BuildMoNa

UNIVERSITÄT LEIPZIG

## SCIENTIFIC AND METHOD MODULES

| Module name | **Hybrid Systems**<br>Functional Biomolecules at (Solid) Materials Interfaces |
|---|---|
| **Number** | 2014-T6 |
| **Aims** | This module teaches the principles in preparation and application of hybrid systems, including immobilization of biomolecules and cells and prerequisites for materials to attach biomolecules, as well as possible future applications in biomedicine, biotechnology and informatics. Moreover, it introduces the knowledge to produce solid-state devices that can be interfaced with soft matter. |
| **Basics** | covered in basic modules B1–B3 (chemical synthesis of peptides and carbohydrates, proteins (recombinant expression, folding, analysis), surfaces (materials, analysis), basics in polymers/macromolecular science, solid-state electronics, cell biology) |
| **Contents** | Hybrids of synthetic and biological compounds (combinations of synthetic molecules and peptides, advantages of synthetic and biological building blocks), Hybrid compatible proteins (protein expression by methods that allow modification and introduction of non-proteinogenic amino acids, intein and impact system, modification of tRNA and genetic code expansion, selective chemical modification, cellfree protein production, pegylation), Biocompatibility, toxicity and biodegradation, Chemical aspects (generation of polymers, surface modification, nanoscaffolds, preparation of building blocks, smart materials), Hybrid compounds (preparation, analysis, ligation strategies, immobilisation), Applications (biomedical science, biosensors), Biological cells on chips (bioimpedance, electrodes and MOSFETs for cells, neuronal networks, cardiac tissue), Smart cell substrates (switchable polymers, nanopores, nanostructures, nanocontact printing). |
| **Methods** | Methods for proteins and peptides (techniques for modified proteins, side-chain protection strategies in peptide synthesis, cell-based assays to study toxicity, biostability and inflammation), Analytics (biocompatible mass spectrometry [MALDI-TOF, ESI-Q3], AFM, solid-state NMR, solution NMR, fluorescence microscopy, confocal microscopy, SPR), Neuronal cells (isolation, culture, patch clamp), Fabrication of solid-state devices (building nanostructures, ZnO-based devices). |
| **Type** | Two-day block course/ bi-yearly recurrence with modification |
| **Date (month/year)** | 22/23 May 2014 |
| **Time** | 22 May: 9:30 - 17:00, 23 May: 9.30 - 17:00 |
| **Work load** | 15 hours presence/ 45 hours self-study |
| **Examination** | Written |
| **Credit points** | 2 |
| **Responsible scientists** | Pompe |
| **International guest lecturers** | Prof. Dr. Manuel Salmeron-Sanchez (University of Glasgow, UK) |
| **Industrial partners** | |
| **Recommendations for literature, e-learning** | |

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**SCHEDULE for Module 2014-T6**

| Time | Lecturer | Programme | Location |
|---|---|---|---|
| **Day 1** | | | |
| 22 May 2014 | | **Materials** | Johannisallee 21, room 215 |
| 9:30-10.45 | Prof. M. Salmeron-Sanchez, University Glasgow | Material-driven protein assembly to engineer the cellular microenvironment | |
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| 11:00-12-15 | Dr. C. Sperling, Leibniz Institute of Polymer Research Dresden | Functionalized surfaces for improved hemocompatibility | |
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| 14:00-15:15 | Dr. H. Hähl, Universität Saarland, Saarbrücken | Proteinadsorption at interfaces | |
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| 15:30-16:45 | Prof. M. Salmeron-Sanchez, University Glasgow | ECM proteins at the cell/material interface | |
| **Day 2** | | | |
| 23 May 2014 | | **Methods** | Johannisallee 21, room 215 |
| 9:30-10:45 | Dr. H. Hähl, Universität Saarland, Saarbrücken | Methods for the analysis of interfacial phenomena | |
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| 11:00-12:15 | Prof. C. Duschl, Fraunhofer Institute for Biomedical Engineering, Potsdam | Interaction of cells with technical substrate surfaces | |
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| 14:00-15:15 | Dr. T. Weikl, Max Planck Institute of Colloid & Interfaces, Potsdam | Adhesion via anchored receptors and ligands: theory and simulations | |
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| 15:30-16:45 | Dr. S. Schmidt, Universität Leipzig | Probing molecular interactions at bio-interfaces | |

**Didactic elements:**
Lecture, discussions.

**Expected performance:**
Active participation in discussions