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

Startsemester: WS 2019/2020	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!)

Praktikum Anorganische Molekülsynthesen - Masterstudium / Lab Course Molecular Synthesis IC - Master-level program (WS 2019/2020, Praktikum, Karsten Meyer et al.)

Advanced Inorganic Chemistry - Seminar Talk (Vortragsseminar zum Fortgeschrittenenpraktikum Anorganische Chemie) (WS 2019/2020, Seminar, 1 SWS, Andreas Scheurer)

Advanced Inorganic Chemistry - Practical (SS 2020, Praktikum, 8 SWS, Die Dozenten der Anorg. Chemie)

Advanced Inorganic Chemistry - Seminar Talk (Vortragsseminar zum Mitarbeiterpraktikum Anorganische Chemie) (SS 2020, Seminar, 1 SWS, Andreas Scheurer)

Praktikum Organische Molekülsynthesen - Masterstudium / Lab Course Molecular Synthesis OC - Master-level program (WS 2019/2020, Praktikum, 7 SWS, Svetlana Tsogoeva et al.)

Syntheseprobleme in der Organischen Chemie / Synthesis problems in organic chemistry (WS 2019/2020, Seminar, 2 SWS, Andreas Hirsch et al.)

Advanced Organic Chemistry - Practical (SS 2020, Praktikum, 7 SWS, Andreas Hirsch)

Lectures & Seminars:

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

Advanced Inorganic Chemistry (WS 2019/2020, Vorlesung, 2 SWS, Ivana Ivanovic-Burmazovic et al.)

Advanced Inorganic Chemistry - Seminar (WS 2019/2020, Seminar, 1 SWS, Ivana Ivanovic-Burmazovic et al.)

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)

Metalle in der Medizin + Grundlagen BioAC (SS 2020, Vorlesung, 1 SWS, Nicolai Burzlaff)

Nanoparticles and Nanostructured Thin Films / Nanopartikel und nanostrukturierte dünne Schichten (WS 2019/2020, Vorlesung, 2 SWS, Julien Bachmann)

Modern X-ray structure determination of single crystals/Einführung i. d. Kristallstrukturbestimmung von Molekülverbindungen (WS 2019/2020, Vorlesung mit Übung, 2 SWS, Frank Wilhelm Heinemann et al.)

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)

Advanced Organic Chemistry I - Synthesis and Catalysis/Fortgeschrittene Organische Chemie I - Synthese und Katalyse (WS 2019/2020, Vorlesung, 2 SWS, Svetlana Tsogoeva et al.)

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. Noncovalent 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).

Studien-/Prüfungsleistungen:

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

Prüfungsleistung, schriftlich oder mündlich
Anteil an der Berechnung der Modulnote: 10%
weitere Erläuterungen:
Assessment and examinations: Oral examination (45 min) or alternative examination according to FAU Corona statutes!
Prüfungssprache: Englisch

Erstablegung: SS 2020, 1. Wdh.: WS 2020/2021
1. Prüfer: Karsten Meyer

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