Translation of Subject Curriculum (Study Plan) for Third-cycle (PhD) Education

Chemistry with specialisation in Microbial Chemistry

Swedish title: Kemi med inriktning mot mikrobiell kemi

TNKEMI12

Swedish curriculum adopted by the Board of the Faculty of Science and Technology (Third-cycle Educational Board) on 2008-07-02, revision on 2019-06-11.
Translations approved 2019-06-11.

The Study Plan for third-cycle studies consists of three parts: a general part, this subject specific study plan, and each doctoral student's individual study plan.

Objective

Based on the general training within the scientific discipline, the education at the graduate level shall provide additional competences within Chemistry and result in deep knowledge within Microbial Chemistry.

Through training at the graduate level shall the PhD student, via participation in advanced courses and by performing his/her own research under supervision, obtain deep theoretical and practical competence in the methods relevant for Chemistry and Microbial Chemistry.

Those obtaining a doctoral degree in Chemistry with specialization in Microbial Chemistry shall be well prepared for performing research in a critical and independent manner. In addition to the academic environment, the graduate is expected to be able to perform research and development projects in, for example, industry, management and companies. Furthermore, the education shall enable the PhD student to actively participate in scientific discussions.

The PhD student must be able to present his goals and results in oral and written form for different audiences in English, and in case of
Swedish-speaking doctoral students, in Swedish. Through active participation in group meetings, seminars and conferences, the PhD students must even be able to acquire and critically discuss new research topics.

Those obtaining a licenciate degree in Chemistry with specialisation in Microbial Chemistry must have experience in independent research work and must have reached the subject specific and methodological competence in the selected specialization that allows them to critically evaluate the scientific development in this research field.

Subject description
Research in Microbial Chemistry is interdisciplinary and lies in between biochemistry, chemistry and biology. Our strategy is to connect fundamental studies with application oriented research to allow innovation leading to the development of renewable energy technologies as well as renewable chemicals and products.

The focus of Microbial Chemistry lies in the understanding, design and development of microbial systems for converting solar energy into fuels, chemicals and other products. Specific examples of our research topics include:
- Microbial metabolism and metabolic regulation
- Cells as platform for production of fuels, chemicals and other products
- Design of modified and synthetic metabolic pathways
- Carbon fixation and cellular partitioning
- Mechanistic studies of enzymes
- Enzyme design and production of artificial enzymes *in vitro* and *in vivo*
- Synthetic biology tools

Eligibility

Basic Eligibility
The basic eligibility for third-cycle studies is described in the general part of the study plan.

Special Eligibility
A person has special eligibility for a third level program in Chemistry with specialization in Microbial Chemistry if she/he has passed
examinations in courses in biochemistry, chemistry or biology, or in courses of other areas of relevance for the discipline, ranging a minimum of 60 higher education credits at the advanced level. Such courses must have resulted in significant knowledge of the candidate in the theory relevant for the research area. We also expect that practical knowledge was obtained in a master thesis that has a relevant topic. Comparable knowledge may have also been obtained in a different way, inside or outside of Sweden.

Since the research in Microbial Chemistry is performed within an international environment, very good command of English, both written and spoken, are requirements for this education.

Admission

Applicants for third-cycle studies in Chemistry with specialisation in Microbial Chemistry must submit an application to the Head of the Department of Chemistry - Ångström. Admission to doctoral studies takes place normally several times per year.

Upon admission to postgraduate education, the Swedish title of the degree is to be specified in the application. According to decision (TEKNAT 2012/215), postgraduate education in Chemistry with specialisation in Microbial Chemistry shall lead to a filosofie doktorsexamen or teknologie doktorsexamen. The English rendering will in either case be a licentiate/doctorate degree of philosophy.

At the time of admission, the department must provide a financial assistance plan demonstrating sufficient support to cover the maintenance of the applicant as well as her/his research.

Program structure

At the time of admission, each doctoral student, together with her/his supervisor and in consultation with the professor in charge of third-cycle studies, draw up an individual study plan. The plan is to be approved by the Head of the Department (by delegation of the Faculty Board) at the time of admission.

The individual study plan shall be annually reviewed jointly by the doctoral student and her/his supervisor, and supplemented with a summary of the achieved results and the plans for the coming year. Significant changes, as well as any disagreement on the individual study plan, shall be reported to the Head of the Department or, if deemed necessary, to the Third-cycle Educational Board.
Courses
The third-cycle studies may include different kinds of courses, such as lectures, literature studies, practical training, field studies, etc. The courses are intended to provide a wider insight into the subject as a complement to the specialist competence acquired during research. The courses included in the individual study plan may be selected among courses and summer schools both inside and outside of Sweden, as long as they do not overlap with the admission requirements.

The following courses are normally included in the studies (suggested year and credits):

- Literature studies related to the doctoral project should be conducted and summarized in a mini-review (year 1/2, 5-10 higher education credits, depending on extent).
- A current course book should be selected that widens the competence of the doctoral student. This selection should be agreed between the candidate, the supervisor and the professor responsible for the third level studies. The new competences should be demonstrated through an oral examination (year 2/3, 5-10 higher education credits).
- A research proposal should be written (year 3/4, 5-10 higher education credits).
- At least one advanced course within biochemical, molecular, biophysical, synthetic biology or microbiological methods that enhances and/or broadens the skills of the doctoral student.
- At least two own presentations (halftime and final; together 2 higher education credits)

The above courses should together have an extend of at least 30 higher education credits for a PhD degree, and 15 higher education credits for a licentiate degree.

Recommended courses:
- Introduction to PhD studies.
- Scientific writing and/or presentation.

A course in research ethics (of at least 2 higher education credits) is mandatory for licentiate and doctoral degree. University educational theory is mandatory for doctoral students who teach at basic or advanced level.
Higher education credits obtained during studies at basic or advanced levels can be credited. This requires an agreement between the candidate, the supervisor and the professor in charge of the third level program. The guideline for the number of credits is the relevance of the course content for the specific PhD education.

Requirements for doctoral degree
The requirements for the doctoral degree consist of passed examinations in the courses included in the approved individual study plan of each doctoral student, as well as a passed public defence of the degree project. The studies awarded a doctoral degree comprise 240 higher education credits (four years of full-time studies), of which the doctoral thesis comprises a minimum of 120 higher education credits and the course part a minimum of 40 higher education credits.

Requirements for licentiate degree
A doctoral student who has acquired at least 120 higher education credits (two years of full-time studies) is eligible for a licentiate degree. The requirements consist of passing the examinations included in the program stage and receiving a passing grade on an academic paper of at least 60 higher education credits. The part of the course amounts to a minimum of 20 higher education credits.

Other
The PhD education shall not only prepare the doctoral student for a research carrier, but also allow obtaining pedagogical competences. Doctoral students are thus expected to contribute to departmental activities related to education and administration.

The interaction with the society and companies (‘samverkan’) plays an increasingly important role and is an integral part of the doctoral education. Doctoral students are thus expected to actively participate in at least one outreach event during their doctoral education.

Additional information can be obtained by the program responsible professor and the professor responsible for the third cycle studies in Chemistry with specialisation in Microbial Chemistry.

More information about our research can be found at the institutional homepage: www.kemi.uu.se.