Translation of Curriculum Statement for Graduate Level (Third-cycle) Education

Biology with specializations listed below

TNBIOL02, TNBIOL03, TNBIOL05, TNBIOL06, TNBIOL08, TNBIOL09, TNBIOL10, TNBIOL11, TNBIOL12, TNBIOL13, TNBIOL14, TNBIOL15, TNBIOL17, TNBIOL18, TNBIOL21, TNBIOL22, TNBIOL23, TNBIOL24, TNBIOL25, TNBIOL26, TNBIOL27, TNBIOL28

Doctoral students are admitted to the specializations below. However, on request from the doctoral student the specialization can be excluded from the diploma and then the degree will be in Biology, TNBIOL00. The request is made using the form Application for admission to postgraduate studies, change of subject, at latest when selecting opponent and committee members or when submitting the thesis to print, whenever of these actions taking place first. Note that several of the specializations do not permit any new admissions (in italic above).


The Curriculum Statement for Third-cycle Education consists of three parts: a general part, this subject specialized curriculum statement, and each doctoral student's individual study plan.

Objective

Based on the basic education in the subject area, studies at the research level should provide competence that lies at the forefront of research in the biological field studied.

During the program, the doctoral student will, through active participation in courses and the execution of dissertation work under supervision, achieve a significant theoretical subject expertise as well as extensive practical competence in the methodology relevant to the subject. Those who have obtained a doctoral degree should be able to independently plan and carry out research projects in the field of
biology. In addition to the academic environment, the doctorate must be able to be responsible for research and development work in, for example management and business. In addition, the training will lead to the doctoral student actively participating in the scientific discussion. The doctoral student should also be able to present his/her goals and results in oral and written form to various target groups in English and, in the case of Swedish-speaking doctoral students, in Swedish.

Those who have obtained a licentiate degree must have experience in independent research work and have attained the subject and methodological skills required for active participation in research projects in the chosen field, and be able to critically relate to the scientific development in the subject.

**Subject description**

Postgraduate education in biology is offered at the Evolutionary Biology Centre (EBC, Department of Ecology and Genetics and Department of Organismal Biology) and Uppsala Biomedical Centre (BMC, Department of Cell and Molecular Biology).

There are a variety of specializations in biology. The programs are called Biology with specialization in xxx. Further information on what research is being carried out can be obtained through discussion with researchers within the various programs and through information on the website. For programs at EBC please refer to www.ebc.uu.se and for programs in biology at BMC please refer to www.icm.uu.se. Here the directions are described, and it is stated at which institution the teaching is given:

**Ecological Botany**

TNBIOL02. In ecological botany processes that influence the occurrence and evolution of plants are studied. The topic includes studies of how interactions with the surrounding environment affect the growth and reproduction of individual plants, population dynamics and population structure, as well as the composition and change of plant populations over time. The research also covers applications in conservation biology.

**Evolutionary Genetics**

TNBIOL05. This specialization includes genome and molecular evolution, evolution of genetic systems and bioinformatics. It also includes biodiversity, conservation genetics, evolutionary biology and molecular ecology. The subject area is connected to several biological sub-disciplines, for example, classical genetics, evolutionary ecology, molecular biology and functional genomics.
Physiological Botany
TNBIOL06. Research in physiological botany is directed towards the processes; molecular, cellular and metabolic, which determine the properties of plants. Current research is mainly experimental, and includes a broad spectrum of experimental approaches; ranging from genetics, molecular biology and biochemistry, to microscopy. Functional studies, and comparative analyses, based on the genome sequences of plants, are important elements of the research.

Comparative physiology
TNBIOL08. Comparative physiology encompasses physiological, biochemical and molecular studies on adaptations in different environments by a range of organisms. Studies are performed on whole organisms as well as on tissues or cells and molecules, often by employing molecular, cell biological and proteomic techniques. An important issue is how physiological processes such as for example immune reactions have developed and changed during the course of evolution.

Limnology
TNBIOL09. Limnology is a discipline within ecology, focusing on inland water ecosystems, including communities, populations, and biogeochemical processes. Microorganisms as well as larger organisms are studied. The issues addressed are of significance for the understanding of aquatic ecosystems, but they also have general ecological and evolutionary implications. Limnology encompasses basic scientific problems as well as research of interest for the management and protection of the environment.

Microbiology
TNBIOL10. (No new admissions, see instead Molecular Life Sciences TNNOBI00).
Microbiology is a subspecialty within biology which focuses on the study of microorganisms. The field covers molecular biology, molecular genetics, physiology, population biology, and ecology. The current research is primarily experimental and concentrated primarily on the first three fields.

Molecular Biotechnology
TNBIOL11. (No new admissions, see instead Molecular Life Sciences TNNOBI00).
Molecular biotechnology is a cross-disciplinary subject which focuses on biotechnology and biological basic research at the molecular level.
Molecular Cell Biology
TNBIOL12. (No new admissions, see instead Molecular Life Sciences TNNOBI00).
Molecular cell biology is a broad interdisciplinary research area which developed from the traditional science branches of genetics, biochemistry and cell biology. An important part of research in this field addresses the molecular mechanisms which control the development of eukaryotic cells and their differentiation to a multicellular organism.

Molecular Evolution
TNBIOL13. (No new admissions, see instead Molecular Life Sciences TNNOBI00).
Molecular evolution concerns studies of evolutionary processes at the molecular level. Included are comparative analyses of complete genomes from bacteria, archaea and eukaryotes. The aim is to understand evolutionary processes and quantify the frequencies of nucleotide substitutions, deletions, duplications, translocations, inversions, horizontal gene transfer events and genome fusions. This subject also includes studies of the mechanisms of cell division, protein interactions and mapping of metabolic networks. The studies can be performed in vivo, in vitro or in silico.

Molecular Immunology
TNBIOL14. (No new admissions, see instead Molecular Life Sciences TNNOBI00).
Molecular immunology includes the study of the immune system and its function at the molecular level. Studies are centered on the cells of the immune system, the different proteins and effector molecules which these produce, and the function of these molecules. It is also important how the different proteins are genetically regulated and how the different molecules interact with each other to affect the individual immune cells as well as the function of other cells. The development of these molecules and cells during vertebrate evolution is also covered.

Molecular Biology
TNBIOL15. (No new admissions, see instead Molecular Life Sciences TNNOBI00).
Molecular biology refers in a general sense to a description of biological systems and their properties at a molecular level. It includes a wide spectrum of experimental techniques, whose purpose is to test the validity of these descriptions.
Structural Biology

TNBIOL18. (No new admissions, see instead Molecular Life Sciences TNNOB100).
Structural biology studies the relationship between structure and function in biological macromolecules. The conformation of the molecules and their complexes are experimentally determined primarily by X-ray crystallography. The results, combined with different computational methods, are then used to explain the mechanisms of different biological processes or for the purpose of designing medicinal drugs. In addition, novel methodologies for both the experimental and theoretical parts of structural biology are being developed.

Animal Ecology

TNBIOL21. Animal ecology is the part of ecology that study how animals interact with their environment. Important parts of the research in animal ecology are the study of phenotypic plasticity and adaptation as an explanation to the diversity of life histories, behaviour and the evolution of new species. The research is in particular focused on the evolution of life histories, evolution of reproductive behaviour (sexual selection) sex differences in different groups of animals, and the ecological preconditions for speciation. Of importance is the connection between life history trade-offs, sexual selection and speciation. The research also includes applied and conservation biology.

Animal Developmental Biology

TNBIOL22. Animal developmental biology deals with the physiological, morphological, and molecular processes and their underlying mechanisms that govern the development of the fertilized egg. The field covers also genetic, evolutionary and teratological aspects of embryonic development and reproduction.

Evolutionary Organismal Biology

TNBIOL23. Evolutionary Organismal Biology is a discipline that analyses large-scale morphological evolution from a phylogenetic perspective. Particular emphasis is placed on linking morphological and developmental data within a common phylogenetic framework, in order to illuminate the correlation between the evolution of molecular patterning and the resulting morphological evolution. The subject area also covers palaeontological research with focus on morphological evolution and phylogeny.

Evolutionary Functional Genomics

TNBIOL24. The goal is to understand the functional role of genetic
variation present in animal and plant genomes in their natural environment. The attainment of this goal requires a combination of approaches including ecology, evolution, population genetics, genomics and functional genomics. The research program includes both experimental studies of variation at different levels (DNA, gene expression, phenotype), and theoretical work. The relevance of specific genetic variation to adaptation is tested in functional and ecological studies.

Systematics
TNBIOL25. The subject concerns systematics with an emphasis on phylogeny and evolutionary processes at different taxonomic levels. This also includes the description and analysis of biodiversity, molecular studies using single and multiple genes, dating and statistical analysis of evolutionary trees.

Animal Conservation
TNBIOL26. (No new admissions in TNBIOL17 Population biology). Animal Conservation is a subject that involves studies on dispersal, migration, demographics, effective population size, inbreeding depression, and minimum population viability of rare or endangered species. The subject includes phenomena that affect the maintenance, loss, and restoration of biodiversity and the science of sustaining evolutionary processes that engender genetic, population, species, and ecosystem diversity.

Environmental Toxicology
TNBIOL27. (No new admissions in TNBIOL03 Environmental Toxicology). Research in Environmental Toxicology aims to determine how man-made and naturally occurring toxic compounds can disturb cellular functions and give rise to adverse health effects in exposed organisms including humans. The research area includes enzyme-catalysed formation of metabolites which alter structure and function of specific target cells/tissues. Developmental toxicity originating from exposure during sensitive early life-stages is another important field of investigation.

Human Evolution and Genetics
TNBIOL28. Human evolution and genetics is a subject that focuses on the evolutionary processes that have shaped, and shaped, our own species. The focus is on understanding the evolution and demographic history of man and hominids from a genetic perspective and with the help of theoretical and empirical studies. These studies examine the human genome, genetic variation, traits and evolutionary processes. Also human interactions and co-evolution with other organisms and
phenomenon is studied. The subject embraces human genetics, population genetics / genomics, computational biology, molecular genetics, archeogenetics, and gene-culture co-evolution. The subject also has touch points towards medical genetics, paleontology, archeology, anthropology, osteology and evolutionary linguistics.

Eligibility

Basic Eligibility
The basic eligibility for third-cycle education is described in the general part of the curriculum statement.

Special Eligibility
For third-cycle studies in Biology it is required that the accepted candidate has passed courses in relevant topics of at least 60 credits at the advanced level. It is required that the student is well acquainted with the theories in the current research field through advanced level courses and have completed a master degree project in a relevant discipline. Provided that the above course requirements are met, the special eligibility can be obtained through studies in the natural science programmes, biomedicine programmes or engineering programmes. Equivalent knowledge can also be acquired in other ways in Sweden or abroad. For specific projects, additional skills and training can be required.

Admission
Applicants for the third-cycle program in Biology must submit an application to the head of the Department (contact the postgraduate study director for information). Admissions to places in third level programs take place normally several times per year.

In connection with the admission it must be stated how it is planned to finance both the personal maintenance of the doctoral student, and her/his research.

Program structure
In connection with the admission, each doctoral student and her/his supervisor shall draw up an individual study plan after consultation with the professor in charge of the third level program. The plan is to be approved by the head of the department (by delegation of the Faculty Board), in connection with the admission.

The individual study plan shall be reviewed jointly by the doctoral student and her/his supervisor, annually, and be provided with a summary of the achieved results and the plans for the coming year.
Significant changes and any disagreement on the individual study plan shall be reported to the head of the department or, if deemed necessary, to the Board for Third-cycle Education.

Courses
The third-cycle studies should include courses that are intended to provide a wider insight into the subject complementary to the competence acquired during research. The courses can consist for example of natural science courses, methodology courses, literature studies, seminars, educational courses and participation in international workshops and symposia. The combination of the courses can vary and the courses planned for each doctoral student should be clearly stated in the individual study plan.

In addition to courses at Uppsala University, the doctoral are encouraged to undertake courses at other universities within and outside the country.

A course in research ethics (of at least 2 higher education credits) is mandatory for licentiate and doctoral degree. A course in university educational theory is mandatory for doctoral students who teach at basic or advanced level.

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 defense 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.