Modulbezeichnung:	**Molecular synthesis (MSM-ME1)** (Molecular synthesis)	**15 ECTS**
Modulverantwortliche/r:	Andreas Hirsch	
Lehrende:	Rik Tykwinski, Frank Wilhelm Heinemann, Svetlana Tsogoeva, Frank Hampel, Karsten Meyer, Assistenten, Milan Kivala, Norbert Jux, Andreas Scheurer, Nicolai Burzlaff, Julien Bachmann, Andreas Hirsch, N.N., Sjoerd Harder, Jürgen Schatz, Die Dozenten der Anorg. Chemie, Ivana Ivanovic-Burmazovic, Marcus Speck	

Startsemester: WS 2015/2016	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)

Praktikum Anorganische Molekülsynthesen - Masterstudium / Lab Course Molecular Synthesis IC - Master-level program (WS 2015/2016, Praktikum, Karsten Meyer et al.)

Praktikum Organische Molekülsynthesen - Masterstudium / Lab Course Molecular Synthesis OC - Master-level program (WS 2015/2016, Praktikum, 7 SWS, Svetlana Tsogoeva et al.)

Lectures & Seminars:

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

Advanced Inorganic Chemistry (WS 2015/2016, Vorlesung, 2 SWS, Ivana Ivanovic-Burmazovic et al.)

Advanced Inorganic Chemistry - Seminar (WS 2015/2016, Seminar, 1 SWS, Ivana Ivanovic-Burmazovic et al.)

Advanced Inorganic Chemistry - Seminar Talk (Vortragsseminar zum Fortgeschrittenenpraktikum Anorganische Chemie) (WS 2015/2016, Seminar, 1 SWS, Andreas Scheurer)

Advanced Inorganic Chemistry - Seminar Talk (SS 2016, Seminar, 1 SWS, Die Dozenten der Anorg. Chemie)

C. Advanced Inorganic Chemistry II (1L)

choice of 1 course from

C1: Bioinorganic chemistry I (1L)

C2: Metals in medicine (1L)

C3: Nanoparticles and nanostructured thin films (1L)

C4: Modern X-Ray structure determination of single crystals

Bioinorganic Chemistry I, Metalloenzymes and Metals in Medicine (WS 2015/2016, Vorlesung, 2 SWS, Nicolai Burzlaff)

Seminar zur Vorlesung 'Metalle in der Medizin' (WS 2015/2016, Seminar, 1 SWS, Nicolai Burzlaff)

Nanoparticles and Nanostructured Thin Films / Nanopartikel und nanostrukturierte dünne Schichten (WS 2015/2016, Vorlesung, 2 SWS, Julien Bachmann)

Modern X-ray structure determination of single crystals/Einführung i. d. Kristallstrukturbestimmung von Molekülverbindungen (WS 2015/2016, 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 2016, 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 2015/2016, 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 (SS 2016, Vorlesung, 2 SWS, Svetlana Tsogoeva)

Seminar: Chemie der Naturstoffe (SS 2016, Hauptseminar, 2 SWS, Marcus Speck et al.)

Current issues in Organic Chemistry I/II (Advanced Organic Chemistry II) (SS 2016, Seminar, 2 SWS, Andreas Hirsch et al.)

Empfohlene Voraussetzungen:

Admission to the M. Sc. program Molecular Science or Chemistry

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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

C2: Platinum based anticancer drugs; Ruthenium and gold based metallotherapeutics; silapharmaca; Li therapeutics; boron neutron capture therapy; MnSOD; insulin mimetic vanadium containing compounds; magnetic resonance imaging (MRI); cobalamin; metal poisoning; Hg in the biosphere; metallotherapeutic arsenic compounds; technetium radiodiagnostics; antimony in medicine; bismuth based pharmaceuticals

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.

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).

Literatur:

Manuscripts available online for most lectures

Check respective information and docket (“Laufzettel") on the Molecular Science web page

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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. 2013 | 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: Portfolio: LAB (SL, AP) Lab course protocol(s) without marks + oral examination (45 min) 2 Examiners
Calculation of the grade for the module: 100% from oral examination
Prüfungssprache: Englisch

Erstablegung: SS 2016, 1. Wdh.: keine Angabe
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: annually/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/C2/C3: winter term

Bemerkungen:

Courses of study for which the module is acceptable: M.Sc. Molecular Nanoscience or M.Sc Molecular Lifescience