



INSIGHT SEMINAR: Synaptic transmission in time and space

ERIK JORGENSEN

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 also 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. Fusion is initiated by calcium influx into the synapse. The speed of fusion is maintained by tight coupling of synaptic vesicles to calcium channels at docking sites 33 nm, so that calcium 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 combined optogenetics, high-pressure freezing and electron microscopy. We observed that in mouse neurons membrane is recycled within 50 to 300 milliseconds after stimulation. This novel form of membrane recovery is called ultrafast endocytosis, and it allows the synapse to recover synaptic vesicle components to maintain neurotransmission.

BIO:

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

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

He is currently a Distinguished Professor in the Department of Biology and an Adjunct Professor in the Departments of Human Genetics and Bioengineering. In 2005, Jorgensen was named an Investigator of the Howard Hughes Medical Institute. The goal of his laboratory is to understand the synapse. The laboratory is employing a genetic approach in the nematode *C. elegans*, and validating these studies in the cultured hippocampal neurons from rodents.

Hosted by: Prof. Dr. Michael Krieg