For immediate release

Peeking inside ‘mini-brains’ could boost understanding of the human brain in health and disease

Revealing details of the internal structure of ‘mini-brains’ could help accelerate drug studies and may offer alternatives to some animal testing

Geneva, Switzerland, 7 January 2021 – 'Mini-brains’ are pin-head sized collections of several different types of human brain cell. They are used as a tool, allowing scientists to learn about how the brain develops, study disease and test new medicines. Personalized ‘mini-brains’ can be grown from stem cells generated from a sample of human hair or skin and could shed light on how brain disease progresses in an individual and how this person may respond to drugs.

Research published today by a team of scientists and engineers from HEPIA and the Wyss Center for Bio and Neuroengineering, in the journal Frontiers in Bioengineering and Biotechnology, has revealed the detailed internal anatomy of ‘mini-brains’, for the first time.

“Despite advances in growing ‘mini-brains’, it has been difficult to understand in detail what is going on inside – until now,” said Professor Adrien Roux from the Tissue Engineering Laboratory, HEPIA, senior author on the paper.

“Typically, to look inside a ‘mini-brain’, we slice it thinly and view it on a slide under a microscope. This is a slow process that can damage the sample. Now, for the first time, we have produced high resolution 3D images of single neurons within intact ‘mini-brains’, revealing their remarkable complexity,” added Dr Subashika Govindan, lead author on the paper, who carried out the work at HEPIA and is now Wellcome DBT early career fellow at the Indian Institute of Technology Madras (IITM).

The team combined a novel technique for labeling individual neurons with a method to make the whole sample completely transparent.

Leveraging the Wyss Center’s microscopy capabilities, the team developed a state-of-the-art custom module, including a bespoke sample holder and sensitive imaging detectors, for capturing 3D images of entire intact ‘mini-brains’, without slicing them. They were then able to visualize and analyze the 3D morphology of specific neurons and their anatomical distribution inside the ‘mini-brains’.

Dr Laura Batti, Microscopy Facility Manager at the Wyss Center said: “Human ‘mini-brains’ have a life span of more than a year and, with our new ability to visualize them in more detail, we can envision benefits such as reducing some animal testing.”

The new approach could also enable imaging of large numbers of ‘mini-brains’, making it suitable for high-throughput screening for drug discovery or toxicity testing. It is reproducible and cost-effective and could potentially help accelerate personalized medicine studies.

The paper ‘Mass generation, neuron labeling, and 3D imaging of minibrains’ by Subashika Govindan, Laura Batti, Samira F. Osterop, Luc Stoppini and Adrien Roux is published in Frontiers in Bioengineering and Biotechnology. DOI: 10.3389/fbioe.2020.582650

https://wysscenter.ch/updates/peeking-inside-mini-brains-could-boost-understanding-of-the-human-brain-in-health-and-disease

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About HEPIA

Apart from education and training, one of the missions of the HES (Schools of Applied Sciences) is to conduct applied research projects in conjunction with businesses, cultural institutions and health and welfare organisations, as well as research laboratories in their regions. These projects support technology transfers to economic, industrial and institutional partners.

Applied Research and Development (AR&D) activities at HEPIA are organised into four institutes, covering all the main areas of engineering and architecture, to carry out cross-disciplinary research projects.

Applied research also helps enhance the teaching delivered to students. HEPIA plays a flagship role in the development of innovative solutions and technologies and offers experience in practical projects, paving the way to a wealth of fascinating career prospects.

www.hesge.ch/hepia

About the Wyss Center for Bio and Neuroengineering, Geneva, Switzerland

The Wyss Center is an independent, non-profit research and development organization that advances our understanding of the brain to realize therapies and improve lives.

The Wyss Center staff, together with the Center's academic, clinical and industrial collaborators, pursue innovations and new approaches in neurobiology, neuroimaging and neurotechnology.

Wyss Center advances reveal unique insights into the mechanisms underlying the dynamics of the brain and the treatment of disease to accelerate the development of devices and therapies for unmet medical needs.

The Wyss Center was established by a generous donation from the Swiss entrepreneur and philanthropist Hansjörg Wyss in 2014. Additional resources from funding agencies and other sources help the Wyss Center accelerate its mission.

www.wysscenter.ch/

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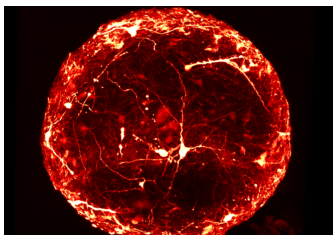
Video

Peeking inside 3D human ‘mini-brains’ to understand the brain https://youtu.be/TZC-LqtsUSM

Original video files are available to download from the Wyss Center on request.

Image downloads



A seven month old 3D ‘mini-brain’ imaged with a confocal microscope to reveal the structure of individual neurons throughout.

Image credit: HEPIA

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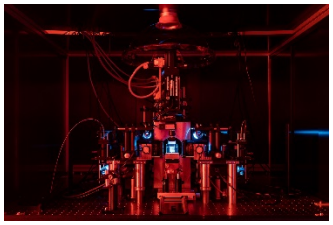

The Wyss Center’s lightsheet microscope

Image credit: Wyss Center

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