Module Name	Module Code
Applied Genome and Proteome Research	AEF-agrig006
Module Coordinator	
Prof. Dr. Karl-Hermann Mühling	
Organizer	
Institute of Plant Nutrition and Soil Science - Plant Nutrition	
Institute of Crop Science and Plant Breeding - Plant Breeding	
Institute of Phytopathology - Molecular Phytopathology	
Institute of Animal Breeding and Husbandry - Animal Breeding and Genetics	
Faculty	
Faculty of Agricultural and Nutritional Sciences	
Examination Office	
Faculty of Agricultural and Nutritional Sciences - Examination Office	

ECTS Credits	6
Evaluation	Graded
Duration	one semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 hours
Total Workload	180 hours
Contact Time	60 hours
Independent Study	120 hours
Teaching Language	English

Further Information on the Teaching Language			
english			
Recommended Requirements			
Advanced understanding of genetics and protein biochemistry (according to modules “Biochemistry and Proteomics“ and “Introduction to Molecular Biology“			
Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Internship	Genome Research Techniques	Compulsory	4
Internship	Proteome Research Techniques	Compulsory	4
Prerequisits for Admission to the Examination(s)			
Regular visit of practical course are necessary.			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Protocol: Applied Genome and Proteome Research	Protocol	Graded	Compulsory	100

Further Information on the Examination(s)

1.+2. period in summer semester
1. period in winter semester

examiner: one of the teachers
QIS: 90600 with number of Examination 90610

Course Content

- Genome research:
- DNA and RNA isolation followed by quality check
- measuring nucleic acid concentrations
- cDNA synthesis
- Applied bioinformatics: BLAST, primer design, phylograms
- genotyping and phenotyping in segregating populations
- PCR and RT-qPCR with complex plant genomes
- whole genome-based transcriptome analysis
- Transcript profiling of selected genes
- Plant phenotyping in the greenhouse and in the field
- Plant-pathogen interactions
- Transcript profiling for candidate genes involved in plant-pathogen interactions
- Functional identification and characterization of miRNAs
- Proteome research:
- Nutriproteomics of plants
- Plant proteomics under abiotic stress

Learning Outcome

Understanding and application of genomic and proteomic technologies and methods. The students will work on a research project to practice techniques in plant molecular biology and genetics. They will learn to analyse DNA, mRNA and protein. They will be able to evaluate transcription profiles by RT-qPCR. Students will learn genotyping and mapping of molecular markers and calculation of recombination frequencies. They will understand the relationship between molecular marker genotyping and target gene phenotyping to work with molecular markers in breeding practice.

- Students learn to handle “Big RNAseq Data”
- Application of RNAseq-based approach for identification of candidate genes involved in plant-pathogen interactions
- Identification and characterization of miRNAs involved in plant-pathogen interactions
- Students understand separation techniques of the visualization of proteins
- Students know different detection techniques for the identification of proteins
- Students learn to apply techniques to extract and quantify DNA from different tissues available from livestock species. They learn on how to efficiently generate marker information including array technology. Different sequencing strategies can be evaluated and results interpreted.

Reading List

- Xu Y (2012) Molecular Plant Breeding. CABI, Oxfordshire
- Kole C, Abbott AG (2008) Principles and Practices of Plant Genomics. Science Publishers, Enfield, New Hampshire
- de Folter, Stefan (2019) Plant MicroRNAs
- Chekanova, J. A. (Ed), Wang, H. V. (Ed) (2019) Plant Long Non-Coding RNAs
- Filippo Geraci, Indrajit Saha and Monica Bianchini (2020) RNA-Seq Analysis: Methods, Applications and Challenges
- Proteomics from Protein sequence to function, Eds. S. R. Pennington and M. J. Dunn, Springer Press

Additional Information

Maximum number of participants: 20
Enrollment by OLAT within workdays Monday through Friday in the 1nd week of the 2. audit period of the preceding semester. Following information are necessary:
matriculation number
last name
first name
striven degree
study program
stu-Email

The allocation of the places takes place in the 2nd week of the 2. audit period of the preceding semester.
Acceptance of the place by students only through participation at the first day of the course.
Students without a place can get a place at the first day of the course by move-up procedure.
Practical course: either:
Genome research techniques (either Prof. Dr. C. Jung by Dr. S. Melzer or Prof. Dr. G. Thaller or Prof. Dr. D. Cai)or:
Proteome research techniques (Prof. Dr. K.H. Mühling by Dr. Britta Pitann)
or:
Off-Campus Internship (coordinated by one of the module advisors)

Use	Compulsory / Optional	Semester
Master, 1-Subject, Agricultural Sciences, Specialisation Agricultural Economics, (Version 2017)	Optional	-
Master, 1-Subject, Agricultural Sciences, Specialisation Agricultural Economics, (Version 2013)	Optional	-
Master, 1-Subject, Agricultural Sciences, Specialisation Agribusiness, (Version 2017)	Optional	-
Master, 1-Subject, Agricultural Sciences, Specialisation Agribusiness, (Version 2013)	Optional	-
Master, 1-Subject, Agricultural Sciences, Specialisation Crop Sciences, (Version 2017)	Optional	-
Master, 1-Subject, Agricultural Sciences, Specialisation Crop Sciences, (Version 2013)	Optional	-
Master, 1-Subject, Agricultural Sciences, Specialisation Animal Sciences, (Version 2017)	Optional	-
Master, 1-Subject, Agricultural Sciences, Specialisation Animal Sciences, (Version 2013)	Optional	-
Master, 1-Subject, Agricultural Sciences, Specialisation Environmental Sciences, (Version 2017)	Optional	-
Master, 1-Subject, Agricultural Sciences, Specialisation Environmental Sciences, (Version 2013)	Optional	-
Master, 1-Subject, AgriGenomics, (Version 2017)	Compulsory	-
Master, 1-Subject, AgriGenomics, (Version 2010)	Compulsory	-
Master, 1-Subject, Dairy Science, (Version 2017)	Optional	-
Master, 1-Subject, Nutritional and Food Science, (Version 2013)	Optional	-
Master, 1-Subject, Nutritional and Consumer Economics, (Version 2017)	Optional	-
Master, 1-Subject, Nutritional and Consumer Economics, (Version 2013)	Optional	-