and electron microscopy. We observed that in m use neurons membrane is recycled within 50 to 300 milliseconds after stimulation. This ovel form of membrane recovery is called ultrafast endocytosis, and it allows the synaps s to recover synaptic vesicle components to maintain neurotransmiss

BIO:

Dr. Jorgensen was born and raised in Saratoga, California. He attended West Valley Junio College. In 1979, he received his Bachelor's Degree in Animal Resources from the Universi y of California at Berkeley. Jorgensen returned to UC Berkeley to study centromere function n yeast with Sy Fogel, and then the University of Heidelberg to study hepatitis proteins und r Heinz Schalle

. He initiated doctoral studies in the Department of Genetics at the University of Washington n 1983, characterizing mutations in thÂntennapedia locus of the fruitfly Drosophila melanogaster with Dr. Richard Garber. He received his Ph.D. in 1989. Postdoctoral work wa conducted in H. Robert Horvitz's laboratory at the Massachusetts Institute of Technolog where he started studying the genetic basis of GABA transmission in the nematodeC. elegans. In 1994 Jorgensen established his own laboratory in the Department of Biology a the University of Utah

He is currently a Distinguished Professor in the Department of Biology and an Adjunc Professor in the Departments of Human Genetics and Bioengineering. In 2005, Jorgense was named an Investigator of the Howard Hughes Medical Institute. The goal of h s laboratory is to understand the synapse. The laboratory is employing a genetic approach n the nematodeC. elegans, and validating these studies in the cultured hippocampal neurons from rodents.

Hosted by: Prof. Dr. Michael Krieg