Introductory Remarks to Symposium 36

Transformations of visual representation from the retina to the cortex

Norma Kühn and Helene Schreyer, Leuven (Belgium) and Basel (Switzerland)

Vision is one of the most studied senses. Yet, we are still working to solve the intricate transformations that lead from the light-triggered signals in our photoreceptors to a neural representation of complex scenes in the cortex. In early visual processing, retina, primary visual thalamus and cortex were often studied in isolation, with very different concepts of cell types and visual representation. Anecdotal evidence about their connectedness led to misconceptions of their respective roles. However, recent technological advances allow the simultaneous recording of large populations of neurons and their inputs in the respective areas. Together with sequencing techniques these provide a more complete picture of how information is transformed along this major visual pathway. To embed these results into a coherent framework, dialogue between experts from these areas is essential.

In this symposium, we aim to explore the distinct perspectives and their intersection on cell types, circuits, and visual feature representation to build a coherent model of visual processing in the brain. Questions we aim to address: How are the features extracted by the retina used in the visual thalamus and cortex? How do the representations of visual information change? What are the underlying mechanisms? How are cell types and visual features defined in the respective areas? And what is the significance of a single neuron firing compared to a population when representing visual information?
We will start in the retina, looking at the retinal ganglion cell types and their distinctive projection patterns (G. Schwartz). From there, we turn to efficient coding theories as a tool to understand encoding and transfer of visual information (W. Młynarski). Next, we learn how visual inputs from the retina and colliculus are coordinated in the primary visual thalamus (L. Liang). We will end with exploring the feedforward mechanisms of the emergence of pattern selectivity in the visual cortex (L. Glickfeld) and the role of visual experience in the development of cortical orientation selectivity (S. Trägenap).
With these unique perspectives from the retina, primary visual thalamus, cortex and theory, we hope to stimulate new experimental ideas and analysis for hypothesis testing along this major visual pathway.

Symposium 36

Friday, March 24, 2023
13:00 - 15:00, Lecture Hall 104

Chairs: Norma Kühn and Helene Schreyer,
Leuven (Belgium) and Basel (Switzerland)

13:00 Gregory Schwartz, Chicago, USA
RETINAL GANGLION CELL TYPOLOGY AND PROJECTION PATTERNS IN THE BRAIN (S36-1)

13:25 Wiktor Młynarski, Klosterneuburg, Austria
NUANCES AND REFINEMENTS OF EFFICIENT CODING THEORIES (S36-2)

13:50 Liang Liang, New Haven, USA
CONVERGENCE OF DISTINCT VISUAL STREAMS IN THE MOUSE PRIMARY VISUAL THALAMUS (S36-3)

14:15 Lindsey Glickfeld, Durham, USA
FEEDFORWARD MECHANISMS OF CROSS-ORIENTATION INTERACTIONS (S36-4)

14:40 Sigrid Trägenap, Frankfurt/Main
EXPERIENCE DRIVES THE DEVELOPMENT OF NOVEL, RELIABLE CORTICAL SENSORY REPRESENTATIONS FROM ENDOGENOUSLY STRUCTURED NETWORKS (S36-5)

14:50 **Concluding Remarks**