Jon Sporring

Statistical analysis of synaptic vesicles in electron microscopy images

Joint with Mahdieh Khanmohammadi, Rasmus Waagepetersen, Nicoletta Nava, Jens Randel Nyengaard, and Sune Darkner

Synaptic vesicles are small objects inside neurons, which store and transport neurotransmitters. Communication between two neurons may occur, when vesicles inside one neuron move to specialised sites on the cells outer membrane, called the active zone, fuse with the membrane, release the neurotransmitter in the synaptic gab between two neurons, and finally, when the neurotransmitter enters the second neuron through receptors.

We have investigated statistical properties of synaptic vesicles density and shape in both serial section transmission electron microscope images (sstem) and focussed ion beam scanning electron microscopy images (fib-sem) for model animals under various conditions. Sstem is particularly challenging, since the 3 dimensional structure of the neuron has to be reconstructed from the individual, manually handled sections.

We have found that 1) the distance to the nearest point on the active zone appears to be a useful parameter for modelling vesicle parameters; 2) the distribution of vesicles near the active zone is clearly influenced by stress in the model animals; 3) 3 dimensional reconstruction of sstem images makes this difference more clear when compared to traditional 2 dimensional analysis; 4) vesicles are on average oblate in shape with the short axis perpendicular to the direction to the active zone.