

Disclaimer: In case of discrepancy between the Swedish original and the English translation of the syllabus, the Swedish version takes precedence.

GENERAL SYLLABUS FOR DOCTORAL STUDIES IN NEUROCHEMISTRY WITH MOLECULAR NEUROBIOLOGY

incl. general syllabus for programmes leading to a licentiate degree

Admission to postgraduate education at Stockholm University shall mainly be made to programmes leading to a doctoral degree.

National regulations concerning admission, education and examination for doctoral studies can be found in the *Higher Education Ordinance*, Chapters 5-7, 10, 12 and Appendix 2. At Stockholm University, the following regulations and rules also apply: *Admission regulations for doctoral studies*, *Regulations for Third-Cycle Education and Examinations at Stockholm University* and *Local degree regulations for Stockholm University*.

The general syllabus was adopted by the Board of Science 2007-07-01, and revised 2018-04-05, 2021-04-26.

1 Subject description

In neurochemistry with molecular neurobiology, the nervous system is studied from a chemical / molecular perspective. The subject includes studies of the molecular properties of individual nerve cells, which partly overlaps with the subject term biochemistry, but with the difference that the emphasis is on membrane proteins important for nerve cell electrical properties, signal transduction, and exocytosis of neurotransmitters. The subject also includes an understanding of how nerve cells interact with other nerve cells and the body's organs. Of central importance are the mechanisms of synaptic signal transmission, but also how nerve cells interact with different forms of glial cells. Furthermore, the molecular mechanisms of interaction between ligands and receptors, which underlie neuropharmacology and, by extension, the pharmaceutical development of drugs, are central to neurochemistry with molecular neurobiology. Understanding pathological and physiological processes in the nervous system is also an essential part of the subject. This can be exemplified by the fact that pathological conditions such as neurodegenerative diseases, schizophrenia, cancer and stress-related conditions, but also physiological functions such as memory storage, can increasingly be described in molecular terms. The subject includes experimental studies at several levels, from the properties of individual molecules to the analysis of experimental animal behavior after manipulation

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of different parts of the nervous system. Also theoretical studies, with e.g. modeling and simulation of molecules, nerve cells and nerve cell circuits may be included.

2 Programme objectives

Postgraduate education shall, in addition to what applies to undergraduate and advanced education, develop the knowledge and skills needed to be able to conduct research independently. Postgraduate education must therefore primarily develop the knowledge and skills needed to be able to conduct research independently but also make the student well prepared for other tasks in society where demands are placed on insights into the nervous system's function and research methodology, e.g. in the pharmaceutical industry, government or education. The education ends with a licentiate or doctoral degree. The objectives that according to the *Higher Education Ordinance* apply to these degrees are set out in sections 5 and 6 below.

3 Prerequisites and entry requirements

For eligibility to doctoral studies, the applicant must meet both the conditions for basic eligibility and the conditions for special eligibility, and have such other abilities as are needed to complete the education.

3.1 General entry requirements

Basic eligibility for admission to postgraduate education requires the applicant to have completed a degree at advanced level, or completed course requirements of at least 240 higher education credits, of which at least 60 credits at advanced level, or otherwise within or outside the country acquired essentially equivalent knowledge. The area board may, for an individual applicant, grant an exemption from the requirement for basic eligibility if there are special reasons.

3.2 Specific entry requirements

For special eligibility to be admitted to postgraduate education in neurochemistry with molecular neurobiology, the applicant must have passed results on courses of at least 120 credits in chemistry / molecular life sciences, including an approved course of at least 15 credits on advanced level in neurochemistry / chemistry / molecular life sciences and 30 credits approved independent work in neurochemistry / chemistry / molecular life sciences at advanced level. Those who have acquired essentially equivalent knowledge within or outside the country can also meet the specific requirements.

4 Selection and admission

Selection from among the applicants who meet the eligibility requirements must be made with regard to their ability to benefit from the education. The mere fact that an applicant is judged to be able to receive previous education or professional activities credited to the education may not, in the selection process, give the applicant priority over other applicants. Decisions on admission are made in accordance with the current delegation procedure. Important assessment criteria are the following: familiarity with theory, skill in the subject area of the doctoral studies, ability to express oneself orally and in writing in Swedish and / or English, analytical ability, creativity, initiative, independence and ability to collaborate. The basis for assessing how the applicant meets these requirements is the relevance of previous studies to the subject, grades of completed university courses (especially those at the advanced level), quality and scope of the independent work, letters of recommendation and references from people who can describe the applicant's skills, and interviews.

5 Programmes leading to a doctoral degree

5.1 General provisions

The education for the doctoral degree comprises four years of full-time studies (240 credits) and consists of a course part that comprises 60 higher education credits, and a thesis component. Even if the course part precedes the thesis part, the doctoral student is recommended to discuss the dissertation topic at an early stage. The scientific literature in the subject area is largely written in English (other languages may also occur). A prerequisite for postgraduate education to be completed within the intended time is that the student has a good knowledge of the English language.

Objectives for doctoral degrees according to the Higher Education Ordinance

Knowledge and understanding

For the doctoral degree, the doctoral student must:

- demonstrate broad knowledge in and a systematic understanding of the research area as well as deep and current specialist knowledge within a limited part of the research area,
- demonstrate familiarity with scientific methodology in general and with the methods of the specific research area in particular.

Skills and Abilities

For the doctoral degree, the doctoral student must

- demonstrate the ability for scientific analysis and synthesis as well as for independent critical review and assessment of new and complex phenomena, issues and situations,
- demonstrate the ability to critically, independently, creatively and with scientific accuracy identify and formulate issues and to plan and conduct adequate research and other qualified tasks within given time frames and to review and evaluate such work,
- with a thesis show their ability to make a significant contribution to the development of knowledge through their own research,
- demonstrate the ability to present and discuss research and research results in dialogue with the scientific community and society in general in both national and international contexts, orally and in writing with authority,
- demonstrate the ability to identify needs for additional knowledge, and
- demonstrate the potential for contributing to the development of society and supporting the learning of others, both in research and education and in other qualified professional contexts.

Judgement and approach

For the doctoral degree, the doctoral student must:

- demonstrate intellectual independence and scholarly integrity and the ability to make research ethics assessments, and
- demonstrate in-depth insight into the possibilities and limitations of science, its role in society and the responsibility of the individual for how it is used.

5.2 Individual study plan

An individual study plan must be drawn up for each doctoral student. The individual study plan must contain:

- a research plan for the doctoral student's education at doctoral level, including a timetable
- information on how the supervision is organized
- a plan of which courses/type of courses the doctoral student must attend during the education
- a description of other scientific activities, such as participation in seminars and literature studies
- a description of any other commitments that the doctoral student and the department have during the study period
- a financing plan for the doctoral student's entire postgraduate education
- if the study funding does not consist of employment, the financing plan should state what social security in the event of, for example, illness or parental leave is associated with the current study funding.

The individual study plan should be made after consultation with the doctoral student and his/her supervisor, and should be reviewed at least once a year. The individual study plan is adopted and followed up in accordance with the current delegation procedure. The follow-up of the individual study plan must state how the doctoral education's activities relate to the *Higher Education Ordinance's degree objectives*.

5.3 Courses and instruction

The scope of the course part shall amount to 60 credits.

The compulsory elements consist of writing a research plan with a literature review (7.5 credits), the chemistry section's joint course package of 9 credits (Teaching chemistry: 2 credits, Philosophy of science and ethics: 3 credits, Writing science: 3 credits, Arrhenius seminar for PhD students: 1 credits), and an oral exam of a total of 22.5 credits in general neurochemistry with molecular neurobiology.

Furthermore, the theoretical part of 7.5 credits in the course Neurochemistry with molecular neurobiology (total 15 credits, AN), or equivalent course, is compulsory in the education.

Other courses are chosen in consultation with the supervisor.

The student should actively participate in the seminars that bring current research results up for discussion. Courses or instruction can be given in collaboration with other departments. The student should take advantage of the opportunities given to attend guest lectures both in their own subject and in related subjects.

5.4 Thesis

As part of the education, the student will write an academic thesis. The dissertation must show the doctoral student's ability to solve the chosen research task independently in a scientifically satisfactory way - within or outside the framework of a collaboration project. In terms of quality, the dissertation should be at such a level that it can be considered to meet reasonably set requirements for publication in a scientific journal of good quality. The doctoral dissertation must be designed either as a uniform, coherent scientific work (monograph dissertation) or as a compilation of scientific papers with a summary of these. The papers may have been written jointly with other people. The doctoral student's contributions must be clearly distinguishable if the work has been carried out within the framework of a collaboration. The doctoral dissertation must be written in English. The department is responsible for ensuring that the English summary of the dissertation is translated into Swedish in the thesis.



5.5 Supervision

For each doctoral student, a main supervisor and at least one assistant supervisor must be appointed. At least one of these must be an associate professor competence and at least one must have undergone supervisor training or have been judged to have equivalent competence. Decisions on supervisors are made in accordance with the current delegation procedure. A doctoral student who requests it must, upon request to the department board, be allowed to change supervisors. The individual study plan must then be revised.

5.6 Examination and public defence

In order to receive a doctoral degree, it is required that the student receives a passing grade both on the exams included in the degree, and on the dissertation. Each course usually ends with a written or oral exam. In some cases, continuous knowledge control can take place in connection with teaching / laboratory work. Exams are assessed with one of the grades failed or passed. The thesis must be defended orally in a public dissertation. The dissertation must follow the rules that apply at the Faculty of Natural Sciences, Stockholm University.

5.7 Credit transfer

Provisions concerning credits can be found in Chapter 6, § 6-8 of the *Higher Education Ordinance*. Courses that have been included in the fulfillment of the requirements for special entry requirements cannot be credited in the doctoral degree. Decisions on crediting are made in accordance with the current delegation procedure.

5.8 Other instructions

Students who have begun education at the doctoral level according to the previous study plan may complete their studies according to this, but have the opportunity to transfer to the present one upon request to the Department Board.

6 Programmes leading to a licentiate degree

The area board may, if there are special reasons, decide that admission to postgraduate education can take place as part of postgraduate education that ends with a licentiate degree comprising at least 120 higher education credits. The fact that study funding is judged to be secure for time corresponding to the achievement of the requirements for a licentiate degree but not for a doctoral degree does not in itself constitute a special reason. Decisions on admission to postgraduate education with a licentiate degree as the goal are made in accordance with the current delegation procedure. In cases where the doctoral student wishes to continue to a doctoral degree, a renewed scientific examination and an analysis of the funding plan must be made before a decision on admission to doctoral education with a doctoral degree as a goal is made in accordance with the current delegation procedure.

6.1 General

A doctoral degree of at least 120 credits, or a part of at least 120 credits of a doctoral degree that is to be completed with a doctoral degree, can be completed with a licentiate degree. Education for a licentiate degree must correspond to two years of full-time studies (120 higher education credits). The education consists of a scientific thesis and a course part of at least 30 credits where the compulsory courses for the doctoral degree are included. Even if the course part precedes the work on the licentiate thesis, the doctoral student is recommended to discuss the topic of the thesis at an early stage.



Objectives for the licentiate degree according to the Higher Education Ordinance

Knowledge and understanding

For the licentiate degree, the doctoral student must

-demonstrate knowledge and understanding in the field of research, including current specialist knowledge in a limited part of this, as well as in-depth knowledge of scientific methodology in general and the methods of the specific research area in particular.

Skills and Abilities

For the licentiate degree, the doctoral student must

-demonstrate the ability to critically, independently and creatively and with scientific accuracy identify and formulate issues, to plan and with adequate methods carry out limited research work and other qualified tasks within given time frames and thereby contribute to the development of knowledge and to evaluate this work,
 - demonstrate the ability to clearly present and discuss research and research results in dialogue with the scientific community and society in general in both national and international contexts, and
 - demonstrate the skills required to participate independently in research and development work and to work independently in other qualified activities.

Judgement and approach

For the licentiate degree, the doctoral student must

- demonstrate the ability to make research ethics assessments in their own research, demonstrate insight into the possibilities and limitations of science, its role in society and human responsibility for how it is used, and
 - show the ability to identify their need for additional knowledge and to take responsibility for their knowledge development.

6.2 Individual study plan

The individual study plan must be formulated in the same way as for the doctoral degree, see 5.2.

6.3 Courses and instruction

The scope of the course-bound teaching must amount to at least 30 credits. The compulsory parts consist of writing a research plan with a literature review (7.5 credits) and the chemistry section's joint course package of 9 credits (Teaching chemistry: 2 credits, Philosophy of science and ethics: 3 credits, Writing science: 3 credits, Arrhenius seminar for PhD students: 1 credits), and the theory part of 7.5 credits in Neurochemistry with Molecular Neurobiology (15 credits, AN). The remaining courses are chosen in consultation with the supervisor. The student should actively participate in the seminars that bring current research results up for discussion. Courses or teaching can be given in collaboration with other departments. The student should take advantage of the opportunities given to attend guest lectures both in their own subject and in related subjects.

6.4 Licentiate thesis

As part of the education, the student must write a licentiate thesis. In terms of quality, the essay should be at such a level that it is judged to meet reasonably set requirements for admission to publication in a scientific series of good quality writing.



6.5 Supervision

See 5.5.

6.6 Examination

The first paragraph of 5.6 also applies to the licentiate degree. The examination of the licentiate thesis takes place in connection with a publicly announced licentiate seminar and must follow the rules that apply at the Natural Sciences Area, Stockholm University.

6.7 Credit transfer

Provisions concerning credits can be found in Chapter 6, § 6-8 of the *Higher Education Ordinance*. Courses that have been included in the fulfillment of the requirements for special eligibility cannot be credited in the licentiate degree. Decisions on crediting are made in accordance with the current delegation procedure.

7 Transitional rules

Doctoral students who have begun their education at doctoral level according to the previous study plan may complete their studies according to this within the nominal duration of the education plus two years. The subject responsible decides on transitional provisions following a request from an individual doctoral student.