**Summary**

Molecular ecology comprises a wide diversity of genetic-based methodological and technical approaches to address ecological and evolutionary questions. This course will focus on general concepts, current techniques and key aspects for the experimental design of molecular studies applied to animal ecology using bats as model species. Particularly, the course will go into detail about population genomics, DNA metabarcoding for diet studies and shotgun metagenomics applied to gut microbiota.

**Preliminary program**

July 28th

Module 1 - Introduction to molecular ecology and experimental design

8:30 - 12:30

* Introduction and overview of the course
* Historical overview of molecular techniques applied to ecological research
* General concepts and techniques
* High-throughput sequencing/Next generation sequencing platforms
* Targeted sequencing, reduced representation genome sequencing and whole genome sequencing
* Key aspects for a good experimental design

Module 2 - General techniques in molecular ecology

14:30 - 18:30

* Sample collection and storage
* DNA extraction
* PCR amplification
* Library build
* Sequencing
* Bioinformatic pre-processing

July 29th

Module 3 - Population genomics

8:30 - 12:30

* Moving from population genetics to population genomics
* Data management and summary statistics (PLINK)
* Population structure and genetic differentiation
* Identifying loci under selection - Fst outlier tests (population genomics approaches)
* Identifying local adaptations - Gene-Environment Associations (landscape genomics approaches)
* Practical population and landscape genomics (R)

Module 2 - DNA metabarcoding

14:30 - 18:30

* Introduction to environmental DNA and metabarcoding
* Things to consider when planning a metabarcoding diet study - in the lab, in the analyses and in the interpretation of results
* In the lab: Quality check of DNA extracts and PCR reactions, tagging PCR products and preparing amplicon pools for sequencing
* In the analyses: How to balance error removal with detection of low abundance prey
* Interpretation of results in a metabarcoding diet study

July 30th

Module 5 - Metagenomics

8:30 - 12:30

* Introduction to shotgun metagenomics applied to gut microbiota
* In the lab: shotgun library build and sequencing
* In the screen: dataset cleaning (clonality, low-complexity reads...), read assembly and mapping strategies.
* Taxonomic analyses: taxonomy assignment and taxonomy diversity statistics
* Functional approach: gene prediction, functional annotation and functional diversity statistics

Module 6 - One-by-one sessions

14:30 - 18:30

* 15 minute sessions
* Experimental design of own projects
* Project specific technical questions