Introductory Remarks to Symposium 36

Neuronal representation of space, directions and goals in insects and vertebrates

Hannah Haberkern and Keram Pfeiffer, Wuerzburg

The ability of animals to orient in space is the most fundamental and vital prerequisite for any goal-directed behavior. It is therefore of paramount importance to understand the underlying neuronal mechanisms. Across the animal kingdom, circuits for spatial orientation must support similar computations: 1. They have to hold a representation of the orientation of the animal's head with respect to an external frame of reference. 2. They must provide some measurement of distance travelled and/or velocity. 3. They need to hold a representation of distance and direction of a goal. 4. They have to constantly compare direction and distance of a goal to distance and direction travelled. While the number of neurons in insect and vertebrate brains differ by orders of magnitude, research in recent years has highlighted that the networks that underlie spatial orientation share many functional and anatomical properties between these groups. To deeper explore these commonalities and possible differences in the processing of spatial information in vertebrates and insects, we bring together researchers working on such diverse species as monarch butterflies, fruit flies, zebra fish and mice.

Our selected talks span not only multiple species, but also different stages of processing required for goal-directed navigation. In the first talk, we will learn how goal directions are encoded in the brain of monarch butterflies (Jerome Beetz, University of Wuerzburg, Germany). The second talk explains how the *Drosophila* brain calculates a stable goal direction from stochastic stimuli, like odor plumes (Katherine Nagel, NYU, USA). We then explore how sensory stimuli feed into the corresponding network in zebra fish (Ruben Portugues, TUM, Germany). Next, Eva María Robles Hernández will talk about how remapping of place cells, i.e. the change of firing patterns of place cells in different environments, is affected in a mouse model of Alzheimer's Disease. The final talk illustrates the importance of the interplay between excitatory and inhibitory information in shaping the head direction signal in mice (Adrian Duszkiewicz, University of Stirling, UK). By illuminating different aspects of spatial orientation in a variety of species, we hope to illustrate how comparable behavioral requirements lead to similar neural circuits and processing and to stimulate exchange and collaborations between researchers in the field across species borders.

Symposium 36

Saturday, March 29, 2025
11:30 - 13:30, Lecture Hall 8

Chairs: Hannah Haberkern and Keram Pfeiffer, Wuerzburg

11:30 **Opening Remarks**

11:35 Jerome Beetz, Wuerzburg
NEURAL REPRESENTATION OF SPACE: FROM COMPASS CODING TO SPATIAL GOAL CODING IN INSECTS (S36-1)

12:00 Katherine Nagel, New York, USA
NEURAL CIRCUIT MECHANISMS FOR WORKING MEMORY AND EVIDENCE INTEGRATION DURING OLFACTORY NAVIGATION (S36-2)

12:25 Ruben Portugues, Munich
HOW LARVAL ZEBRAFISH ORIENT AND MOVE IN SPACE (S36-3)

12:50 Eva María Robles Hernández, Berlin
EVALUATION OF CA3 PLACE CELL REMAPPING IN THE APP/PS1 MODEL MOUSE OF ALZHEIMER'S DISEASE (S36-4)

13:05 Adrian Duszkiewicz, Stirling, UK
ORIGIN OF INHIBITORY TUNING IN THE RODENT HEAD-DIRECTION CORTEX (S36-5)