Biosensor Technology

Programme course

6 credits

Biosensorteknik

TFTB34

Valid from: 2017 Spring semester

Determined by
Board of Studies for Chemistry, Biology and Biotechnology

Date determined
2017-01-25

Main field of study
Engineering Biology, Biomedical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Chemical Biology
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- Engineering Biology, M Sc in Engineering

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
Molecular and surface physics (can be taken in parallel), Biochemistry, Microbiology with immunology

Intended learning outcomes
The course will give insights into the complexities involved in combining biological materials such as enzymes, antibodies and DNA with optical, electrochemical and other transducers to provide practical and easy-to-use systems. In order to integrate this knowledge and to introduce the importance of intellectual property protection, students will participate in practical classes and a group project on patent litigation at the end of the course.
The overall purpose of the course is to give the student a thorough understanding of the fundamentals and applications of biosensor technology together with an appreciation of its current and future impact on society.
Following the course, the student should be able to:

- design and construct a simple biosensor,
- use biosensors in the laboratory
- explain how biosensors are constructed and manufactured
- show how biosensors can be used to solve real analytical problems
- reflect on the patenting and commercialisation of a biosensor

Course content

This course will provide a concise overview of biosensor technology and its application in healthcare, food safety, environmental monitoring and security. The lectures and practical exercises will focus on the construction, design and manufacture of biosensors, the principal and emerging materials and components used and three case studies of key devices. Lectures and a group project will examine some pivotal biosensor patents and an example of patent litigation. The course will conclude with a consideration of commercialisation routes, ethical issues and future perspectives.
Practical exercises will focus on enzyme electrodes, bioaffinity monitoring using two examples including the BIAcore and a site visit to see the printing facilities for biosensor production in Norrköping. The group project will study a patent litigation case and will culminate in a mock court battle.
The course will cover, an introduction to biosensors, applications of biosensors, transducers and sensor systems, bioreceptors and their immobilisation, synthetic receptors and nanomaterials for biosensors, design parameters for catalytic biosensors, design of affinity biosensors, microfluidics and arrays, glucose biosensors for diabetes, surface plasmon resonance for bioaffinity monitoring, electronic noses and tongues, patenting and litigation in the field of biosensors, commercialising biosensors, ethics and future prospects.

Teaching and working methods

Lectures, practical exercises and a group assignment.

Examination

LAB1	Laboratory work	1 credits	U, G
UPG1	Project assignment	1 credits	U, G
TEN2	Oral or written examination	4 credits	U, 3, 4, 5

The written examination will test the ability of the student to understand different biosensor technologies and concepts together with their practical application and commercialisation. During the practical laboratory exercises the student will be expected to construct and use enzyme electrodes for glucose measurement and to learn how to operate the BiaCore system for bioaffinity monitoring. The site visit will be used to assess observation skills and inquisitiveness. The group project will test the student's ability to work as part of a team to analyse a specific biosensor technology in detail, to present technical and commercial arguments and to individually reflect on the outcome.

Grades

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

Department
Institutionen för fysik, kemi och biologi

Director of Studies or equivalent
Magnus Boman

Examiner
Wing Cheung Mak

Course website and other links
http://www.ifm.liu.se/edu/coursescms/tftb34

Education components
Preliminary scheduled hours: 56 h
Recommended self-study hours: 104 h

Course literature
YouTube Video: Biosensors: An Introduction by Anthony Turner: http://www.youtube.com/watch?v=KChAkSAizCw Turner, A.P.F. (2013). Biosensors: sense and sensibility. Chemical Society Reviews 42 (8), 3184-3196. OPEN ACCESS: http://xlink.rsc.org/?doi=C3CS35528D Newman, J.D. and Turner, A.P.F. (2005). Home blood glucose biosensors: a commercial perspective. Biosensors and Bioelectronics 20, 2435-2453. (available online in LiU) Handbook of Biosensors and Biochips; Robert S. Marks, Christopher R. Lowe, David C. Cullen, Howard H. Weetall, Isao Karube, (2007) Wiley (available as e-book in LiU) Chemical sensors and biosensors; Brian R. Eggins (2002) Wiley (available in LiU library) US Patent: 5,436,161 - Matrix coating for sensing surfaces capable of selective biomolecular interactions, to be used in biosensor systems. Biacore AB.: http://www.google.com/patents/US5436161?dq=Patent+US+5,436,161&hl=en&sa=X&ei=HSf5UZjuLYLPtAbzm4GQDg&ved=0CDQQ6AEwAA Reviews and articles in the Elsevier journal Biosensors and Bioelectronics (available online in LiU): www.elsevier.com/locate/bios Biosensors and Bioelectronics Centre website: www.ifm.liu.se/biosensors PDF files of lectures and accompanying material.

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.