

QBio305: Population & Quantitative Genetics

Module Responsible:

Prof. Dr. Maria von Korff Schmising

Version:

30/12/2020

Module Organizer:

Prof. Dr. Maria von Korff Schmising

Type:

Compulsory

Lecturer:

Prof. Dr. Maria von Korff Schmising, Prof. Dr. Juliette de Meaux, Dr. Markus Stetter

Total Working Time

180 h

Credit Points

6 CP

Contact Time

60 h

Self Study

120 h

Duration

1 Semester

Course Components

Lecture: 3 SWS

Exercise: 1 SWS

Group Size

P: 40

P: 20

Frequency

Every Winter Semester

Learning Competencies:

After completing the module, students can:

- describe types and sources of genetic variation and explain methods for the detection and characterisation of genetic diversity
- define and describe important population and quantitative genetic concepts such as: genetic drift, gene flow, natural selection, selective sweep, mating systems, heritability and quantitative traits
- infer population histories and signatures of selection from genetic and genomic data.
- Explain and estimate components of phenotypic variation from experimental data
- Understand and apply statistical methods for QTL detection and association mapping
- evaluate results from crossbreeding and breeding experiments and develop explanatory models.
- Describe the genetic and genomic changes implicated in crop domestication

Content:

- Origin of molecular diversity
 - Types of mutations (and how to detect them)
 - Models of mutations
- Detection and Quantification of genetic variation
 - Heterozygosity
 - DNA sequence variation (SFS, π , θ)
- Genetic differentiation
 - F_{st} , PCA, STRUCTURE
- Neutral theory
- Recombination and linkage disequilibrium
- Selection
 - Types of selection (positive, balancing, purifying)
 - Detection of selection (sweeps, F_{st} outliers, K_a/K_s)

- Demography
 - Expansion, bottlenecks, subpopulations, migration
- Quantitative Trait variation
 - Quantitative characters, Breeding type,
- Variance and covariances and heritability
 - Estimation of genetic variance and covariance from experiments
- Mapping quantitative traits
 - Experimental and natural populations, QTL analysis, Association analysis, marker assisted selection
- Epistasis, dominance
- Quantitative evolutionary genetics
 - adaptive evolution, fitness
- Domestication genetics

Conditions of Participation:

Passed Module QBio203

Examination:

Learning portfolio consisting of:

- Written Exam (50% of final grade)
- Exercise (50% of final grade)

Prerequisites for Awarding Credits for this Module:

- Passing the exercises (50 % of Exercise Sheets)
- Passing the written exam

Factor for the Overall Grade:

The grade is weighted according to the credit points (CP) in the overall grade.

Language:

English

Literature: -

“A primer of molecular population genetics” by Asher Cutter
 “Principles of population genetics” Hartl and Clark
 “Quantitative Genetics” by Armando Caballero
 “Evolution and selection of quantitative traits” by Walsh and Lynch
 “Population Genetics” by M.B. Hamilton, 2009
 “An introduction to quantitative genetics” Falconer D.S.

Further Information: -