Syllabus – Master’s Programme in Toxicology
4TX15

Established by the Board of Higher Education, 7 November 2007

Confirmed by the Board of Higher Education, 18 December 2014
## 1. Basic Programme Information

<table>
<thead>
<tr>
<th>1.1. Programme code</th>
<th>4TX15</th>
</tr>
</thead>
</table>
| 1.2. Programme title| Masterprogrammet i toxikologi  
*Master's Programme in Toxicology* |
| 1.3. Number of credits | 120 credits (120 ECTS credits) |
| 1.4. Starting date | The syllabus applies to students who commence their studies in or after autumn 2015. |
| 1.5. Specific eligibility requirements | A Bachelor's degree or a professional degree equivalent to a Swedish Bachelor's degree of at least 180 credits in biomedicine, biology, cellular and molecular biology, pharmaceutics, chemistry, medicine, nutrition or biotechnology. And proficiency in English equivalent to English B/English 6. |
| 1.6. Major field of study | Toxicology |
| 1.7. Qualification | Medicine masterexamen med huvudområdet toxikologi  
*Degree of Master of Medical Science (120 credits) with a Major in Toxicology*  
A student who fulfils the requirements for the award of a qualification shall, upon request, be provided with a certificate. |

## 2. Outcomes

### 2.1. Outcomes of second level according to the Higher Education Act

Second-cycle courses and study programmes shall be based fundamentally on the knowledge acquired by students during first-cycle courses and study programmes, or its equivalent.

Second-cycle courses and study programmes shall involve the acquisition of specialist knowledge, competence and skills in relation to first-cycle courses and study programmes, and in addition to the requirements for first-cycle courses and study programmes shall:
– further develop the ability of students to integrate and make autonomous use of their knowledge,
– develop the students’ ability to deal with complex phenomena, issues and situations, and
– develop the students’ potential for professional activities that demand considerable autonomy, or for research and development work.

2.2. Outcomes of the Degree of Master (120 credits) according to the Higher Education Ordinance

Knowledge and understanding
For a Degree of Master students shall
– demonstrate knowledge and understanding in the main field of study, including both broad knowledge of the field and a considerable degree of specialised knowledge in certain areas of the field as well as insight into current research and development work, and
– demonstrate specialised methodological knowledge in the main field of study.

Competence and skills
For a Degree of Master students shall
– demonstrate the ability to critically and systematically integrate knowledge and analyse, assess and deal with complex phenomena, issues and situations even with limited information
– demonstrate the ability to identify and formulate issues critically, autonomously and creatively as well as to plan and, using appropriate methods, undertake advanced tasks within predetermined time frames and so contribute to the formation of knowledge as well as the ability to evaluate this work
– demonstrate the ability in speech and writing both nationally and internationally to report clearly and discuss his or her conclusions and the knowledge and arguments on which they are based in dialogue with different audiences, and
– demonstrate the skills required for participation in research and development work or autonomous employment in some other qualified capacity.

Judgment and approach
For a Degree of Master students shall
– demonstrate the ability to make assessments in the main field of study informed by relevant disciplinary, social and ethical issues and also to demonstrate awareness of ethical aspects of research and development work
– demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and
– demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

2.3. Outcomes of the study programme at Karolinska Institutet

In addition to the national objectives, the following outcomes apply for the programme at Karolinska Institutet:

Knowledge and understanding
Students shall
– demonstrate in-depth knowledge of the interaction between exposure to exogenous chemicals and toxic effects in humans and relevant experimental models,
– demonstrate general and integrated understanding of the harmful effects of chemical substances on humans and underlying mechanisms,
– demonstrate in-depth knowledge of relevant experimental methods within the field of toxicology, including the theoretical background, implementation, applications and limitations of the methods, as well as considerably deeper knowledge of experimental methods within certain areas of the field of toxicology,
– demonstrate in-depth knowledge of basic principles and methods for assessing the health risks of chemical substances and products, and in-depth insight in needs for development,
– demonstrate knowledge of statistical methods that are used within toxicology.

Skills and abilities
Students shall

– demonstrate an insight into the toxicological research process and have a good ability to formulate, both individually and working with others, relevant hypotheses within the field of toxicology and, on the basis of this, to plan and carry out studies and experiments, document and analyse observations, and assess the relevance of these observations,
– demonstrate an ability to apply for the relevant permissions for carrying out studies within the field of toxicology,
– demonstrate a good ability to independently find, summarise and assess scientific information within the field of toxicology, and to be able to use this information in other problems and in assessing the health risks of chemical substances, and
– demonstrate a good ability, both orally and in writing, to present a toxicological problem, both for the public and for experts.

Judgment and approach
Students shall

– demonstrate a good insight into research ethics, as well as respect for ethical aspects of experiments in which live animals are used and for the integrity of individuals, and
– be able to evaluate information and relate this to established knowledge and the needs of the society within the integrated field of toxicology.
3. Content and structure

3.1. Main content and structure
The Master’s Programme in Toxicology is a research and vocational programme that is the basis for qualified work tasks in toxicology research, testing and risk assessment.

The first term begins with a broad introductory course on the principles and methods in toxicology. The term also includes a course about how chemical substances are absorbed, distributed, metabolised and excreted by the body. Other courses deal with the mechanisms underlying organ and tissue damage caused by chemical substances, and how they can be studied.

In the second term, the students gain advanced knowledge about the methods used in toxicology research. Statistics and alternative methods to traditional animal testing are included as two components. Term 2 also includes a course in health risk assessment, where the applications of risk assessment theory are a key part. During the term, the students also attend a course in the practice and theory of laboratory animal science.

The third term includes a course on toxicity testing according to OECD guidelines and Good Laboratory Practice. One common theme is 3R - Refinement, Reduction and Replacement of animal experiments. The course has all the components that are included in toxicity testing, including statistical analysis and the written reporting of results. In the same term, students address global chemical problems while focusing on possible solutions and the role of toxicology in a sustainable society. Term 3 also provides options for in-depth studies of toxicologically-relevant areas, through optional courses in experimental toxicology and health risk assessment.

The programme concludes with an individual degree project of 30 or 37.5 credits. The degree project can either be experimental or a risk assessment-related, literature-based project. A shorter degree project (30 credits) can be combined with optional courses and/or projects of toxicological relevance.

3.2. Teaching language
The teaching language is English.

4. Transitional provisions
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5. Other guidelines

5.1. Grading scale
The grades used are Fail, Pass or Pass with Distinction. Alternative grading scales may apply to elective courses or cross-programme courses. The grading scale is detailed in the course syllabus.

5.2. Specific eligibility requirements within the programme
See respective course syllabus for course-specific entry requirements.
### 6. Study plan with constituent courses

<table>
<thead>
<tr>
<th>Term</th>
<th>Name of the course</th>
<th>Credits</th>
<th>Main field of study</th>
<th>Cycle and depth of the course</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Principles of toxicology</td>
<td>7,5</td>
<td>Toxicology</td>
<td>First (G2)</td>
</tr>
<tr>
<td>1</td>
<td>Toxicokinetics</td>
<td>3</td>
<td>Toxicology</td>
<td>Second (Advanced)</td>
</tr>
<tr>
<td>1</td>
<td>Target organ toxicology</td>
<td>14,5</td>
<td>Toxicology</td>
<td>Second (Advanced)</td>
</tr>
<tr>
<td>1</td>
<td>Histopathology and clinical pathology</td>
<td>5</td>
<td>Toxicology</td>
<td>Second (Advanced)</td>
</tr>
<tr>
<td>2</td>
<td>Laboratory animal science in theory and practice</td>
<td>4,5</td>
<td>Toxicology</td>
<td>Second (Advanced)</td>
</tr>
<tr>
<td>2</td>
<td>Applications of methods in toxicological research</td>
<td>18</td>
<td>Toxicology</td>
<td>Second (Advanced)</td>
</tr>
<tr>
<td>2</td>
<td>Health risk assessment</td>
<td>7,5</td>
<td>Toxicology</td>
<td>Second (Advanced)</td>
</tr>
<tr>
<td>3</td>
<td>Global toxicology in a sustainable society</td>
<td>1,5</td>
<td>Toxicology</td>
<td>Second (Advanced)</td>
</tr>
<tr>
<td>3</td>
<td>Regulatory toxicity testing</td>
<td>12</td>
<td>Toxicology</td>
<td>Second (Advanced)</td>
</tr>
<tr>
<td>3</td>
<td>Elective courses</td>
<td>9</td>
<td>Toxicology</td>
<td>Second (Advanced)</td>
</tr>
</tbody>
</table>

**Alternative 1**

| 3 and 4 | Degree project in toxicology | 37,5 | Toxicology | Second (Advanced) |

**Alternative 2**

| 3 and 4 | Project work or elective courses | 7,5 | Toxicology | Second (Advanced) |
| 3 and 4 | Degree project in toxicology      | 30  | Toxicology | Second (Advanced) |