Animal Function and Environmental Adaptation

Programme course

15 credits

Djurens fysiologiska funktioner och deras anpassning till miljön

NBIC49

Valid from: 2017 Spring semester

Determined by
Board of Studies for Chemistry, Biology and Biotechnology

Date determined
2017-01-25

Main field of study
Biology

Course level
First cycle

Advancement level
G2X

Course offered for
- Biology

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites

Passed basic subjects in biology (75 credits, at least 45 credits theory).

Basic knowledge in statistics.

Understanding of the following essential physiological concepts as presented in Silverthorn, D. U. Human Physiology. An integrated approach (Pearson, Benjamin Cummings, San Francisco, 2007). 1.Homeostasis
2.Negative feedback control loops
3.Resting membrane potential
4.Action potential
5.Synapse
6.Classification of the vertebrate nervous system: central, peripheral, sensory, motor, somatic, autonomic, parasympathetic and sympathetic
7.Receptor adaptation
8.Pituitary hormones
9.Cross-bridge cycling in muscle: role of actin and myosin
10. Dynamics of calcium in muscle contraction
11. Muscle types: skeletal, cardiac and smooth
12. Types of cells in blood
13. Respiratory pigments: hemoglobin
14. Gas partial pressures and Dalton's law
15. Gas solubilities and Henry's law
16. Oxygen dissociation curve
17. Structure of a nephron
18. Gastrointestinal peristalsis
19. Chemical digestive enzymes
20. Phases of the menstrual cycle

Intended learning outcomes

The student will increase her/his understanding of how animals adjust their organism to thrive and survive in the environment they live in. They will do this by by applying the essential principles of physiology covered in an earlier basic physiology course such as NBIB29 Fysiologiska principer. For every environmental scenario the student will be able

- to identify the fundamental concepts implicated by discussion with fellow students
- to understand the fundamental concepts by explaining them orally in tutorial sessions
- to integrate all mechanisms involved in a multi-faceted response of the entire organism by writing a concise essay outlining all the steps of the physiological response

In consequence, the student will improve her/his ability

- to articulate and explain scientific concepts orally and spontaneously
- to write briefly and precisely on the progression of biological processes
- to describe quantitatively the outcome of physiological responses

Course content

The weekly themes are the following: 1) dealing with high and low temperatures, 2) dealing with high altitudes, 3) dealing with life under water, 4) dealing with scarce resources (fasting and starvation), 5) dealing with stress (animal welfare), 6) dealing with environmental pollutants, 7) dealing with the embryonic environment and 8) dealing with disease and parasites. In this fashion, all themes will require the integration of two or more physiological systems. For instance theme 4 on dealing with scarce resources incorporates topics of digestive physiology, endocrinology and even kidney physiology when water is scarce. Theme 5 on stress has also numerous consequences on the cardiovascular system (heart failure, for example) but also on reproduction and the theme will require an important consideration of nerve physiology as well. Theme 6 on dealing with environmental pollutants incorporates topics of reproductive physiology (gender bender pollutants), metabolism and kidney physiology.

Teaching and working methods

The course is organized around weekly themes related to environments in which animals are living. The course will emphasize the physiology of vertebrate species with dedicated parts to humans. Each theme will have a similar structure:
Day 1. Presentation of the specific problems related to the weekly theme and further work on them during the day
Day 2. Introductory lectures to the weekly theme (2-4 h) with links to the specific problems
Days 3 and 4. Individual or group work on specific problems related to the theme chosen by the students. There will always be at least one problem emphasizing human physiology and one problem emphasizing animal physiology. Practical activities in the form of laboratory exercises or demonstrations adequate to the week theme will be organized.
Day 5. Colloquium with the different student groups. Discussion of relevant articles and definition of further learning issues.
The last week of the course will be used to collect and work on the further learning issues identified for each theme, which will be used as the subject for the home exam.

Examination

UPG4	Home exam	3 credits	U, 3, 4, 5
UPG3	Laboratory reports	4 credits	U, 3, 4, 5
UPG2	Oral colloquium discussions	4 credits	U, 3, 4, 5
UPG1	Individual written problem essays	4 credits	U, 3, 4, 5

The final grade is the combination of all grades 30% for UPG1 and UPG4 and 20% for UPG2 and UPG3.

Grades
Four-grade scale, LiU, U, 3, 4, 5

Department
Institutionen för fysik, kemi och biologi

Director of Studies or equivalent
Agneta Johansson

Examiner
Jordi Altimiras

Course website and other links
http://cms.ifm.liu.se/edu/coursescms/

Education components
Preliminary scheduled hours: 120 h
Recommended self-study hours: 280 h

Course literature
Hill, R. W., Wyse, G. A. & Anderson, M. Animal Physiology 3rd edition (Sinauer, 2012). ISBN10: 0878936629. ISBN13: 9780878936625

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.