

LS17-037 - Photochemical control of biohybrid matrices to reconstitute nervous system organization from three-dimensional neural organoids

Abstract

A remarkable finding over the last years is that stem cells can be cultured in three-dimensional conditions, such that from random starting points, they can form a highly patterned tissue that closely resembles the tissues we find in our bodies. This is a process called self-organization. We have shown that a single mouse pluripotent stem cell can grow in three-dimensional conditions to form a piece of developing spinal cord with all correct cell types in the correct arrangement. We show that this process involves the diversification of the cells into two types that communicate with each other to come to an appropriate proportion of cell types. Similar cells also adhere to each other as another trait that facilitates this self-organization. We show that the mode of intercellular communication relies on the bone morphogenetic protein family (BMP) and its inhibitors. Cells forming the bottom part of the spinal cord, the floorplate, express BMPs and their inhibitors in a manner that prevents neighboring cells to form the same cell type and eventually further signals from the floorplate actively tell neighboring cells to form motor neuron precursors. We have measured the length scale over which the BMP system acts and what happens when we grow larger tissues.

Scientific disciplines:

Stem cell research (60%) | Tissue engineering (40%)

Keywords:

Neural organoid, PEG scaffolds, photo-chemical modification

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Status: Completed (01.04.2018 – 30.09.2022)

GrantID: 10.47379/LS17037

Further links to the persons involved and to the project can be found under

<https://www.wwtf.at/jpeto2.brunner.at/funding/programmes/ls/LS17-037/>