



**Karolinska  
Institutet**

Course syllabus for

## **Biochemical and molecular toxicology, 18 credits**

Biokemisk och molekylär toxikologi, 18 hp

This course has been cancelled, for further information see Transitional provisions in the last version of the syllabus.

Please note that the course syllabus is available in the following versions:

Spring2011 , Spring2013 , Spring2015

Course code	4TX010
Course name	Biochemical and molecular toxicology
Credits	18 credits
Form of Education	Higher Education, study regulation 2007
Main field of study	Toxicology
Level	AV - Second cycle
Grading scale	Pass with distinction, Pass, Fail
Department	Institute of Environmental Medicine
Participating institutions	<ul style="list-style-type: none"><li>• Department of Physiology and Pharmacology</li><li>• Department of Neuroscience</li></ul>
Decided by	Programnämnd 7
Decision date	2010-10-26
Revised by	Programnämnd 7
Last revision	2012-11-07
Course syllabus valid from	Spring 2013

## **Specific entry requirements**

At least the grade Pass for the courses Introduction to toxicology and Target organ toxicology

## **Objectives**

Upon completion of the course, the student should:

- independently, and in a safe way, be able to carry out common tasks in toxicological laboratory work including work with toxic chemicals,
- have comprehensive knowledge of and be able to present basic research and analytical methods used in biochemical and molecular toxicology,
- be able to identify different cell death mechanisms and an appropriate methodology for identifying these,

- be able to identify sources of error, weaknesses and strengths of different methods that are used in toxicological research,
- be able to plan trials and analyses that can be used in the investigation of specific biochemical and molecular toxicological issues,
- understand the usability of different analytical methods in the examination of toxicological mechanisms and modes of action,
- be able to use mathematical methods for analysis of dose-effect relationships and relative potency and understand their role in risk assessment,
- have general knowledge of methods within molecular epidemiology,
- have general knowledge of "omics" applications within toxicology,.
- have general knowledge of method for measurement of irritation of the skin and contact allergy in humans,
- have general knowledge of health effects of various types of radiation,
- demonstrate an understanding of global perspectives in toxicology and the importance of chemical safety for sustainable development,
- be able to write a report according to principles in scientific writing.

## Content

The course is divided in four parts:

**Biochemical and molecular toxicology in practice, 9.5 hp** The course contains basic biochemical and molecular methods, and toxicological applications of these and more specialised methods that are often used in toxicological research. Laboratory technology and laboratory safety is included. The methods that are included may vary from course to course depending on current research issues. Examples of methods included are:

Basic molecular biological methods for the analysis of DNA, RNA levels, protein levels and enzyme activity, e.g. with PCR, Real-time PCR, Northern blot, Western blot. Cell culture. Gene regulation and reporter assays. Microarray technology. Proteomics. Metabolomics. Computational models of xenobiotic metabolism. Bioinformatics.

Heterologous expression and enzyme activity (e.g. purifying glutathione transferase with affinity chromatography, enzyme kinetics and inhibition). Genotyping techniques within molecular genetics.

Molecular epidemiology.

Methods for determining cell toxicity (e.g. detection of markers of DNA injury, apoptosis, phagocytosis and necrosis).

Methods within endocrine toxicology (e.g. enzyme activity measurement with fluorescence spectrophotometry, analysis of vitamin A with HPLC). Methods for analysis of dose-effect relationships and relative toxic potency.

Radiation biology with examples such as electromagnetic field and radon.

Method for measurement of irritation of the skin and contact allergy in humans. **Theoretical method**

**assignment, 1.5 hp** Description and analysis of methods used for toxicological studies of a specific chemical compound. Scientific writing. **Global perspectives in toxicology, 2 hp** Global perspectives in toxicology including the importance of chemicals safety for sustainable development.

**Integration of biochemical and molecular toxicology, 5 hp** The course ends with an integrative part where the content of other parts is examined by a summative evaluation.

## Teaching methods

The course builds largely on laboratory sessions in groups. Laboratory sessions are introduced and supplemented by lectures. Laboratory reports are written individually and in groups and oral discussions are held within independent laboratory session blocks. The students furthermore individually carry out a theoretical project focusing on methodology. A theoretical group assignment about global perspectives and sustainable development is included.

## Examination

Biochemical and molecular toxicology in practice (9.5 credits) is graded Pass/Fail and is examined through written laboratory reports.

Theoretical method assignment (1.5 credits) is graded Pass/Fail and is examined through written and oral presentations.

Global perspectives in toxicology (2 credits) is graded Pass/Fail and is examined through written and oral presentation.

Integration of biochemical and molecular toxicology (5 credits) is graded Pass with distinction/Pass/Fail and is examined through a written examination.

The final grade of the whole course is based on the grade of the part Integration of biochemical and molecular toxixology.

The course director can decide that re-examination will be oral.

### Compulsory participation

All practical parts including presentations and occasional lectures (indicated in the schedule) are compulsory. The course director assesses if and, in that case, how absence can be compensated. Before the student has participated in all compulsory parts or compensated absence in accordance with the course director's instructions, the student's results for respective part will not be registered in LADOK.

### Limited number of examinations or practical training sessions:

Students who have not passed the regular examination are entitled to participate in five more examinations. If the student is not approved after four examinations, he/she is recommended to retake the course at the next regular course date, and may, after that, participate in two more examinations. If the student has failed six examinations/tests, no additional examination or new admission is provided.

The number of times that the student has participated in one and the same examination is regarded as an examination session. Submission of a blank examination is regarded as an examination. An examination for which the student registered but not participated in, will not be counted as an examination.

## Transitional provisions

After each course, there will be at least 6 occasions for examination within a two-year period after the end of the course.

## Other directives

The course language is English.

Course evaluation will be carried out in accordance with the guidelines established by the Board of Higher Education.

Oral evaluation in the form of course council meetings will be carried out during the course.

## Literature and other teaching aids

### Mandatory literature

#### Principles and methods of toxicology

*Hayes, A. Wallace*

5. ed. : Philadelphia, Pa. : Taylor & Francis, 2008 - xxiii, 2270 s.

ISBN:0-8493-3778-X (ISBN 10) LIBRIS-ID:10593922

[Library search](#)

Handouts, scientific papers and other assigned literature.

