DANDRITE
Danish Research Institute of Translational Neuroscience
Nordic EMBL Partnership for Molecular Medicine

AARHUS UNIVERSITY

DANDRITE Lecture

Tuesday 17 April 2018
at 11:00 – 12:00

Aarhus University, building 1170, auditorium 6 (room 345)

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Lecture on "Revealing the neural code: Linking single-photon signals to neural spikes and behavior in mice and men"

Correlating neural circuit function with behavior is a pivotal goal in neuroscience. This is difficult because of the complexity of neural circuits and the computations relevant for behavior. The mammalian retina at visual threshold offers an exceptional opportunity to overcome these challenges, since the circuits processing signals originating from single photons are well defined. Our aim has been to attack two major unresolved questions at the sensitivity limit of vision: First, how behavioral performance depends on retinal output signals. Second, what neural mechanisms limit and/or allow retinal signals and behavior at the sensitivity limit.

A transgenic mouse line allowed us to separate the two primary retinal outputs: ON and OFF pathways, carrying information on photon absorptions as increases and decreases in spiking, respectively. We measured the sensitivity limit of mouse rods and ON and OFF retinal ganglion cells, and correlated these results with visually-guided behavior. We show that behavioral decisions rely only on the ON pathway even when the OFF pathway would allow higher sensitivity. Paradoxically, behavior does not utilize the maximal information present in the neural spike trains, but rather uses a specific decoding strategy based only on increases in spiking. Finally, we show that these findings on mouse vision allow us to link the sensitivity limit of human vision to the precisely quantifiable ganglion cell signals of the primate retina.

Host: Group Leader Keisuke Yonehara, DANDRITE, Dept. of Biomedicine, Aarhus University