Astrocytes and neurons generated from induced pluripotent human stem cells derived from psychiatric patients in 3D co-culture.

Cells differentiated from iPSCs can be used to model patient-specific disease mechanisms in vitro, for transplantation to replace lost cells, or for drug screening. This technology is especially crucial for neuroscience research, where brain cells from human patients are not easily obtainable. Thus, human iPSC-derived neurons make an ideal model system for the study of neurological disorders.

Aims

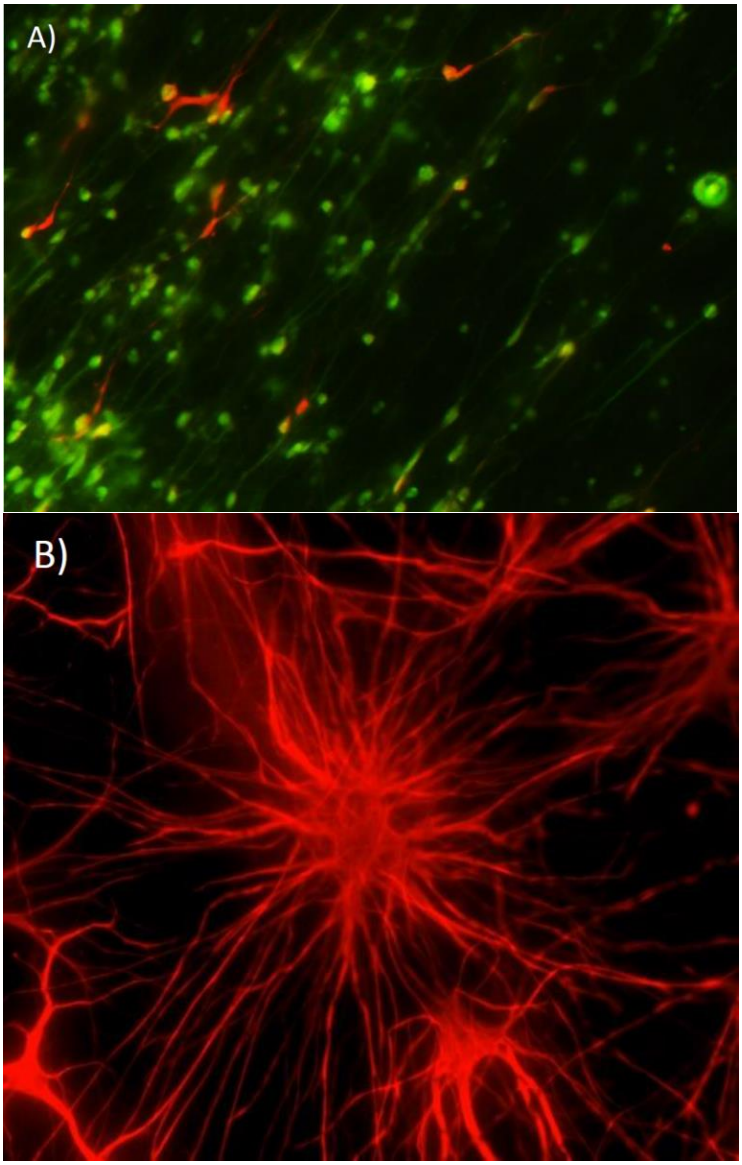
In this case working for a major pharmaceutical company, Cellevate was tasked with helping improve the relevance of their in-vitro models in psychiatric disease research. Therefore, we offered to help create a unique model set out to developed a disease relevant cellular 3D model based on astrocytes and neurons generated from iPSCs.

After creating a broad understanding of the issues our customer had been experiencing, our technical team set out to create an evaluation platform that would address specific issues with a focus on 1. Physiological relevance 2. Specific readouts 3. Useability. Based on these criteria, several types of nanofibrous scaffolds were prepared and evaluated at the customer site in an initial round of testing.

After the first optimization experiments were concluded, the customer chose to proceed with the design they found best related to their needs.

Results

“Neurons and astrocytes matured faster in 3D culture compared to conventional 2D culture and the co-cultures could be maintained for several weeks without affecting cell viability. First stainings indicate that neurons develop a very dense neuronal network and surrounding astrocytes are in close interaction with them. The Cellevate 3D plates provided an efficient matrix for studying neurons and astrocytes in a tissue-like environment.”



A) Neurons stained with MAP2 in green and TH in red after 3 DIV B) GFAP stained astrocyte after long-term culture.

Conclusions

Through collaboration we managed to design a model that not only helped our customer to increase viability, increase the relevance by mimicking the in vivo like features but also adapting the model not to impact the costumers work flow. This project was presented at The XIV European Meeting on Glial Cells in Health and Disease. Although the model is still undergoing further development and optimization the model is currently in use to help the development of novel drugs for neurological diseases.

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