DEPARTMENT OF CELL AND MOLECULAR BIOLOGY

C5F3107, CNS Injuries and Repair, 2 credits (hec)

CNS-skador och reparation, 2 högskolepoäng

Third-cycle level / Forskarnivå

Approval

This syllabus was approved by the The Committee for Doctoral Education on 2023-11-27, and was last revised on 2024-02-19. The revised course syllabus is valid from autumn semester 2024.

Responsible department

Department of Cell and Molecular Biology, Faculty of Medicine

Prerequisite courses, or equivalent

The course targets PhD students and postdocs interested in regenerative medicine applied to the central nervous system (CNS).

Purpose & Intended learning outcomes

Purpose

The goal of this course is to enable doctoral students and postdocs to accurately identify and understand the cellular mechanisms activated by lesions to the central nervous system. It aims to deepen their knowledge of state-of-the-art methodologies for studying these mechanisms and the current landscape of regenerative therapy development. Participants will be trained to critically assess and integrate the latest research findings and methodologies into their scholarly work to contribute effectively to the advancement of regenerative neuroscience.

Intended learning outcomes

Upon successful completion of the course, the doctoral students can describe molecular and cellular mechanisms of injury response and the limitations of endogenous regenerative responses in the adult mammalian central nervous system. The participants will be familiar with the novel approaches to study CNS development, injury response and regeneration, with a focus on neural stem cells, molecular regulation of cell identity and injury response, single cell and spatial genomics and strategies to manipulate the regenerative response of resident cell populations.

The participants can relate injury responses to their potential use in regenerative medicine. The participants will be able to discuss and critically evaluate different regenerative strategies to repair central nervous system lesions, from basic research to potential clinical applications.

Course content

The lectures will include the following topics. Molecular and cellular mechanisms of injury response, following lesions to the central nervous system. Scientific approaches and technologies taken in the study of injury responses, including presentations by leaders in the field about state of the art experimental models. Experimental strategies in regenerative medicine: stem cells and reprogramming. Potential for development of regenerative therapies.

Forms of teaching and learning

Each team will receive a specific central nervous system lesion topic (medical problem case) and will be assigned specific mandatory literature some weeks before the start of the course. Initial self-study and work in the team (corresponding to 2 days), interactive lectures of international experts in the field of central nervous system regenerative medicine, small group discussions, poster presentations and discussions (5 days on site). The initial self-study work in teams will consist of an assigned reading task regarding the course literature and discussion of an injury-regenerative strategy case. During the course the students will discuss their questions, the implications of the case and they will work on their presentations.

Language of instruction

The course is given in English

Grading scale

Pass (G) /Fail (U)

Compulsory components & forms of assessment

Compulsory components

Active participation in the initial project work in an assigned team, the group discussions and presentations is mandatory. Compensation is according to the instructions of the course director.

Forms of assessment

Students are examined on the outcomes of the course based on the project work in teams, individual poster presentations and active participation in discussions during the lectures. Using this specific lesion and model system as example, the students will use the recommended literature, and the new knowledge acquired during the course lectures to evaluate the known endogenous repair and regeneration mechanisms and their differences and limitations. The students will present the specific medical and experimental problems and solutions, approaches how to study central nervous system repair as well as potential approaches for regenerative

medicine. This presentation will be in form of a scientific poster of which each student will present a specific part at the end of the course. All poster presentations will be held as scientific discussions with the entire group during the last day of the course.

Course literature

Recommended reads. Some of them will be mandatory to specific teams.
Recent articles in the field, including:
Microglia-organized scar-free spinal cord repair in neonatal mice. Nature, 2020 Nov;587(7835):613-618.
Reducing Pericyte-Derived Scarring Promotes Recovery after Spinal Cord Injury. Cell, 2018 Mar 22;173(1):153-165.
A latent lineage potential in resident neural stem cells enables spinal cord repair. Science, 2020 Oct 2;370(6512):eabb8795
The neurons that restore walking after paralysis. Nature, 2022 Nov;611(7936):540-547.
Rewired glycosylation activity promotes scarless regeneration and functional recovery in spiny mice after complete spinal cord transection. Dev Cell, 2022 Feb 28;57(4):440-450.e7.
CNS remyelination and inflammation: From basic mechanisms to therapeutic opportunities. Neuron, 2022 Nov 2;110(21):3549-3565.
Gene modification after spinal cord injury: Mechanisms and therapeutics. Exp Neurol, 2022 Oct;356:114156.
Microglia coordinate cellular interactions during spinal cord repair in mice. Nat Commun, 2022 Jul 14;13(1):4096.
Astrocytes and oligodendrocytes undergo subtype-specific transcriptional changes in Alzheimer's disease. Neuron, 2022 Jun 1;110(11):1788-1805.