Modulbezeichnung:	**Chemistry of life (CE10/MSM-ME6)** (Chemistry of life)	**15 ECTS**
Modulverantwortliche/r:	Ivana Ivanovic-Burmazovic	
Lehrende:	Andriy Mokhir, Ivana Ivanovic-Burmazovic	

Startsemester: WS 2017/2018	Dauer: 2 Semester	Turnus: jährlich (WS)
Präsenzzeit: 225 Std.	Eigenstudium: 225 Std.	Sprache: Englisch

Lehrveranstaltungen:

A. Chemistry of Biomolecules and Cellular Functions (2 SWS/VORL)
Chemistry of Biomolecules and Cellular Functions (WS 2017/2018, Vorlesung, Andriy Mokhir)

B. Cell Signaling and chemistry of oxidative stress (2 SWS/VORL)
Cell Signaling and chemistry of oxidative stress (SS 2018, Vorlesung, 2 SWS, Ivana Ivanovic-Burmazovic)

C. Seminar: Experimental Techniques and Selected Topics in Chemical Biology of Diseases (1SWS/SEM)
Experimental Techniques and Selected Topics in Chemical Biology of Diseases (part1) (WS 2017/2018, Seminar, 1 SWS, Milos Filipovic et al.)
Experimental Techniques and Selected Topics in Chemical Biology of Diseases (part2) (SS 2018, Seminar, 1 SWS, Ivana Ivanovic-Burmazovic)

D . Practical session (10SWS/PRA)
Attendance in lab course is compulsory!
Chemistry of Life - Practical session (WS 2017/2018, Praktikum, Ivana Ivanovic-Burmazovic et al.)
Chemistry of Life - Practical session (SS 2018, Praktikum, Ivana Ivanovic-Burmazovic et al.)

Inhalt:

A.
- Relation between the 3D protein structure and their function, including discussion of state-of-the-art methodology
- Biochemistry of biological membranes (chemistry of carbohydrates, lipids an protein channels)
- Chemical biology of nucleic acids as therapeutic targets
- Protein-nucleic acid interactions
- Cell as self-sustainable and bio-functional confined space
- Nucleosides and Nucleotides
- Chemical and biological synthesis of nucleic acids
- DNA and RNA structure
- Nucleic acids in biotechnology
- Spectroscopic and structural methods applied in studies of nucleic acids
- Nucleic acids and their analogues as drugs

B.
- Bioinorganic chemistry of electron transfer
- Thermodynamics and kinetics of mitochondrial processes
- Biochemistry of free radical generation and removal
- Monitoring oxidative stress in living systems
- Interplay between oxidative stress and cell signaling pathways: Inflammation, Neuropathie and Cancer as model systems
- Redox drugs

C. Seminar: Preparation for practical session with an accent on the methodological approach and medical aspects

D.

D1: Structure and function of proteins: denaturation/renaturation, protein-ligand interactions (UV-Vis, fluorescence and EPR spectroscopy, amperometric analysis of small-molecule interactions)

D2: Kinetics of SOD and Catalase activity of natural enzymes and their synthetic mimics (direct stopped-flow methods vs. indirect assays)

D3: Cell preparation for fluorescence microscopy (staining of cell compartments and detection of oxidative stress)
D4: Protein purification and analysis (cell extract preparation, 2D-electrophoresis of total cell extract, trypsin digestion, HPLC separation and ESI-MS-detection)
D5: Synthesis of a representative nucleic acid analogue; its identification (MALDI-TOF MS), purification (HPLC), quantification (UV-visible spectroscopy), study of binding to a target nucleic acid (fluorescence spectroscopy, melting profile measurement).
D6: As a DEMO-Experiment: testing inhibitors in cellular cultures, monitoring inhibition by using flow cytometry and RT PCR

Lernziele und Kompetenzen:

Students

- are provided with the up-to-date practical and operative know-how suitable for future scientific and/or applied work in research institutes, pharmaceutical/food industry, medical care laboratories, bio-technological, bio-analytical and environmental branches
- get an advanced theoretical background and an overview of emerging trends in life sciences (chemistry, biology and medicine)
- look at living systems through the lens of basic chemical principles
- are prepared to work in interdisciplinary environment and participate in national and international development of forefront fields such as translational medicine.

Literatur:

Selected chapters from:

- Voet & Voet, Biochemistry, Wiley & Sons;
- Barry Halliwell & John M. C. Gutteridge, Free Radicals in Biology and medicine, Oxford
- I. M. Rosenberg, Protein Analysis and Purification, Birkhäuser
- Bertini, Gray, Stiefe, Valentine, Biological Inorganic Chemistry, Structure & Reactivity, University Science Books
- F. Marks, U. Klingmüller, K. Müller-Decker, Cellular Signal Processing: An Introduction to the Molecular Mechanisms of Signal Transduction, Taylor & Francis

---

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 | NatFak | Molecular Science (Master of Science) | Wahlpflichtmodul Molecular Science)

Dieses Modul ist daneben auch in den Studienfächern "Chemie (Master of Science)" verwendbar.

Organisatorisches:

Module frequency: Annually, **starting only in winter term;**
the module can only be taken as a whole

Bemerkungen:

Module compatibility: M.Sc. Molecular (Life) Science (Mandatory elective module/ Wahlpflichtmodul)/ M.Sc. Chemistry (Elective Module/Wahlmodul)