Module variant to: Advanced Genetics and Genomics

Module: Epigenetics of Plants, Animals and Fungi	
University/Department/Teaching Unit: Freie Universität Berlin/Department of Biology, Chemistry, Pharmacy/Biology	
Module coordinator: Daniel Schubert, Léa Faivre	
Prerequisites: none	

Learning objectives:
Epigenetics deals with mitotically and/or meiotically stable inheritance that is not based on changes of the DNA sequence. Epigenetics therefore allows stable but also reversible inheritance of gene expression states across cell divisions. Epigenetic gene regulation is fundamental for developmental processes, stress adaptation, genome integrity, regulation of transposable elements and also for the development of human diseases. The molecular regulatory principles are largely conserved between animals, plants and fungi suggesting an ancient origin. After completing this module, students will have a basic and broad spectrum of theoretical and methodological knowledge in the field of epigenetics, with a focus on epigenetics in plants and algae (theoretical and practical) and animals and fungi (theoretical). Students will acquire molecular biology but also bioinformatics and AI related skills. Students are able to understand, present and discuss original scientific literature on epigenetics with a focus on critical examination. In addition, they are able to independently develop further research approaches to answer questions in epigenetic research.

Content:
This module covers various topics of epigenetic gene regulation with a focus on photosynthetic organisms. Since many epigenetic processes are highly conserved, the module will also include topics from the animal and fungal kingdoms. In the first part, general mechanisms of epigenetic inheritance will be presented and discussed. In the second part, specific epigenetic systems such as Polycomb/Trithorax proteins, DNA methylation and histone modifications, Eu and heterochromatin regulation and reprogramming of epigenetic inheritance will be discussed in more detail. The third part deals with the role of epigenetics in plant and animal development and addresses the role for epigenetics in stem cells and its relevance for human disease. Current topics in epigenetics are reviewed, presented and critically discussed with the aid of original literature. This teaches the preparation, publication and critical discussion of scientific results. In the practical, molecular experiments imaging techniques to study epigenetics are presented and carried out. Bioinformatic and AI-guided techniques are used to study epigenomic profiles and protein-protein/DNA interactions.

Modes of instruction	**Contact hours** (hours per week during the semester)	**Types of active participation**	**Workload** (in hours)	
Lecture (V)	2	–	Class attendance (lecture) Preparation, before and after (lecture)	30 30
Seminar (S)	1	Presentation and discussion	Class attendance (seminar) Preparation, before and after (seminar)	15 30
Safety Lab (sP)	5	Carrying out and documenting lab experiments	Class attendance (safety lab) Preparation, before and after (safety lab)	75 40
			Exam preparation and exam	80
Module assessment		Written exam (60 minutes), wholly or partially in multiple-choice format; can also be carried out electronically or written report on research results (approx. 10 pages) or examination colloquium (approx. 20 minutes)		
Language		English		
Regular attendance required		Seminar and safety lab: yes, lecture: attendance recommended		
Total workload		300 hours	10 credit points	
Duration		one semester		
Frequency		irregular		
Applicability		Master's degree program M.Sc. Biology		

Utilization in the following specializations (decision by the examining board):

Biodiversity, Evolution and Ecology	
Genetics and Genomics	x

Microbiology	
Molecular- and Cellular Biology	x
Molecular Plant Sciences	x
Neurobiology	
Biology	x