Import module

[C2.4]	Biological Synthesis	Elective module in the core area C2	7 CP (total) = 210 h		4 SWS
			Contact hours 4 SWS / 60 h	Independent study 150 h	

Content

Seminar: Introduction to the concepts and principles that determine biological synthesis, demonstrated using selected examples: Biosynthetic concepts for the production of proteins, amino acids, nucleic acids, fatty acids, polyketides, non - ribosomal peptides, alkaloids and terpenes; conversion of light into chemical energy; fixation of CO_2 ; Key metabolic pathways in living organisms (ie citric acid cycle as the central metabolic pathway); Engineering of biosynthetic pathways for the directed production of bioactive compounds (ie polyketides and non-ribosomal peptides). An overview of synthetic principles and a detailed mechanistic insight into specific enzymes are given. The focus will be on chemical-biological aspects. Concepts of selected structural biological methods (EM, ET and X-ray crystallography) as well as enzymatic assays are presented. Emerging technologies relevant to the field of biomolecule engineering and pathway design are introduced, such as amber codon suppression for the incorporation of non-canonical amino acids into proteins.

Lecture: Introduction to the application of biomacromolecules as bioactive substances to control metabolic processes, in particular the application of biomolecules and their pharmaceutical development aspects in the treatment of diseases and disorders. The focus is on diabetes mellitus and its treatment with insulin and antidiabetic peptides, viral infections (mainly HIV), immune disorders and other rare muscle diseases, and treatment with small molecule enzyme inhibitors, antibodies and oligonucleotides (RNA). 3D structural biological methods and pharmaceutical development aspects are presented and selected case studies are discussed.

Learning outcomes and skills

The course introduces biological synthesis as an alternative and complementary method to chemical synthesis and introduces key molecules that regulate biological synthesis and processes (factors, effectors, biologics, ...). The aim is to provide students with an inspiring background that enables them to 1) understand synthetic and regulatory processes in the cell, 2) rationally design and evolve biological systems to acquire new functions (e.g. synthesis of a non natural polymer that can be used in materials science), 3) to construct new macromolecular complexes or nanomachines that can be artificially regulated (eg synthesis of macromolecular machines that can be switched on and off), and 4) to pursue and design new approaches in synthetic biology that can lead to the creation of new artificial cells (e.g. design of a minimal artificial cell that can regenerate itself).

Admissions requirements/Conditions for participation in the module/courses

Recommended prior knowledge

Organizational details

Import module, the registration and cancellation periods of the regulations for the Master's degree in chemistry apply. (The oral exam requires **registration** no later than **seven days** before the examination date. You can withdraw up to two working days before the examination date without giving reasons.)

Module allocation (degree programme/faculty)	Master Chemistry / FB14
Module transferrable to other degree programmes	Master Biochemistry / FB14, Master Molecular Biotechnology / FB15
Module offered	winter semester
Duration	1 semester
Module coordinator	Prof. Grininger
Course requirements for credits	
Participation record	Seminar: regular and active participation
Coursework	
Forms of teaching / learning	seminar, lecture
Language teaching and instruction	English (exam language either German or English)
Module assessment	**Form / duration / content, if applicable**
Final module assessment	Oral Exam (20 min.)
Cumulative module assessment consisting of	
Composition of the module grade for cumulative module assessment	

	Mode of teaching / study	Semester hours per week	Semester CP			
			1	2	3	4
Biological synthesis	S	2	4			
Structural biological aspects and pharmaceutical development of biomacromolecules	L	2	3			
TOTAL		4	7			