# The genetics of complex traits

Genetiska mekanismer bakom komplexa egenskaper
7.5 credits

Programme course

8MEA14

Valid from: 2022 Spring semester

| **Determined by** | **Main field of study** | |
|---|---|---|
| The Board for First and Second Cycle Programmes at the Faculty of Medicine and Health Sciences | Medical Biology | |
| **Date determined** | **Course level** | **Progressive specialisation** |
| 2019-03-07 | Second cycle | A1X |
| **Revised by** | **Disciplinary domain** | |
| Chairman of The Board for First and Second Cycle Programmes | Medicine | |
| **Revision date** | **Subject group** | |
| 2021-09-23 | Medical Biology | |
| **Offered first time** | **Offered for the last time** | |
| Autumn semester 2019 | | |
| **Department** | **Replaced by** | |
| Institutionen för fysik, kemi och biologi | | |

# Course offered for

- Master's Programme in Experimental and Medical Biosciences

# Intended learning outcomes

The student will learn and understand the basis of quantitative genetic techniques, in particular how they pertain to the identification of genes underlying complex traits and diseases.

Knowledge and understanding
On completion of the course, the student shall be able to:

- Describe and understand statistical quantitative genetic techniques and how they apply to complex traits.
- Explain the statistical basis of quantitative traits.
- Explain and distinguish between linkage and linkage disequilibrium and their uses.
- Analyse the genetic architecture of different behavioral and disease-related traits.
- Analyse and understand the theory and steps required to identify the genetic components of a quantitative trait.

Skills and abilities
On completion of the course, the student shall be able to:

- Apply the correct statistical analyses required for several different real-world quantitative genetic data sets.
- Perform statistical analyses for quantitative trait locus mapping and gene expression analyses and interpret the results.

Judgement ability and approach
After completion of the course, the student shall be able to:

- Critically assess the types of genomic analyses that are prevalent in current biology and how they are complementary to one another, as well as identify weaknesses within the tools currently available.
- Discuss and theorise around the merits of particular aspects of gene identification and how they interact with one another.

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## Course content

The field of genetics has rapidly developed from the analysis of traits controlled by single genes, with one of the biggest challenges in biology now the analysis of quantitative traits controlled by a large number of separate loci. Such quantitative traits (also called complex traits) now represent the bulk of the phenotypes we wish to elucidate at a genetic level. As this field has risen to greater prominence, the genes that underpin both the mechanisms and variation present in these complex traits are starting to be understood.

This course will teach both a combination of the genetic knowledge required to interpret this field, as well as an understanding of how quantitative traits are measured. The course will focus on practical aspects of complex trait genetics, principally the use of statistics and how they are required in the field, experimental design and the like. Aspects as diverse as heritability, genetic mapping, transcriptomics, mutagenesis and transgenics will be covered, whilst a variety of different behaviours and diseases will be looked at and dissected. Students will apply quantitative genetic techniques on real data, discuss the limits of the different techniques they are using, and make comparisons between different techniques. Statistical quantitative genetic analyses will be performed using the R software package.

## Teaching and working methods

At the Faculty of Medicine and Health Sciences student centered and problem based learning make up the foundation of the teaching. The student takes responsibility for studies and researches current content of the courses and study programme. The methods of the course work challenge the students to independently formulate questions for learning, to seek knowledge and in dialogue with others judge and evaluate achieved knowledge. The course will consist of lectures, seminars and a combined literature and data analysis project.

## Examination

The course is examined via a home exam, a data project and seminars. In addition, active participation in compulsory elements is required to pass the course. Compulsory elements are seminars and a project.

Change of examiner
A student who has obtained a failing grade twice for a course or a part of a course is, after request, entitled to be appointed another examiner, unless there are special reasons to the contrary.

Application for examination/written exam
Instructions on how to apply for examinations are given prior to the beginning of each course.

## Grades

Three-grade scale, U, G, VG

## Course literature

Anholt, R.R.H., Mackay, T.F.C. Principles of Behavioral Genetics. (Academic Press, 2010).

## 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.


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