

SCIENTIFIC AND METHOD MODULES

Module name	Hybrid systems
Number	2009-M09
Aims	Understanding the principle of biohybrid systems consisting of various nano-structured bioelectrical microarrays and viable cell and tissue models. The focus will be the generation and characterization of biomimetic interfaces and the biological component. Microfluidic and biosensoric monitoring systems will be demonstrated for understanding how the (bio)hybrid systems could be used for screening of active pharmaceutical ingredients.
Basics	(The topics are covered by lectures in biochemistry/biotechnology courses from existing bachelor and master courses): Principles in cell biology and biosensors as well as in microfabrication technology (photolithography, nanobiotechnology, biophysics)
Contents	1. Development of planary and 3D.microcavity-arrays with various substrates and conductive materials including the processing technology (overview) 2. Biophysical techniques to characterize cells using impedance spectroscopy and electrophysiology on biosensors. 3. Cell and tissue models on multielectrode-microarrays e.g. Morbus Alzheimer on a chip, Tumour-chip, cardiomyocyte-based array and a new stem cell biochip. 4. Microfluidic assays and bioreactors for eukaryotic cells – technical design, development, fabrication and validation.
Methods	Processing techniques to develop and fabricate nano-structured 2D and 3D micro-electrode-arrays including the ccharacterisation of material surface topology. High resolution microscopic techniques (Multiphoton Laser Scanning-Microscopy with STED modus). Monitoring and Imaging of biological models via bioelectrical and optical monitoring.
Type	Two-day block course/ yearly recurrence with modification
Date (month/year)	February 2 nd and 3 rd , 2010
Time	9.00 – 18.00
Work load	15 hours presence/ 45 hours self-study
Examination	Oral – February 09th, 2010
Credit points	2
Responsible scientists	Andrea Robitzki
International guest lecturers	Andreas Schober (TU Ilmenau), Leipzig University: Randy Kurz, Heinz-Georg Jahnke, Daniel Kloß; Ronny Schulz (TRM/BBZ)
Industrial partners	Till Mack (KeyNeurotek AG, Magdeburg)
Recommendations for literature, e-learning	s. http://www.uni-leipzig.de/~dmpt/lectures (pdf files of selected reviews and power point presentations)

SCHEDULE

Time	Lecturer	Programme	Location
February 2nd, 2010			
09:00–09:15	Andrea Robitzki	Overview and Introduction in Biohybrid Systems – Road Map	BBZ lecture hall
09:15-10:45	Randy Kurz, BBZ	Microstructures and microarrays for a real time monitoring of stem cells	BBZ lecture hall
11:00-12:30	Daniel Kloß	3D active microstructures for catching, positioning and measuring 3D <i>in vitro</i> tissue models or inorganic materials	
12:30-14:00	<i>Lunch break</i>		
14:00-15:30	Heinz-Georg Jahnke	<i>Morbus Alzheimer</i> models on biochips – from living neural cells to viable brain slices	BBZ lecture hall
15:45 – 18:00	All lecturers	Demonstration course of selected nano-micro-structures and biosensors	BBZ Laboratories 4 th floor
February 03rd, 2010			
09:30–11:00	Till Mack	<u>Research in Industry:</u> Modelling <i>M. Alzheimer</i> -typical neurodegeneration by localized gene transfer of mutated tau	BBZ lecture hall
11:15-13:00	Andreas Schober	Hybrid systems for Life Science applications	BBZ lecture hall
13:00-14:30	<i>Lunch break</i>		
14:30-15:30	Andreas Schober	Demonstration course of microfluidic systems - Practical aspects -	BBZ Laboratories 4 th floor
15:45-17:15	Ronny Schulz	Bioreactor strategies for Skeletal Tissue Engineering	BBZ lecture hall
17:30-18:30	Ronny Schulz	Demonstration course of bioreactor technology	BBZ Laboratories 2 nd floor

Didactic elements:

Lecture, discussions, practical training – lab demonstration

Expected performance:

Active participation in discussions during lab demonstration (selected work stations)