Generation of mature human brain organoids for the study of neurodegenerative diseases

Commonly used acronym: *MatBOneurodeg*
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SCOPE OF THE METHOD

The Method relates to	Human health
The Method is situated in	Basic Research, Translational - Applied Research
Type of method	In vitro - Ex vivo
This method makes use of	Human derived cells / tissues / organs
Specify the type of cells/tissues/organs	Human Brain Organoids

DESCRIPTION

Method keywords

HUman brain organoids

adult human brain features

neurodegeneration
Alzheimer's disease

Scientific area keywords

Stem cell methods
Organoids
neuroscience
Biomedicine

Method description

The maturation of the human brain shows species-specific differences of neoteny when compared to lower mammals. This process encompass a time window that expands from late embryonic stages to early adolescence. Major features of brain maturation are the acquisition of phenotypic complex traits such as axonal and dendritic trees and the presence of dendritic spines which correlate with higher functionality and connectivity of the neurons. Interestingly, human transcriptomic data has shown a narrow time window from the birth of the individual to the first two years of life where major transcriptomic changes occur. Here, we address human-specific species features of brain maturation using a multicellular human *in vitro* brain organoid model composed of neurons and glia cell types. Long-term human brain organoids are analysed functionally for the acquisition of mature neuronal phenotypes to understand the time line of maturation compared to the *in vivo* situation. Further, we show that long-term human brain organoids acquire features characteristic of the adult human brain and that they can recapitulate hallmarks of AD *in vitro*.

Lab equipment

- Human stem cell culture facility,

- Bioreactor for the growth of long-term human brain organoids.

Method status

Still in development
History of use

PROS, CONS & FUTURE POTENTIAL

Advantages

This improved method for the generation of long-term human brain organoids recapitulates human brain maturation features including the expression of genes present in the adult human brain.

Challenges

Time is a limiting factor, it requires an extensive amount of time (long-term culture) to achive the expression of mature brain adult features in human brain organoids.

Modifications

Modifications of the system are being tested such as the exposure to extrinsic cues or the modification of intrinsic factors.

Future & Other applications

The generation of an adult human brain organoid model would be instrumental for the study of neurodegenerative diseases in a reductionist manner in a purely *in vitro* set up.

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

References

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Associated documents

Links

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PARTNERS AND COLLABORATIONS

Organisation

Name of the organisation University of Liège (ULiège)

Department GIGA Neuroscience

Country Belgium

Geographical Area Walloon

Coordinated by

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