Master program in Evolution, Ecology and Systematics: Topical Courses

Evolutionary Ecology

This is one of three basic modules in the first semester, where students will be introduced to the main topics of evolutionary ecology. A wide range of topics, such as plasticity and the ecological niche, physiological ecology, life history theory, population dynamics, species interactions, community ecology, ecosystem ecology and many, many more will be discussed. The aim is for students to acquire a firm knowledge of the principles of evolutionary ecology and to understand the relationships between the topics discussed.

Evolutionary Genetics

The second basic module in the first semester is an introduction to evolutionary genetics. The lectures will cover both classical and modern topics, including: natural selection, adaptation, genetic drift, neutral theory, human evolution, evolution of sex, molecular evolution, speciation, and genome evolution. The goal is that students receive an extensive background in the principles of evolutionary genetics, on both the phenotypic and molecular side. They are exposed to problems in contemporary research and learn how basic concepts apply in this context.

Systematic Data and Evidence

The final basic module "Systematic Data and Evidence" provides an introduction into the topic and tools of systematics, the field of science focusing on documenting, naming, classifying, and understanding the diversify of life on Earth. Lectures cover "tree thinking"; how to measure biodiversity; the use of collections; barcoding; species concepts; how to infer changes in character states; basics of fungal systematics; basics of the description and naming of fossils; coevolution and the role of phylogenetics in inferring it; and alternative ways of naming and classifying clades. Visits to botanical, zoological, mycological, and paleontological collections are part of the course. The aim is for students to acquire a firm understanding of the kinds of data with which phylogenetic relationships and macroevolution can be inferred.

Individual Research Training (IRT)

Each semester, students conduct a small research project (IRT). Each consists of lab work with a supervisor of the student's choice and the required amount of time spent on these IRTs increases progressively with each semester, until you are spending all of your time doing research on your Master's Thesis in the 4th Semester. In order to proceed from one IRT to the next, you must have successfully completed the previous lab rotations. Further,

- the second lab rotation (IRT2) must take place in a different lab than the first lab rotation (IRT1).
- it is recommended that the third lab rotation (IRT3) take place in the lab where the student will conduct his or her Master's thesis.

Skills Courses

The Skills Courses are designed to develop skills required in science, such as learning how to effectively present and write up one's results, creatively explore questions, and design posters for conferences.

- Semester 1: *Scientific Writing & Presentations*
- Semester 2: *Posters and Layout*
- Semester 3: *Grant Proposal Writing*

Seminar and Discussion (S&D)

There is one S&D course per semester for the first three semesters of the program. Students read scientific research articles and prepare and lead discussions based on these articles. The two main goals of the Seminar & Discussion courses are

- to foster an integrative picture of evolutionary biology and
- to train the students' communication skills in oral presentations and scientific discussions.

The three umbrella topics for the courses are:

- S&D 1: e.g. *Species Concepts, Adaptation and Speciation*
- S&D 2: e.g. *Global Change*
- S&D 3: e.g. *Hot Topics in Evolution genomics, Ecology and Systematics*

EES Excursion

In the second semester, students are able to go on an excursion. The goal of this excursion is to provide students with a comprehensive, interdisciplinary approach to a habitat (e.g., high alpine valleys). It will include small field projects followed by a thorough statistical analysis of the data.

Zoological, botanical and fungal systematics, ecology and human impact will be taught concurrently to give a comprehensive understanding of the ecological selection pressures and evolutionary interactions between species. After an introduction to the selected habitat, students will work in groups on small research questions. The collected data will be analyzed statistically following the excursion. In short talks, students will present the results of their small research projects and will put their different projects into context.

Statistics

The statistics course consists of both lectures and practical work. The lectures will provide students with an overview and background knowledge of the most important topics in statistics for biologists. Topics include applied statistical testing, analysis of variance, regression and likelihood methods. Under applied statistical tests, students will learn how to select the proper test, to detect typical mistakes in using tests, and to perform transformations and power analyses. Students will learn about linear, multi-dimensional, partial and non-linear regressions, in addition to ANCOVAs. Students will learn how to use ANOVAs, including the general linear model, the 1- and 2-factorial analysis of variance, and nonparametric methods.

In the practical part, students are introduced to a statistics package (e.g. R or SPSS) and carry out exercises in which they learn to apply the knowledge they have acquired in the lectures.

The goals of both the lectures and the practicals are to give students a firm knowledge of important statistical methods and tools, as well as teaching them how to use statistics software and to apply their knowledge to practical problems.