Open Ph.D. projects

1.

Announcer: Melinda Pirity

Doctoral School: University of Szeged, Faculty of Science and Informatics, Doctoral School of Biology

Title of the research topic: Investigating the role of RYBP in development by embryonic stem cells

Description of the research topic: Ring1 and YY1-Binding Protein (RYBP) is a transcriptional regulatory protein and a central, essential member of mammalian Polycomb Repressive Complexes (PRC1). PRC1 complexes are involved in the formation of the long-term, so-called epigenetic memory of cells. As a result of their operation, during embryonic development, the expression of certain genes ceases, while those necessary for the given developmental stage are activated. This is how first differentiated cells (nerve, muscle, heart, etc.) are formed from the zygote, and hereafter increasingly complex tissues and finally organs arise.
Our group has shown that the function of RYBP is essential for embryo implantation, and for the development of the nervous system. We are looking for a motivated PhD student, who investigates the role of RYBP in neural and cardiac development in an in vitro mouse stem cell system. As a result of the work, it is expected that our knowledge of embryonic development, the formation of neural progenitors, oligodendrocytes, astrocytes and cardiac muscle cells will increase.
The specific goals of the project are: mapping of interactions between Rybp and the target neural genes.
Methods: stem cell cultivation, in vitro differentiation, Western-blot analysis, Fluorescent immunocytochemistry, RNA isolation, Reverse transcription, Real-time PCR.

2.

Announcer: Melinda Pirity

Doctoral School: University of Szeged, Faculty of Science and Informatics, Doctoral School of Biology

Title of the research topic: Establishing self-organizing 3D organoids from pluripotent stem cells

Description of the research topic: The most recently developed organoid model systems enable more accurate investigation of developmental processes. With them, the steps of differentiation, thus the molecular and cellular biological processes leading to healthy and diseased development can be studied in a three-dimensional space. The aim of the project is three-dimensional modelling of the phylogenetically newest part of the cerebral cortex, the neocortex, in a stem cell-based system. The neocortex differentiates into six horizontal layers,

and the formation of these layers can be easily followed in three-dimensional organoid cultures. We are looking for a motivated PhD student who would contribute to the creation of mouse cortical organoids in our laboratory. The long-term goal of the project is to learn about the role of a specific gene in the stratification of the cerebral cortex using these organoid models. This gene has been previously characterised in our laboratory in vivo, in mouse and in two-dimensional stem cell based model systems. The specific goals of the project are: (1) differentiation of wild-type mouse stem cells into cortical organoids (2) creation of cortical organoids from mutant stem cells and examine the stratification of the neocortex (3) comparative studies of wild-type and mutant organoids using cell and molecular biological methods (in vitro differentiation, protein and RNA level analysis, fluorescence immunocytochemistry, microscopic and comparative studies based on OMICs). Methods: stem cell cultivation, in vitro differentiation, Western-blot analysis, Fluorescent immunocytochemistry, RNA isolation, Reverse transcription, Real-time PCR.

3.

Announcer: Melinda Pirity

Doctoral School: University of Szeged, Faculty of Science and Informatics, Doctoral School of Biology

Title of the research topic: Generation of patient specific human induced pluripotent stem cells by reprogramming for the purpose of investigating cardiac ion channel diseases

Description of the research topic: Reprogramming somatic cells to pluripotent state (induced pluripotent stem (IPS) cell technology) brought a breakthrough in personalized medicine and in drug production and toxicology applications. However, the improvement and adaptation of the method to special cases or to different starting cell types still presents challenges. Increasing the efficiency of reprogramming is also currently an intensively researched field. We are looking for a motivated PhD student whose task will be to reprogram somatic cells from patients with heart ion channel disease and from their healthy relatives. We have already successfully adapted a procedure based on gene delivery in our laboratory, creating the prerequisites for subsequent studies in order to differentiate and analyze function of the heart muscle. The specific tasks of the candidate are the following (1) production of patient-specific pluripotent stem cells (2) and to differentiate them to cardiac muscle (3) characterization of cardiac muscle cells formed as a result of differentiation with molecular (e.g. RNA) and cell biology (e.g. immunocytochemistry) methods (3) revealing indicative of pathological processes exploring differences in patient-specific samples
Methods: culture of human stem cells, in vitro differentiation, protein and RNA level molecular and cell biological studies.