



DEPARTMENT OF WOMEN'S AND CHILDREN'S HEALTH

K6F5538 The Basics of Skeletal Biology: from Evolutionary Origins to Translational Research, 3 credits (hec)

Grunderna i skelettbologi: från evolutionens ursprung till translationell forskning, 3 högskolepoäng

Third-cycle level / Forskarnivå

Approval

This syllabus is approved by the The Committee for Doctoral Education on 2023-12-11, and is valid from Spring semester 2024.

Responsible department

Department of Women's and Children's Health, Faculty of Medicine

Prerequisite courses, or equivalent

KI's Laboratory safety test for laboratory Staff: <https://staff.ki.se/kis-laboratory-safety-test>

Purpose & Intended learning outcomes

Purpose

The course aims to enable doctoral students and postdoctoral fellows to acquire a comprehensive knowledge in different aspects of skeletal biology, from development to function in health and disease, as well as the most recent advances in regenerative medicine of bone and cartilage tissues. The course will cover basic cell biological, developmental and clinical aspects of skeletal physiology in health and disease. This course will also give students a glimpse of skeletal-related practical work, as well as the opportunity to develop their critical thinking by discussing the topics and connecting the learned concepts to students' respective study plans.

Intended learning outcomes

At the end of the course, the student will be able to:

- explain the functions of the most common cell-types and extracellular matrix components within bone and cartilage tissues during development and homeostasis

- connect processes in cellular biology to clinical manifestations
- discuss skeletal functions in relation to health and in examples of disease
- describe novel technologies in bone and cartilage regenerative medicine
- discuss the purposes of histochemically staining and imaging skeletal tissue sections, and how to do this, from their own practical experiences.
- integrate the obtained knowledge into their own doctoral project

Course content

The course will cover key theoretical and experimental knowledge in skeletal biology from function to clinical applications. The content is divided by interlinked theoretical modules: 1) introduction and origins, 2) Bone tissue and cells, 3) Hormonal regulation of the skeleton, 4) Diseases and aging, 5) Genetic and epigenetic regulation of the skeleton, 6) Regenerative medicine, 7) Scientific interactions and networking.

The combination of theoretic knowledge with “hands on” experimental practice and clinical insights, will bring together classical and advanced translational methods that will prepare the students for a career in skeletal biology research.

Forms of teaching and learning

There are several activities with specific outcomes:

- Lectures: Lectures will be conducted by world leading researchers in their fields. Students will be able to gain theoretical knowledge about the given research area.
- Students will get to meet one of the former patients of one of the lecturers of the course, to see how molecular biology techniques can be used to make real world impacts to a patient's lives.
- Break-out discussions: Students will discuss questions provided by the most recent speakers in groups of 3-4, with each session lasting for 12 minutes. Students will frequently be re-allocated into new discussion groups. The remaining time will be used to have a group discussion and summarise the day.
- Laboratory work: Histochemical staining of mouse bone sections. Students will take sections of mouse bones (prepared in advance by the organisers) and conduct safranin O/fast green staining, allowing a distinction between bone, cartilage and bone marrow tissues. Imaging and quantification of the stained tissue sections. Students will capture images of their stained slides and be shown how to recognise different structures and to quantify the growth plate height at two different ages. Students will submit this quantification and representative images as a course assignment.

Language of instruction

The course is given in English.

Grading scale

Pass (G) /Fail (U)

Compulsory components & forms of assessment

Compulsory components

Attendance: Students should not miss more than 4 hours of the course. For each lecture missed, a half-page summary of the topic should be submitted. Practical sessions will be mandatory, but in the case of illness, course organisers will devise an alternative task dependent on the student's prior expertise.

Participation in group discussions: Students will be expected to participate in the group discussions both virtually and in-person.

Practical session: Students will conduct histochemical staining and collect their own data. Each student will submit a one page piece of coursework including representative images and quantification.

Examination: See below.

Forms of assessment

Students will be asked to prepare a 10-minute presentation linking at least one of the course's scientific themes, including the major points from intended learning outcomes (ILOs), to their own project. In addition, the aspects of ILOs in each presentation will be followed by 5-10 minutes of questions from the audience (other students and examiners). This activity will encourage the students to think about what they have learnt and apply it to their own current and future research.

Course literature

Recommended literature:

Bones and Cartilage

Developmental and Evolutionary Skeletal Biology

Brian K Hall (2005)

Available via KI library (ISBN: 1-280-64135-5, ISBN: 9786610641352, ISBN: 0-08-045415-1, OCLC: (OCoLC)475999795, OCLC: (OCoLC)162572612, ISBN: 0-12-319060-6)

Chapter 2 - Bone

Chapter 3 - Cartilage (up to and including pg. 38)

Chapter 29 - Repair of Fractures and Regeneration of Growth Plates (up to and including pg. 380)

Osteoporosis and Bone Mass Disorders: From Gene Pathways to Treatments.

Rivadeneira F, Mäkitie O. Trends Endocrinol Metab. 2016 May;27(5):262-281. doi:

10.1016/j.tem.2016.03.006. Epub 2016 Apr 11. PMID: 27079517

Genetics of osteoporosis.

Ralston SH, Uitterlinden AG. Endocr Rev. 2010 Oct;31(5):629-62. doi: 10.1210/er.2009-0044. Epub 2010 Apr 29. PMID: 20431112

Osteoarthritis.

Martel-Pelletier J, Barr AJ, Cicuttini FM, Conaghan PG, Cooper C, Goldring MB, Goldring SR, Jones G, Teichtahl AJ, Pelletier JP. Nat Rev Dis Primers. 2016 Oct 13;2:16072. doi: 10.1038/nrdp.2016.72. PMID: 27734845

How many rare diseases are there?

Haendel M, Vasilevsky N, Unni D, Bologna C, Harris N, Rehm H, Hamosh A, Baynam G, Groza T, McMurry J, Dawkins H, Rath A, Thaxon C, Bocci G, Joachimiak MP, Köhler S, Robinson PN, Mungall C, Oprea TI. Nat Rev Drug Discov. 2020 Feb;19(2):77-78. doi: 10.1038/d41573-019-00180-y. PMID: 32020066

Additional literature may be suggested by the speakers.