M4455	M4455 - Synthetic Biology and Biotechnology Synthetische Biologie und Biotechnologie

Coordinator (responsible lecturer) Prof. Dr. Matias Zurbriggen (matias.zurbriggen@uni-duesseldorf.de)			**Stand:** 01.10.2018
Lecturers Prof. Dr. Ilka Axmann, Prof. Dr. Oliver Ebenhöh, Prof. Dr. Markus Kollmann, Prof. Dr. Andreas Weber, Prof. Dr. Matias Zurbriggen			**Semester:** 1.- 2.
Contact and organization Prof. Dr. Matias Zurbriggen (matias.zurbriggen@uni-duesseldorf.de)			**Mode:** Optional compulsory course
Workload 420 h	**Credit points** 14 CP	**Contact time** 225 h	**Self-study** 195 h
Course components Practical course: 18 SWS Lectures: 3 SWS	**Frequency** Each winter semester (if needed also in the summer semester)	**Group size** 16	**Duration** 1 Semester

Learning outcomes/skills

The students are able to describe and apply the theoretical and practical principles and strategies of synthetic biology and systems biotechnology in prokaryotic and eukaryotic systems (fungi, yeasts, plants and animals). The students can implement the new synthetic biology technologies and approaches, including new cloning methods and synthetic molecular switches, and can construct signalling, optogenetic and metabolic networks for fundamental research and biotechnological applications. The students are able to develop and formulate scientific questions, to plan experiments and to document, independently interpret and present the results. The students can describe the principles of the singal relay and integration and metabolite processing in prokaryotes and eukaryotes, as well as to understand and apply the concepts and methods of the quantitative biology that describe these systems. This includes the ability to computationally simulate biochemical kienetic parameters and to perform a statistical analysis of experimental data. The students are able to explain how to create and solve differential equations. They can independently perform, analysie and evaluate experimental determinations in the lab. They are able to independetly prepare and adequately present in English a seminar on a topic of their own choice with the aid of subject-related literature in English.

Forms of teaching

Lectures with exercises or wet-lab work, and seminar/presentation

Content

Experimentally oriented lecture and practical part:

The students obtain a review on the central principles of signal transduction, gene regulation, and of the metabolism of prokaryotic and eukaryotic cells of relevance in synthetic biology and biotechnological applications. They will learn new synthetic biology methdos for the construction of signalling and metabolic networks, biosensors and chemically- and light-regulated switches. The students receive insights into the novel contributions of synthetic biology in the fundamental and applied fields of agriculture, biomedicine, pharmaceutical development and production, as well as for the production of bioenergy and biomass. The lectures are complemented with practical sessions. Thereby, the studetns will learn new cloning methods and as an exercise/project will independently design, construct and implement syntehtic networks in prokayrotic and eukaryotic systems. The students will obtain

quantitative data from determinations of cellular responses to enviromental cues, e.g. determinations of inducible gene expression (light (optogenetics) and chemically-regulated switches), circadian clock regulated genes, and measurements and calculation of metabolite concentrations in cells during differetn growth phases.
Theoretically oriented lectures:
The students learn with simple programming languages (Phython how to computationally simulate biochemical reaction rates and to perform statistical analysis thereof. The mathematical principles (differntial equatioons, statistics) will be introduced in accompanying lectures at a level that is easily understandable.

Eligibility
Formal: Admission to Master program
Content-related: noe

Examination types
Learning portfolio consisting of:
(1) Skill area knowledge (60% of the grade): written or oral examination on the content of the lecture and the practical course, exercises
(2) Skill area documentation (20% of the grade): protocol (presentation of subject, execution, evaluation and discussions of scientific experiments)
(3) Skill area scientific presentation (20% of the grade): preparation, presentation and discussion of a subject related publication/seminar.

Requirements for the award of credit points for this course
(1) Regular attendance and active participation in the classes and the practical course. Submission of a protocol complying with the requirements of scientific documentation
(2) Pass of exam
(3) Oral presentation in a seminar with an accompanying handout.
(4) The final grade is calculated from the mark of the written exam (60% of final grade) and the description of the analyses, performance of experiments and the scientific presentation (40% of the grade).

Relevant for following study programs/major
M.Sc. Biology
Major:
Synthetic Biology and Biotechnology
Molecular Ecology and Evolution
Physiology and Development
Structural Biology

Compatibility with other curricula
M.Sc. Biochemistry, Molecular Biomedicine

Significance oft he mark fort he overall grade
The mark given will contribute to the final grade in proper relation to its credits.
M.Sc. Biologie 14/72 CP (2-years program)

Course language
German
English
German and English
German, English on demand
Examination in English; German on demand

Additional information
Enrolling into the module is granted by the central study office of the Department of Biology. http://www.biologie.hhu.de/en/studies-in-biology/students-info/central-allocation-of-modules.html or per e-mail to matias.zurbriggen@uni-duesseldorf.de