Module Number	Title:
4c	**Stem cell based brain organoids**

Module type: compulsory elective	**Language:** English	**Group Size:** 10 students
Study semester: 2	**Availability:** summer semester	**Duration:** 1 semester

Workload: 240 hrs	**Credits:** 8 CP	**Contact time:** 90 hrs	**Independent study:** 180

1 Courses

a) Lectures: 3 SWS
b) Seminar: 1 SWS
c) Practical course: 2 SWS

2 Intended learning outcomes

After completion of this module, students will be to analyse

1. Knowledge on stem cells, pluripotent and induced pluripotent stem cells (iPSCs)
2. 3D *in vitro* models such as human brain organoids
3. Theoretical knowledge on iPSCs and brain organoid generation
4. Principles of neural stem cell biology
5. Theoretical knowledge on brain development and disease modelling using human brain organoids
6. Cellular organelles regulating neural stem cells proliferation and differentiation
7. Handling and culturing of neural stem cells
8. Immunostaining and imaging of stem cells including cancer stem cells
9. Sectioning of human brain organoids, immunostaining and high resolution imaging

3 Content

Lectures:

Historical aspects in development of in vitro models to study human brain development and disorder. Introduction to pluripotent and induced pluripotent stem cells (iPSCs). Generation of iPSCs. Characterization of iPSCs. Generation of human brain organoids. Trends and challenges in human organoids research. Modelling human brain development and modelling neurodevelopmental disorders. Cellular organelles regulating neural stem cell homeostasis. Principles in symmetric and asymmetric cell divisions. Disease modelling of rare disorders. Imaging methodologies.

Practical courses:

Introductions to light microscopy and image analysis. Microscopic examinations of iPSCs and iPSC-derived neural stem cells. Analysis of neural stem cells with various markers. Introduction to culturing iPSCs, neural stem cells and cancer stem cells. Analysis of cellular organelles and their dynamics. Chemical compounds treatments that target cancer stem cells. Introductions to brain organoids handling, imaging and analysis. Image processing and analysis.

Seminar: Short presentation of experimental results at the end of the course. Presentation of selected scientific papers on the relevant topic.

4 Teaching methods

Lectures, seminar and practical courses with accompanying lessons

5 Prerequisites

With regards to content:

Basic knowledge of microscopy, cell biology and neurobiology

6 Examination type:

	1. Presentation (power point / chalk talk) (50 % of total grade) 2. Written examination followed by oral examination (50 % of total grade)
7	**Requirements for award of credit points** Regular and active participation during seminars and practical courses; passing the oral examination prior to each experiment; submission of a report (electronically); final presentation and discussion of experimental results; passing the written examination
8	**Module applicability**
9	**Assessment** The mark given will contribute to the final grade in proper relation to its credits.
10	**Module convenor and main lectures** Prof. Jay Gopalakrishnan, Dr. Anand Ramani, Dr. Arul Mariappan and Dr. Elke Gabriel
11	**Further information** The regular participation in the lectures is strongly recommended. The content of the lectures is prerequisite for the practical and relevant for the written exam.