BuildMoNa

UNIVERSITÄT LEIPZIG

SCIENTIFIC AND METHOD MODULES

Module name	Multifunctional scaffolds - From Colloids to Amyloids, Biomimetic Scaffolds and Nano-Machines
Number	2010-M10
Aims	The module aims at providing the scientific background required to study and manipulate biopolymers, biopolymer networks, proteins and protein networks, including the highly dynamic polymer scaffolds in living tissues as an organizing matrix for smart nanoelements, molecular motors, mechano-sensing, in natural and artificial nanoscopic devices for force-generation, motile polymeric machines, biomimetic devices etc.
Basics	The topics covered in biophysics lectures from existing master courses; Basic knowledge about biopolymers (DNA, actin, microtubules), viscoelasticity, statistical physics
Contents	The module introduces the participants to physical, chemical and biological perspectives onto various multifunctional scaffolds as well as to modern experimental techniques. Topics comprise general soft matter background, statistical physics and simulation approaches, protein assembly and aggregation, the complex interactions in aqueous media, biopolymers and biopolymer networks, molecular motors, artificial nano-actuators, biomimetic structures, cytoskeleton & extra-cellular matrix
Methods	Single molecule imaging/tracking, advanced microscopy & scattering techniques, quantitative 3d-nano-scale measurements, micro-rheology, biochemistry, statistical mechanics, modeling, computer simulations
Type	Two-day block course/ yearly recurrence with modification
Date (month/year)	30.3.-1.4. 2010
Time	14h – 19:00h, 9h – 19h
Work load	15 hours presence/ 45 hours self-study
Examination	written exam 1.4.2010
Credit points	2
Responsible scientists	K. Kroy
International guest lecturers	E. del Gado (ETH Zürich), M. Claessens (Univ. Twente), A. Parmeggiani (Univ. Montpellier), A. Vilfan (Stefan Inst., Ljubljana), O. Lieleg (Harvard Univ.), S. Diez (MPI Dresden), P. Kollmannsberger (MPI Golm), T. Gisler (Univ. Konstanz)
Recommendations for literature, e-learning	Introductory: A. R. Bausch, K. Kroy, *A bottom-up approach to cell mechanics*, Nature Phys. 2 (2006) 231. P. Schwille and S. Diez, *Synthetic biology of minimal systems,* Crit. Rev. Biochem. Mol. Biol. 44 (2009) 223; D. Discher *et al*., *Biomechanics: Cell Research and Applications for the Next Decade,* Ann. Biomed. Eng. 37 (2009) 847. Further Reading: C. Semmrich, *et al., Glass Transition and Rheological Redundancy in F-Actin Solutions,* Proc. Natl. Acad. Sci. (USA), 104 (2007) 20199. M. Vilfan *et al., Self-assembled artificial cilia,* Proc. Natl. Acad. Sci. (USA), doi:10.1073/pnas. 0906819106. A. Zaccone et al. *Elasticity of Arrested Short-Ranged Attractive Colloids:Homogeneous and Heterogeneous Glasses,* Phys. Rev. Lett. 103 (2009) 208301. O. Lieleg et al., *Structure and dynamics of cross-linked actin networks,* Soft Matter 6 (2010) 218.

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SCHEDULE 2010

Time	Lecturer	Title
30.3.2010		
14:00-15:00	K. Kroy (Univ. Leipzig)	From colloids to amyloids
15:00-16:30	E. del Gado (ETH Zürich)	Structure and dynamics of colloidal gels and glasses
16:30-18:00	S. Diez (MPI-CBG Dresden)	3D-optical nanometry on biomolecular motor systems
18:00-19:30	A. Vilfan (Stefan Inst. Ljubljana)	Hydrodynamics of natural and artificial cilia
DINNER		
31.3.2010		
09:00-10:30	O. Lieleg (Harvard Univ.)	Physical properties of biological hydrogels
10:30-12:00	A. Parmeggiani (Univ. Montpellier)	Physical properties of intracellular cytoskeletal transport
12:00-13:30	T. Gisler (Univ. Konstanz)	Scattering techniques for probing cellular and tissue dynamics
LUNCH		
14:30-16:00	P. Kollmannsberger (MPI-KG Golm)	Magnetic microrheology as a tool for the mechanical characterization of cells and biopolymer networks
16:00-17:30	Mireille Claessens (Univ. Twente)	Unstructured proteins, amyloids and disease
17:30-19:00	R. Krishnan (Harvard Univ.)	Dynamic force regulation in adherent cells
DINNER		

Didactic elements:
Lectures, discussions (with coffee) between the lectures, etc.

Expected performance:
Active participation in discussions, exercises, and written examination

Location:
Chemistry building, Johannisallee 29, seminar room: 101 (1st floor)