

CCNM17-CN-107:1: Visual Neuroscience, Course Description

Aim of the course

Aim of the course: The course focuses on the neural mechanisms of visual information processing from the sensory to perceptual aspects to it. It starts with the anatomical foundation of the visual and oculomotor system. It will cover the main cellular pathways from the retina through the thalamus and visual cortex to the higher visual cortical areas, including their associations with different of attributes of the visual scene. Transformation between these stages and the receptive field organization at the retinal, LGN and cortical levels will be discussed. The cortical circuitry of visual cortex will be discussed in anatomical and cellular neurophysiological details. The primary segregation and recombination of color, shape, motion and disparity channels will be introduced. The course puts a special emphasis on the interplay between feed-forward and feedback processes. The difference between V1, V2, V3-V4 and V5 will be correlated with different aspects of visual perception and psychophysics. Retinotopic and spatiotopic representations will be compared. We will review the status of feedback connections to V1. We separately discuss the dorsal stream and ventral stream. Spatial representations in the parietal visual associational areas and object representations in the temporal lobe will be illustrated by key experimental examples. The convergence of higher visual pathways in the temporal lobe and hippocampus will elucidate the relationship between visual processing and visuo-spatial memory. Moreover, the course will cover 'active vision' and the role of the eye movements and oculomotor system. We will devote sufficient time for discussing various disorders of visual information processing: cortical blindness, akinetopsia, achromatopsia, hemiparietal neglect and prosopagnosia in association with the actual topic. The course will conclude with implications about visual consciousness.

Learning outcome, competences

knowledge:

- To ensure students can read articles, understand the methods and interpret results.

attitude:

- is sensitive to and interested in noticing psychological phenomena and problems

skills:

- To provide an overview of traditional and cutting-edge experimental techniques.

Content of the course

Topics of the course

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Learning activities, learning methods

Lectures and interactive discussions

Evaluation of outcomes

Learning requirements, mode of evaluation, criteria of evaluation:

requirements

- attendance
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mode of evaluation: examination

criteria of evaluation

Reading list

Compulsory reading list

- Zeki, S. (1993). A vision of the brain. Oxford ; Boston: Blackwell Scientific Publications.
- Werner, J. S., & Chalupa, L. M. (2013). The New Visual Neurosciences. Cambridge MA: The MIT Press.
- Lu, Z.-L., & Doshier, B. (2014). Visual psychophysics: from laboratory to theory. Cambridge, Massachusetts: The MIT Press.

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Recommended reading list

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