AARHUS UNIVERSITY

CiViA Center for Immunology of Viral Infections

CiViA lecture

" A human stem cell-derived organoid model of the trigeminal ganglion"

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https://humantechnopole.it/en/people/oliver-harschnitz/

Date: Tuesday 25 November 2025, 10:00-11:00

Location: Lakeside auditorium; 1253-211 Merete Barker lecture theatre

Abstract:

The trigeminal ganglion (TG) is composed of peripheral sensory neurons which transmit pain, temperature and touch information from the face to the brain. Developmentally, it originates from an ectodermal population named pre-placodal ectoderm, which is marked by the expression of the transcription factor SIX1, and which gives rise to most of the facial peripheral nervous system. The TG is involved in several human pathologies, such as

migraine and viral diseases, including the establishment of viral latency in trigeminal sensory neurons by herpesviruses. TG-associated pathologies remain poorly understood in part due to a lack of human, scalable in vitro models of the ganglion. Human pluripotent stem cells can be differentiated towards three-dimensional organoids mirroring tissue development, morphology and function, but organoids of the TG are yet to be developed. Here, we developed the first TG organoid (TGO) and characterised its development, maturation and function. Characterisation of TGOs by scRNA-seq and spatial transcriptomics at defined developmental time points highlighted the emergence of distinct sensory neuron and glial subpopulations, which transcriptionally and spatially resembled in vivo TG cells. Importantly, the sensory neurons in TGOs are functional, as they are able to fire action potentials in response to pain and temperature-mimicking stimuli. TGOs thus closely resemble human TG in vivo in their development, cell composition, and function. Furthermore, they are susceptible to neurotropic viruses such as HSV-1 and VZV. They constitute the first human scalable and experimentally tractable system to investigate TG physiology and pathology.

Biosketch:

Oliver Harschnitz is a group leader at Human Technopole at the Centre for Neurogenomics. His research group focuses on the development and application of a wide range of cutting-edge human pluripotent stem cell models to better understand the molecular mechanisms that underlie viral and autoimmune encephalitis and to identify the drivers of chronic inflammation in the brain. As a clinician-scientist, his research is aimed at finding therapeutic targets that may be directly translated to patients who suffer from neuroimmunological disease.

Oliver obtained his medical degree at the University of Maastricht (The Netherlands) in 2009 and completed his PhD in the groups of Leonard van den Berg and Jeroen Pasterkamp at Utrecht University Medical Center (The Netherlands) in 2017, while gaining clinical experience as a neurology resident. During his PhD, Oliver developed human pluripotent stem cell models to study inflammatory neuropathies and motor neuron disease. From 2017 to 2021, he continued his postdoctoral research in the lab of Lorenz Studer at Sloan Kettering Institute (USA) studying host-virus interactions in the central nervous system using human pluripotent stem cell models and forward genetic screens.