Advanced Medical and Molecular Genetics

Avancerad medicinsk och molekylär genetik
7.5 credits

Single subject course

8FA341

Valid from: 2026 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**
2025-06-13	Second cycle	A1N
Revised by	**Disciplinary domain**	
	Medicine, Natural sciences	
Revision date	**Subject group**	
	Medical Biology	
Offered first time	**Offered for the last time**	
Autumn semester 2026		
Department	**Replaced by**	
Institutionen för biomedicinska och kliniska vetenskaper		

Specific information

The course is given in English.

Entry requirements

- A bachelor's degree equivalent to a Swedish Kandidatexamen with a major in one of the
following or equivalent main areas:
-Medical Biology
-Biomedicine, Biology
-Medicine
-Biomedical laboratory science
or
180 ECTS credits passed with 90 ECTS credits in one of the
following or equivalent main areas:
-Medical Biology
-Biomedicine
-Biology
-Medicine
-Biomedical laboratory science.
- Approved courses in genetics and/or molecular genetics or equivalent courses of at least 6 ECTS credits.
- English corresponding to the level of English in Swedish upper secondary education (Engelska 6 or Engelska nivå 2).
Exemption from Swedish.

Intended learning outcomes

Knowledge and understanding

After completing the course, the student is expected to be able to:

- Explain the origin of genetic syndromes.
- Explain the interactions between genes contributing to health and diseases.
- Describe and discuss variation and selection in a population and in an organism.
- Describe how genetic stability is preserved.
- Discuss the causes and the consequences of genetic instability.
- Describe and discuss the characteristics of the most relevant genetic model organisms.
- Describe current developments in genetics that are relevant for human health.

Skills and abilities

After completing the course, the student is expected to be able to:

- Identify genetic predispositions and clonal evolution.
- Analyze genetic screenings for the discovery and characterization of biological pathways and/or mutations.
- Design genetic experiments to discover or characterize new mechanisms, genes, or drugs of medical interest.
- Design and perform experiments to study mammalian cells transformation.
- Evaluate and discuss new theories in the field of medical genetics.
- Analyze, evaluate, and present experimental results.

Judgement and approach

After completing the course, the student is expected to be able to:

- Argue the ethical and sustainability aspects of the use of model organisms in genetics.
- Argue the ethical and sustainability aspects within the medical application of genetics.
- Reflect on the ethical aspects of genetic research.

Course content

This course covers advanced concepts of molecular genetics with application to human health. Based on the groundbreaking historical experiments that have been essential for understanding how genetics regulates cell and organism's life, the course will cover the main theoretical principles of genetics and their application in medicine:

- Model organisms and genetic screening.
- Advanced principles of genetics: gene complementation, reversion, genetic suppression, synthetic lethality, epistatic interactions, uniparental disomy, loss of heterozygosity and clonal selection.
- Germline and somatic genome stability.
- Cause and consequences of genome instability.
- Human genetics: pedigree analysis, genetic predisposition, pathological variants.
- Gene therapy: problems, progresses and halts.
- Ethics and sustainability of genetic screenings and gene therapy in patients.

Teaching and working methods

Within the Faculty of Medicine, student-centered and problem-based learning form the basis of teaching. The students take personal responsibility for their 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 to develop their own learning based on real-life situations, contributing to fellow students' learning and practicing cooperation. The teacher's role is to support students in this way of working.

The course uses lecturers, base group work and laboratory work.

Examination

The course is examined with an individual written exam and a group written laboratory report. The written exam may be taken an unlimited number of times by students who have not achieved a passing result.

Group laboratory reports can be revised twice during the ongoing course. In the event of a failed report, the re-examination is offered the following year.

Teaching and examinations take place in English.

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

The bibliography is determined no later than two months before the start of the course by the departmental board at the department of BKV. Mandatory course literature is not available.

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 conducted in such a way that there are equal opportunities with regard to sex, transgender identity or expression, ethnicity, religion or other belief, disability, sexual orientation and age.

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.

If special circumstances prevail, the vice-chancellor may in a special decision specify the preconditions for temporary deviations from this course syllabus, and delegate the right to take such decisions.