BuildMoNa

UNIVERSITÄT LEIPZIG

Module name	Multifunctional scaffolds
Number	2009-M10
Aims	The basic background in soft matter physics and the state of the art knowledge in active and passive biopolymer networks (with a focus on molecular motors) will be taught to enable the students to use highly dynamic polymer scaffolds as an organizing matrix for smart nanoelements and active proteins. A particular focus will be to build mechano-sensing, force-generating, moving, polymeric machines.
Basics	(The topics are covered in biophysics lectures from existing master courses): Polymer physics, liquid crystal physics, properties and isolation of biopolymers (DNA, actin, intermediate filaments, microtubule), viscoelasticity, statistical physics and thermodynamics of polymer chains
Contents	Different architectures of semiflexible polymer networks, polymer physics of semifelxible polymer chains (individual filaments, entangled and cross linked solutions, nematics), liquid crystal physics of lipid membranes (self-assembly, phase diagrams, vesicles, Langmuir monolayers, supported bilayers, thermal ratchets and molecular motors, thermal rachets and polymerization, self-organization in active polymer networks, active and passive filament bundles contractile structures)).
Methods	Rheology and microrheology techniques, single molecule imaging, digital polarization microscopy, confocal/multiphoton microscopy, scanning force spectroscopy of individual polymer chains, dielectric spectroscopy, single particle tracking, soft lithography and microfluidics, biochemistry, recombinant DNA.
Type	Two-day block course/ July 9-10
Work load	15 hours presence/ 45 hours self-study
Examination	written
Credit points	2
Responsible scientists	Käs
International guest lecturers	Prof. Wolfgang Frey, University of Texas at Austin
Industrial partners	n/a
Recommendations for literature, e-learning	• Masao Doi, “Introduction to polymer physics”, Oxford Science • P.G. de Gennes and J. Prost, “The physics of liquid crystals”, Oxford Science

SCHEDULE

Time	Lecturer	Program	Location
Day 1, Thursday, July 9th 2009			
9:00-10:45	Josef Käs	Introduction to polymer physics (part 1)	Aula
		Coffee break	
11:15-12:00	Josef Käs	Introduction to polymer physics (part 2)	Aula
		Lunch break	
14:00-14:45	Josef Käs	Semiflexible biopolymers	Aula
14:45-15:30	Josef Käs	Active polymer systems	Aula
Day 2, Friday, July 10th 2009			
9:00-10:00	Wolfgang Frey	Phenotype Control through a Defined Microenvironment: Mechanotransduction and the Clustering of Integrins	Aula
10:00-10:45	Josef Käs	Introduction to the physics of liquid crystals (part 1)	Aula
		Coffee break	
11:15-12:00	Josef Käs	Introduction to the physics of liquid crystals (part 2)	Aula

Location: Room 331 (Aula), Physics Building, Linnéstr. 5

Didactic elements:
Lecture that includes active discussions

Expected performance:
Homework as successful written exam