

Experimental stem cell biology; 2019

kisosbhb18em or bb2n1i21 (for SH students starting in 2017)

Date and location

Mondays, 12:00 – 15:00; 3x45 min lectures, 8 occasions

6-418., seminar room of the Dept. Physiology and Neurobiology

The first lecture will take place on Monday, February 25th, 2019

Lecturers

Katalin Schlett, PhD

Krisztián Tárnok, PhD

Course requirements

Students are required to read at least one scientific paper during the semester for a discussion during the lectures. The exam is an oral one in English, held in the exam period (on request, earlier exam dates are also possible, depending on previous notifications). Hungarian students can also register to the course in case they accept that the language of the course is English. For these students, the oral exam can be taken either in English or in Hungarian, according to the student's preference.

Students will blindly pick one of the exam topics and will have an approx. 15-20 min conversation with the two lecturers. Evaluation is based on the traditional 5-level marking system. The list of the exam topics will be finalized by the end of the course and will depend on the discussed material (see the exam topics for 2018 as an example).

Course Description

The course provides a comprehensive overview on stem cell biology, including fundamental aspects of embryonic and adult stem and progenitor cells, the processes of organogenesis and cellular differentiation especially in the central nervous system as well as relevant research techniques. Reviews and original papers of important contributions from the literature are used as teaching material. Besides presenting the general properties of stem cells in different tissue types, discussed topics include iPSC technologies, the molecular and (epi)genetic control of cell fate specification and differentiation as well as the practical application and therapeutic potential of stem cells in regenerative medicine. Ethical concerns and critical aspects of stem-cell based therapies and regenerative medicine will be also discussed.

Course Topics

#1 Principles of stem cell biology (25 February, 2019)

Concept of stem cells. Hierarchy of stem cell potency and functions in organisms. Basic mechanisms of pluripotency. Regulatory signals influencing “stemness” and self-renewal.

#2 Embryonic stem cells (4 March, 2019)

Early lineage segregation in the mammalian zygote. Origin of embryonic stem cell lines. Comparison of mouse and human stem cell lines. Stem cell derived organoids.

#3 Reprogramming pluripotency – the iPSC saga (11 March, 2019)

Generation of induced pluripotent stem cells (iPSC) – the classic methodology. The

Yamanaka-factors. Experimental breakthroughs and limitations – recent reprogramming protocols and direct (chemical) conversion. Applications for iPS cells: disease modeling and drug discovery – an overview. Generation of specific neuronal subtypes (excitatory cortical neurons, GABAergic neurons, dopaminergic neurons, motor neurons, etc.).

#4 Stem cells and niches (18 March, 2019)

Overview of stem cell niche theory. Similarities and tissue specific differences in stem cell microenvironments. Comparison of skin, hair follicle, intestinal and muscle stem cell niches.

#5 Stem cells within the developing and adult brain (25 March, 2019)

Embryonic development of the mammalian CNS. Characterization of embryonic neural stem cells. Neurogenic niches in the adult brain, adult neuronal stem cells.

#6 Stem cell therapies in CNS diseases I. Visual restoration (01 April, 2019)

CNS-specific considerations of regenerative medicine and stem cell based therapies. Controversial source of cells; copyright and patent issues. Stem cell banks or patient-specific applications? Stem cell based therapies and clinical trials to restore visual functions.

#7 Stem cell therapies in CNS diseases II. Parkinson and metabolic diseases (08 April, 2019)

Use of stem cells for cell replacement, regeneration or enzyme replacement therapies. Cell sources, different attempts and clinical trials to treat Parkinson's disease. International efforts.

#8 Stem cell therapies in CNS diseases III. Spinal cord injury, ALS and other motor coordination diseases (15 April, 2019)

Use of stem cells for cell replacement, remyelination, regeneration or enzyme replacement therapies. Stem-cell based attempts to cure acute and chronic spinal cord injuries. Possible therapies to treat Parkinson's disease, ALS, Batten disease or Duchenne muscular dystrophy.

Course materials & Recommended readings:

All lecture slides and supplementary materials will be available on the course website for the registered students: <http://physiology.elte.hu/ossejt.html>. **Password for the course material will be announced via Neptun to the registered students.**

There is no textbook on this topic. Basic information about stem cells is available on NIH website (<https://stemcells.nih.gov/info/basics/1.htm>).

For online source we recommend the *StemBook* and recent review papers discussed during the lectures. Stem Book is an open access collection of invited, original, peer-reviewed chapters covering a range of topics related to stem cell biology and written by top researchers in the field at the Harvard Stem Cell Institute and worldwide. StemBook can be accessed at <http://www.stembook.org>.