Modulbezeichnung:	Molecular synthesis (MSM-ME1) (Molecular synthesis)	15 ECTS
Modulverantwortliche/r:	Andreas Hirsch	
Lehrende:	Marcus Speck, Ivana Ivanovic-Burmazovic, Frank Wilhelm Heinemann, Nicolai Burzlaff, Andreas Scheurer, Karsten Meyer, Julien Bachmann, Svetlana Tsogoeva, Andreas Hirsch	

Startsemester: SS 2020	Dauer: 2 Semester	Turnus: halbjährlich (WS+SS)
Präsenzzeit: 210 Std.	Eigenstudium: 240 Std.	Sprache: Englisch

Lehrveranstaltungen:

Check for other alternatives in **UnivIS**

NB: no overlap with courses in Mandatory Module allowed

A. LAB course Molecular Synthesis

either in Inorganic or Organic Chemistry (6LAB/1S)

(Attendance in lab course is compulsory!)

Lab course Molecular Synthesis - IC (SS 2020, Praktikum, Die Dozenten der Anorg. Chemie et al.)

Challenges in Organic Chemistry / Seminar: Syntheseprobleme in der Organischen Chemie (SS 2020, Hauptseminar, 2 SWS, Andreas Hirsch et al.)

Lectures & Seminars:

B. Advanced Inorganic Chemistry I (2L/1S)

C. Advanced Inorganic Chemistry II (1L)

choice of 1 course from

C1: Bioinorganic chemistry I (1L)

C2: NN

C3: Nanoparticles and nanostructured thin films (1L)

C4: Modern X-Ray structure determination of single crystals (2L)

Bioinorganic Chemistry I, Metalloenzymes and Metals in Medicine (SS 2020, Vorlesung, 2 SWS, Nicolai Burzlaff)

Modern X-ray structure determination of single crystals/Einführung i. d. Kristallstrukturbestimmung von Molekülverbindungen (SS 2020, Vorlesung mit Übung, 2 SWS, Frank Wilhelm Heinemann et al.)

D. Advanced Organic Chemistry I (2L)

E. Advanced Organic Chemistry II (2L)

choice of 1 course from

E1: Organocatalysis (2L)

E2: Chemie der Naturstoffe (2L)

E3: Radical Chemistry (2L)

Organocatalysis and catalytic reactions in water (SS 2020, Vorlesung, 2 SWS, Svetlana Tsogoeva et al.)

Seminar: Chemie der Naturstoffe (SS 2020, Hauptseminar, 2 SWS, Marcus Speck et al.)

Current issues in Organic Chemistry I/II (Advanced Organic Chemistry II) (SS 2020, Seminar, 2 SWS, Andreas Hirsch et al.)

Inhalt:

A: Advanced chemical synthesis and molecular analysis

B: Inorganic and coordination chemistry principles; application of spectroscopic methods; advanced reaction mechanisms and experimental methods; important catalytic processes driven by metal complexes; design and synthesis of catalysts, physiologically active substances and new materials based on transition metals compounds

D: Modern synthetic methods in organic chemistry: pericyclic reactions, heterocycle syntheses, modern catalytic methodologies (metal-, organo- and biocatalysis), strategies in stereoselective synthesis

C1: Metal binding to proteins and DNA; functions of metal ions in enzymes; O_2transport, storage and activation; electron transfer in proteins; heme and non-heme iron containing oxygenases; zinc peptidases and proteases; superoxide dismutases; copper containing enzymes; biological function of nickel, molybdenum and tungsten; concepts and synthesis of model complexes; basics of Photosynthesis

C3: Synthesis of n-dimensional nano-materials. Systematic approaches towards nano-particles of defined size and structure are the basis to prepare materials with taylor-made electronic, optical or catalytic properties. The interplay between nano-particles, nano-rods, nano-wires, 2- and 3-dimentional materials are highlighted.
C4: Fundamentals of crystallization; polymorphism; structural description of crystals, crystal systems, unit cell, symmetry and symmetry elements, space groups; diffraction power of crystals, diffraction conditions, structure factor; generation of X-rays, single crystal diffractometers, data collection, data reduction; structure solution and refinement, problems and pitfalls, anomalous dispersion and absolute structure, interpretation of results, graphical representations, data bases.
E1: General concepts of organocatalysis. Enamine/iminiumion activation by Lewis basic amines. Non-covalent catalysis with ureas, thioureas and diols. Brønsted- and Lewis-acid catalysis. Phase-transfer catalysis. Bi- and multi-functional catalysts. Iminium/Enamine cascade catalysis. Organocatalytic domino reactions; natural product and chiral drug synthesis.
E2: Structure, isolation and structure elucidation of natural products; biosynthesis and degradation of carbon hydrates, lipids, peptides and terpenoids; biological and medicinal aspects of tetrapyrrols and alkaloids; technical synthesis of vitamins
E3: Radical reactivity; time scales and radical clock experiments; electrophilic and nucleophilic radicals; radical initiators; radical generation by oxidation or reduction; tin hydrides and modern replacements; atom and group transfer reactions; generation of various carbon-centered radicals; generation of oxygen- and nitrogencentered radicals.

Lernziele und Kompetenzen:

The students are able

- to understand and to explain the principles of advanced chemical synthesis routes and molecular analysis in organic and inorganic chemistry
- to understand the functionality of various molecular systems
- to participate in planning, developing and executing of experimental routes for the synthesis of more complex molecular systems
- to characterize molecular samples (natural compounds, e.g., peptides or vitamins, or metal-based drugs) using modern experimental methods and techniques
- to interpret and critically summarize experimental results in written form (lab report in paper-style format)
- to work in smaller research teams (team ability).

Verwendbarkeit des Moduls / Einpassung in den Musterstudienplan:

Das Modul ist im Kontext der folgenden Studienfächer/Vertiefungsrichtungen verwendbar:

[1] **Molecular Science (Master of Science)**
(Po-Vers. 2007 | NatFak | Molecular Science (Master of Science) | alte Prüfungsordnungen | Gesamtkonto | Wahlpflichtmodul Molecular Science)

[2] **Molecular Science (Master of Science)**
(Po-Vers. 2013 | NatFak | Molecular Science (Master of Science) | Wahlpflichtmodul Molecular Science)

Studien-/Prüfungsleistungen:

Molekülsynthesen - Molecular Synthesis (Prüfungsnummer: 30801)
(englische Bezeichnung: Molecular Synthesis)

Prüfungsleistung, mündliche Prüfung, Dauer (in Minuten): 45
Anteil an der Berechnung der Modulnote: 100%
weitere Erläuterungen:
Assessment and examinations: O45 (PL) + LAB (SL): oral examination (45 min), 2 Examiners + Lab course protocol(s), ungraded
Calculation of the grade for the module: 100% from oral examination
Prüfungssprache: Englisch

Erstablegung: WS 2020/2021, 1. Wdh.: SS 2021
1. Prüfer: Andreas Hirsch (070402)

Organisatorisches:

Intended stage in the degree course: Mandatory elective module (Wahlpflichtmodul) or Elective module (Wahlmodul), semester 1-3

Frequency of offer: start of studies is available in summer and winter term

A: upon appointment with contact persons

B & D: winter term

E1/E2: summer term; E2 also winter term;

E3: winter term

C1: summer term

C3: winter term