Bioinformatics for the Life Sciences

Bioinformatik för livsvetenskap
7.5 credits

Programme course

8MEA16

Valid from: 2023 Autumn semester

Determined by	**Main field of study**	
Chairman of The Board for First and Second Cycle Programmes	Medical Biology	
Date determined	**Course level**	**Progressive specialisation**
2023-01-09	Second cycle	A1N
Revised by	**Disciplinary domain**	
	Natural sciences	
Revision date	**Subject group**	
	Medical Biology	
Offered first time	**Offered for the last time**	
Autumn semester 2023		
Department	**Replaced by**	
Institutionen för biomedicinska och kliniska vetenskaper		

Specific information

The course is primarily intended for medical biology students with a fundamental knowledge in data analysis and bioinformatics from bachelor's level and with a background in genetics, molecular biology or microbiology.

The course is given in English.

Course offered for

- Master's Programme in Experimental and Medical Biosciences

Entry requirements

The eligibility requirement is the possession of the Degree of Bachelor of Sciences (180 ECTS credits) in a major subject area with relevance for studies in medical biology that include a minimum of 90 ECTS credits in some of the following topics:

- biochemistry
- cell biology
- molecular biology
- genetics
- gene technology
- microbiology
- immunology
- physiology
- histology
- anatomy
- pathology

or similar.

Applicants must also have documented skills in English corresponding to the level of English in Swedish upper secondary education (English 6/B).

(Exemption from Swedish)

Intended learning outcomes

By the end of the course the student will be able to:

Knowledge and understanding

- Identify suitable bioinformatics tools for specific high-throughput biomedical analyses
- Justify the need for the reproducibility of scientific computational analysis

Competence and skills

- Use command-line interfaces (CLI) to work on a remote high-performance computer cluster (HPC)
- Produce clean, transparent and reproducible code taking into consideration the good practices for data analysis
- Apply common bioinformatic methods and workflows to specific biomedical data analyses

Judgement and approach

- Critically interpret the results obtained through computational analysis
- Choose and apply the most appropriate data analysis approach for a specific NGS dataset and assess the weakness and strengths of the approach

Course content

Modern technical progress in biomedicine has led to the generation of large amounts of data and this has placed far-reaching demands on high data analysis capacity and requires formalized analysis workflows. This data-driven approach is a growing discipline in the life sciences.

Students will apply commonly used bioinformatic tools for the analysis of next-generation sequencing (NGS) data relevant to biomedicine, including for example sequence quality control, quantification of gene expression, detection of genetic variants or metagenomics. In addition, the students will learn how to work with analysis pipelines and document their own code in an efficient and reproducible manner.

The course includes:

- Remote high-performance cluster use
- Good practices in coding and documentation
- NGS data formats and Quality Control
- Differential gene expression
- Metagenomics
- DNA methylation and epigenetics

Teaching and working methods

Within the Faculty of Medicine, student-centered and problem-based learning forms the basis of teaching. The student takes personal responsibility for the learning through an active and processing approach to the learning tasks. The working methods challenge the students to independently formulate questions for learning, to seek knowledge and to assess and evaluate acquired knowledge in dialogue with others. Students work together in groups based on real-life situations to develop their own learning, contribute to fellow students' learning and to practice cooperation. The teacher's role is to support students in this way of working.

The teaching uses different forms of work such as lectures, seminars and work with group assignments.

Examination

The examination consists of individual and group written reports, an oral presentation of the group assignment and an individual written exam. Group assignments are assessed individually. Active participation in obligatory learning

activities is required. Active participation includes giving individual contributions and/or reflections with relevance to the learning tasks. The obligatory tasks are seminars.

Course is examined in English.

Grades

Grades are fail, pass and pass with distinction. Grades for written reports and the written exam form the basis for the final course grade.

If special circumstances prevail, and if it is possible with consideration of the nature of the compulsory component, the examiner may decide to replace the compulsory component with another equivalent component.

Application for examination

Instructions on how to apply for examinations are given prior to the beginning of each course.

Re-examination

The date for re-examination should normally be announced by the date of the regular examination at latest; in which case the scope must be the same as at the regular examination.

Examination for students with disabilities

If the LiU coordinator for students with disabilities has granted a student the right to an adapted examination for a written examination in an examination hall, the student has the right to it.

If the coordinator has recommended for the student an adapted examination or alternative form of examination, the examiner may grant this if the examiner assesses that it is possible, based on consideration of the course objectives.

An examiner may also decide that an adapted examination or alternative form of examination if the examiner assessed that special circumstances prevail, and the examiner assesses that it is possible while maintaining the objectives of the course.

Nomination of another examiner

A student who has taken two examinations in a course or a part of a course without obtaining a pass grade is entitled to the nomination of another examiner, unless there are special reasons to the contrary.

Grades

Three-grade scale, U, G, VG

Course literature

List of relevant literature is available at least 2 months prior to the start of the course as decided by the programme board. There is no mandatory literature in the course.

Other information

Planning and implementation of the course is to be based on the wordings in the course syllabus. A course evaluation is compulsory for each course and should include how the course is in agreement with the course syllabus. The course coordinator will analyse the course evaluation and propose appropriate development of the course. The analysis and proposal will be returned to the students, the Director of Studies, and as needed to the Education Board, if related to general development and improvement.

The course is carried out in such a way that knowledge of gender, gender identity/expression, ethnicity, religion or other belief system, disability, sexual orientation and age is addressed, highlighted and communicated as part of the programme.

If the course is cancelled or undergoes major changes, examination is normally offered under this course syllabus, at a total of three occasions, within/in connection to the two following semesters, of which one in close proximity to the first examination.