DEPARTMENT OF MOLECULAR MEDICINE AND SURGERY

K1F6013, Vascular Cell Biology, 3 credits (hec)

Vaskulär cellbiologi, 3 högskolepoäng

Third-cycle level / Forskarnivå

Approval

This syllabus was approved by the The Committee for Doctoral Education on 2024-02-22, and was last revised on 2024-03-04. The revised course syllabus is valid from autumn semester 2024.

Responsible department

Department of Molecular Medicine and Surgery, Faculty of Medicine

Prerequisite courses, or equivalent

Function A course: Carrying out minor procedures in rodents

Purpose & Intended learning outcomes

Purpose

The objective of the course is to build up knowledge in the field of cardiovascular biology and disease using translational approaches. More specifically, the course provides an overview of the healthy and diseased vessel wall from the cellular and molecular perspective, including vascular development, biomechanics, blood flow and role of inflammation, lipid metabolism and smooth muscle cells. The course is designed to lay a solid foundation for the student commitment to basic, clinical, and translational cardiovascular research utilizing the most advanced technologies and expertise in the field. Through team-work and joint presentations/discussions, students should increase their skills for collaborative networking, scientific presentation and communication to peers and to the public. An additional objective of the course is to introduce the students to the concepts of relevant sustainability goals, applicable to cardiovascular diseases and related clinical and experimental research.

Knowledge and understanding

Knowledge and understanding

- At the basic level students should be able to account for the various cell types and extracellular matrix components in the vessel wall, and critically review/discuss the potential cellular transdifferentiations in pathological conditions relevant to cardiovascular disease.
- They should be able to interpret the complex interactions among the different components, biomechanical and systemic influences within the vessel wall, and use it to explain the causality in the development of vascular disease.
- Students should become aware of social- and gender- related inequities with respect to cardiovascular diseases and best medical treatment opportunities (SDG3, SDG4, SDG5, SDG10).

Competence and skills

Competence and skills
- By conducting laboratory projects during the course, students should be able to make a synthesis of the theoretical and practical knowledge and envision how that knowledge could be applicable in their own research projects.
- They should be able to discuss and compare state-of-the-art laboratory, translational and animal techniques applied for specific questions in this research area.

Judgement and approach

Judgement and approach
- Students should be able to demonstrate awareness of the ethical perspectives related to the biobanking and animal research in cardiovascular disease, which will be incorporated and discussed during the course from the perspective of related sustainability goals (SDG12, SDG14, SDG15, SDG9).
- They should be able to demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.
- They should be able to demonstrate insight into the importance of partnerships and large, international collaborations for sharing research data and resources in order to achieve more sustainable scientific and clinical developments for broad societal benefit (SDG17).

Course content

The course will provide a theoretical and practical introduction to the basic cell types, extracellular components and their transformations present in the healthy and diseased vascular wall. Focus will also be on the signaling and basic biological process of cell activation, migration, proliferation and turnover involved in the vessel wall homeostasis during vascular development (arteriogenesis, angiogenesis), as well as the main vascular pathologies and vascular remodeling during injury and healing reactions. The impact of vessel biomechanics and components from the systemic blood flow on cell plasticity will also be covered. Sustainable development goals specified above will be incorporated throughout the course, both in lectures and in practical moments.

Forms of teaching and learning

The learning methods in this course include both individual and group studies, exemplified

through literature reading, journal club discussions and practical workshops related to the intended learning outcomes. Seminars with expert lecturers from KI and externally invited, will initiate and enhance the learning process. A practical laboratory project, where the students will test relevant methods for vascular research (in vitro, in situ and in vivo) and produce their own results, will be integrated. Course leaders will serve as facilitators for discussions, promote networking and collaboration skills during team-work.

Language of instruction

The course is given in English

Grading scale

Pass (G) /Fail (U)

Compulsory components & forms of assessment

Compulsory components

The course is work-intensive. Presence is strongly recommended during the whole course, but is compulsory during group work, practical experimental tasks and examination. Absence is allowed in exceptional circumstances only and will have to be compensated with a written assignment in agreement with the course leader.

Forms of assessment

All learning outcomes of the course must be reached to pass the course. Every participant will be individually assessed and examination will be based on several formats:

i) oral presentations of assigned research group work. Time for group work will be designated during the whole course where teams prepare a presentation based on the experimental research project they have designed and results they produced during laboratory work, supervised by the seminar leaders.

ii) participation during workshop/journal club that will encompass e.g. critical evaluation of assigned papers, writing short risk assessment for laboratory protocol, or a prototype ethical application for a clinical or mouse study, etc. including discussion among the teams facilitated by the seminar leaders.

Course literature

Lecturers and course organisers will recommend suitable research articles for optional individual studies one week prior to the course start. Recent literature, lectures and other information will be provided timely in the Canvas learning platform of the course. Examples of literature are given below:

1. Dennis Wolf, Klaus Ley. Immunity and Inflammation in Atherosclerosis. Circ Res. 2019 Jan;124(2):315-327.

2. Herbert SP, Stainier DYR. Molecular control of endothelial cell behaviour during blood vessel morphogenesis. Nat Rev Mol Cell Biol. 2011 Aug;12(9)551-564.
3. Ashish Misra, Rajan Rehan, Alexander Lin, Sanjay Patel, Edward A Fisher. Emerging Concepts of Vascular Cell Clonal Expansion in Atherosclerosis. Arterioscler Thromb Vasc Biol. 2022 Feb 3;ATVBAHA121316093.
4. Gemma L Basatemur, Helle F Jørgensen, Murray C H Clarke, Martin R Bennett, Ziad Mallat. Vascular smooth muscle cells in atherosclerosis. Nat Rev Cardiol 2019 Dec;16(12):727-744.
5. Peter Libby. The changing landscape of atherosclerosis. Nature. 2021 Apr;592(7855):524-533.