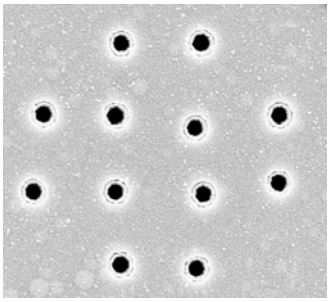
Swiss Soft  Days

1ST WORKSHOP Zürich 04.02.2010

Sponsored by

MRC
Materials Research Center

N. Spencer
ETHZ, Department of Materials
Surface Science and Technology

H.C. Öttinger
ETHZ, Department of Materials
Polymer Physics

Local Organizer

Emanuela Del Gado
ETHZ, Department of Materials
Polymer Physics

Lucio Isa
ETHZ, Department of Materials
Surface Science and Technology

Program

10.00-10.15	Introductory remarks	
Theme 1: Colloids & Polymers		
10.15-10.30	Ilg (ETHZ)	Structure and dynamics of complex fluids: simulations and coarse-graining issues
10.30-10.45	Kohlbrecher (PSI)	Structure and phase diagram of an adhesive colloidal dispersion under high pressure
10.45-11.00	Lattuada (ETHZ)	Magnetic gelation
11.00-11.15	Gasser (PSI)	Crystal structure of highly concentrated pH- and temperature-sensitive microgel suspensions studied by SAXS and SANS
11.15-11.30	Jeney (U Basel)	Confined Brownian motion studied by optical trapping interferometry
11.30-11.45	Witz (EPFL)	Topological effects in polymer physics probed with circular DNA
11.45-12.00	Ubbink (Nestlé)	Structural signatures of plasticization and antiplasticization in amorphous biomaterials
12.00-14.00	**Lunch / Coffee / Posters / Discussion**	
14.00-14.15	De Los Rios (EPFL)	Gaussian behavior of polymers at intermediate lengths
Theme 2: BioPhysics		
14.15-14.30	Aergerter (U Zürich)	Mechanics of the Drosophila wing imaginal disc
14.30-14.45	Fink (U Zürich)	Structural Biology at the single molecule level using coherent low energy electrons
14.45-15.00	Lim (U Basel)	Biomimetic functionality of polyethylene glycol (PEG)-- gated nanopores derived from binding interactions with associated antibodies
15.00-15.15	Hall (ETHZ)	3D-fibrin hydrogel matrices as scaffold and release systems
15.15-15.30	Delamarche (IBM)	Stamps, chips and miniaturized assays
15.30-16.30	**Coffee / Posters / Discussion**	
Theme 3: Assembly		
16.30-16.45	Stoll (U Geneva)	Modelling polymer adsorption/ complexation processes, nanoparticle surface properties, and aggregation of colloidal particles. Applications to aquatic ecosystems
16.45-17.00	Fischer (ETHZ)	Interfacial rheology of coacervated protein-polysaccharide-surfactant systems: The uneasy role of dilatation
17.00-17.15	Sturzenegger (ETHZ)	Fabrication of solid-coated microcapsules with unique microstructural and mechanical properties
17.15-17.30	Reimhult (ETHZ)	Lipid membranes on surfaces and ultra-stable core-shell nanoparticles as nanomaterials
17.30-17.45	Palivan (U Basel)	Antioxidant nanoreactors: a way to fight oxidative stress
17.45-18.00	Concluding remarks	
18.10-19.00	**Apero / Posters / Discussion**	

Abstracts

Theme 1: Colloids & Polymers 10.15 – 12.15

Structure and dynamics of complex fluids: simulations and coarse-graining issues

P. Ilg
Eidgenössische Technische Hochschule Zürich

Complex fluids like polymer solutions and melts, liquid crystals, colloidal fluids, etc. posses an internal structure with characteristic internal length and time scales. Dynamics and flow of such fluids is severely affected by their internal microstructure which itself is modified by the fluid dynamics. Understanding this interplay is essential for many applications and very interesting from a theoretical point of view.
I will show examples, where computer simulations can provide very valuable insight into this problem. However, the huge gap between microscopic structure and macroscopic behaviour imposes limits on brute force approaches. Therefore, I will also present a systematic coarse-graining method that is designed to bridge length and time scales in complex fluids.

Structure and phase diagram of an adhesive colloidal dispersion under high pressure

R. Vavrin, J. Kohlbrecher, A. Wilk, M. Ratajczyk, M. P. Lettinga, J. Buitenhuis, G. Meier
Paul Scherrer Institut

In this contribution we are concerned with the structure and phase diagram of a polydisperse adhesive hard sphere system. This system is known to display a complex phase behavior. Its phase diagram not only shows a gas-liquid phase separation line but also a percolation or gel line, which intersects the coexistence line. Numerous studies have been performed trying to shed a light on the structural properties that underlie this phase behavior. The model system we use in this study consists of silica spheres grafted with octadecyl chains in toluene at various volume fractions. This system of sticky hard sphere is a good model system as first, the interaction between the particles, and therefore the phase behavior, can very easily be tuned varying the temperature, as toluene is a marginal solvent for the grafted polymers. More interestingly, the interaction can equally be tuned with pressure such that a liquid-liquid phase transition can be induced also by changing the pressure. We have applied small angle neutron scattering (SANS), diffusing wave spectroscopy (DWS), and dynamic light scattering (DLS) on gas-liquid phase separation and percolation, depending on temperature T, pressure P, and concentration φ. We have determined by DLS the pressure dependence of the coexistence temperature and the spinodal temperature. The gel line or percolation limit was measured by DWS under high pressure using the condition that the system became nonergodic when crossing it and we determined the coexistence line at higher volume fractions from the DWS limit of turbid samples. From SANS measurements we determined the stickiness parameter $\tau_B(P,T,\varphi)$ of the Baxter model, characterizing a polydisperse adhesive hard sphere at various temperatures, pressures, and concentrations in the homogeneous phase. The phase coexistence and percolation line as predicted from $\tau_B(P,T,\varphi)$ correspond with the determinations by DWS and were used to construct an experimental phase diagram for a polydisperse sticky hard sphere model system. A comparison with theory shows good agreement especially concerning the predictions for the percolation threshold.

Magnetic Gelation

Marco Lattuada
Eidgenössische Technische Hochschule Zürich

We have introduced a novel technique to create porous materials with controlled structure that we called magnetic gelation. First of all, magnetic colloids, composed of several ~10nm magnetite nanocrystals dispersed into a polymeric matrix, and stabilized by a polymerizable surfactant, have been prepared via miniemulsion polymerization. Due to the superparamagnetic behavior of the nanocrystals embedded in the polymer matrix, the magnetic colloids, which can be prepared in a size range from 70 to 300 nm, develop strong and reversible dipolar interactions only in the presence of an external magnetic field.
We have then studied the gelation behavior of dispersions of these nanoparticles in presence and absence of an external magnetic field. The nanoparticels, which are stabilized by means of electrostatic interactions, are partially destabilized through the addition of controlled amount of electrolytes. In the absence of magnetic fields, the particles self-assemble into random fractal clusters, which eventually percolate to form a colloidal gel, at particle volume fraction of a few percents. Instead, when an external magnetic field is applied, the particles align themselves in columnar structures in the direction of the field. By tuning the time when the magnetic field is applied, as well as the size and magnetite content of the particles, different structures and characteristic pore sizes in the final gel are obtained. The materials obtained through the magnetic gelation process have been characterized by means of scanning electron microscopy.
In order to gain a better insight into the physics of the magnetic gelation process, and have some guidance in the choice of the optimal experimental conditions, Brownian Dynamic Simulations have been performed. A qualitative comparison between the simulation results and the experimental findings is presented.

Crystal structure of highly concentrated pH- and temperature-sensitive microgel suspensions studied by SAXS and SANS

U. Gasser, B. Sierra-Martin, A. Fernandez-Nieves
Paul Scherrer Institut

We present a small angle neutron and X-ray scattering study of the crystal structure formed by pH- and temperature-sensitive microgel particles. We focus on highly swollen particles and explore concentrations ranging from below close packing to well above close packing, where the particles are forced to shrink and/or interpenetrate. The crystal structure found from poly- as well as mono-crystalline areas is found to be random hexagonally close packed with a strong tendency towards hexagonal close packed structure.

Confined Brownian Motion studied by Optical Trapping Interferometry

Sylvia Jeney
Universität Basel & Ecole Polytechnique Fédérale de Lausanne

The dynamic behavior of a single colloidal particle in water confined by an optical trap and a plain surface is investigated at time scales where the inertia of the surrounding fluid plays a significant role. A weak optical trap with interferometric position detection allows monitoring a single micron-sized sphere with a spatial resolution better than 1 nm and a temporal resolution on the order of microseconds.
First, we quantify the influence of the confinement created by the harmonic potential of the optical tap on the particle's velocity autocorrelation, mean-square displacement and power spectral density. We find that they are in excellent agreement with the theory for a Brownian particle in a harmonic potential that accounts for hydrodynamic memory effects, which states that the transition from ballistic to diffusive motion is delayed to

significantly longer times than predicted by the standard Langevin equation. This delay is a consequence of the inertia of the fluid, introducing a backflow on the particle's fluctuations. At longer times the motion of the particle is dominated by the trapping potential. By identifying the time below which the particle doesn't "feel" the potential, we can exclude the existence of free diffusive motion as usually assumed in common optical trapping experiments.
Second, the particle is brought close to a hard surface and we observe how the subtle interplay of surface confinement and hydrodynamic backflow changes the decay of the particle's velocity autocorrelations from a slow $t^{-3/2}$ to a much faster power-law $t^{-5/2}$.
These findings show that the temporal resolution of Optical Trapping Interferometry can be extended down to time scales where the nature of the fluid influences diffusion, bringing the long discussed idea of using a Brownian particle as a local reporter of the dynamics of complex biological fluids one step further.

Gaussian behavior of polymers at intermediate lengths

Paolo De Los Rios
Ecole Polytechnique Fédérale de Lausanne

Two regimes are well characterized, both experimentally and theoretically, about the statistics of polymers: on short lengths, smaller than the persistence length, polymers behave as rigid rods; on lengths much longer then the persistence length they behave as self-avoiding walks. We highlight here through experiments, analytical arguments and simulations the presence of an intermediate regime with simple random walk statistics.

Topological effects in polymer physics probed with circular DNA

Guillaume Witz, Kristian Rechendorff, Jozef Adamcik, Giovanni Dietler
Ecole Polytechnique Fédérale de Lausanne

Thanks to the contributions by Flory and de Gennes in particular, the statistical physics of linear polymers is nowadays well understood, whereas ring polymers, because of the topological constraint, represent a much more challenging problem to treat analytically and remain relatively unexplored experimentally. We investigated the statistical properties of ring polymers by imaging circular DNA molecules deposited on a flat surface using atomic force microscopy (AFM). Due to the preparation procedure, the circular polymers are in a purely two-dimensional conformation. First, using diluted chains of different lengths, we could study the scaling properties, and mainly confirmed the topological invariance of the Flory exponent. Combining our experimental data with numerical and analytical results of colleagues, we also found a universal description for the bond orientational correlation function and analyzed in detail the impact of topology on shape parameters like the asphericity. Second, by using high densities of DNA, we could study 2D circular polymer melts. The main finding here is the similarity between the behavior of a collapsed circular polymer in a melt and that of a pressurized vesicle, two physically very distinct objects. In all these results we highlight the important interplay between topology and self-avoidance.

Structural signatures of plasticization and antiplasticization in amorphous biomaterials

Job Ubbink
Centre de Recherche Nestlé

The last decades have witnessed a considerable impact of the study of phase transitions in carbohydrate-based systems on the prediction and optimization of product stability and shelf life and pharmaceutics. Such studies were in particular aimed at the analysis of

the glass transition and the role of water and other low-molecular weight compounds as plasticizers. The picture which emerges from recent studies on the dynamic properties of binary glasses containing a low-molecular weight compound is more complex, however. It turns out that, in the glassy state, antiplasticization of the carbohydrate matrix impacts the local mobility. It turns out that this is of importance for the use of such matrices in encapsulation and biostabilization.
In the lecture, I will provide an overview of developments in the molecular physics of carbohydrate matrices, including our own work on the elucidation of the carbohydrate nanostructure using the Positron Annihilation Lifetime Spectroscopy (PALS) facilities at the University of Bristol and Molecular Dynamics (MD) simulations. In particular, I will discuss the roles of water, glycerol and low-molecular weight carbohydrates in the plasticization and antiplasticization of amorphous matrices consisting of amorphous carbohydrate polymers. In addition, I will report on our recent experiments combining PALS and Fourier-transform infrared (FTIR) spectroscopy as probes for molecular organization and hydrogen bonding respectively.

Theme 2: BioPhysics 14.15 – 15.30

Mechanics of the Drosophila wing imaginal disc

C.M. Aegerter, U. Nienhaus, T. Schluck, and T. Aegerter-Wilmsen
Universität Zürich

The Wing imaginal disc is a precursor organ that will develop into the wing of the adult fly during pupation. However, the size of the wing is determined by the size of the wing imaginal disc as only one round of divisions remains between the final stage of a wing disc and a wing. Growth factors alone, which have been studied by biologists for decades cannot explain the observed growth pattern and size regulation. Here, we present a both theoretical and experimental investigation of mechanical forces in Drosophila wing imaginal discs. At first we present a model of growth based on mechanical regulation of growth to explain the uniform growth pattern and the cessation of growth. We then experimentally investigate the necessary stresses using photoelasticity and find reasonable agreement with the model. Using controlled stretching experiments on disc tissue, we are also able to quantify the (visco-)elastic properties of the tissue and compare these to the ones necessitated by the model. Finally, we extend the model and the experiments to include properties on the cellular level, i.e. the topological morphology of the tissue.

Structural Biology at the single molecule level using coherent low energy electrons

H.-W. Fink
Universität Zürich

Coherent low energy electron waves hold promise for structural studies of single bio-molecules. We could recently show that DNA withstands coherent low energy electron radiation with deBroglie wavelength in the Ångstrom regime despite a vast dose of 10^8 electrons/nm^2 accumulated over more than one hour. The permissible dose leaving a molecule unperturbed is thus at least 5 orders of magnitude greater than in conventional X-rays or high energy electrons imaging, demonstrating that coherent low energy electrons are the only known non-damaging Ångstrom wave lengths radiation. The status and recent progress in low energy electron holography and coherent diffraction imaging applied to individual biological molecules shall be presented. The challenges to eventually arrive at a novel tool for structural biology on the single molecule level shall also be discussed.

Quantitative studies on the energetics of individual DNA have been carried out using Video Fluorescent Microscopy. Temperature dependent statistical experiments with individual molecules reveal activation energies for DNA self diffusion. The energy barrier governing the transition between the straightened and random coil configuration for a single DNA has been explored as well.

Biomimetic functionality of polyethylene glycol (PEG)-- gated nanopores derived from binding interactions with associated antibodies

R.Y.H. Lim
Universität Basel

Cellular nanomachines are touted to offer novel technological strategies provided that their mechanisms can be replicated outside the cell. This provides the driving impetus in our lab to resolve the *modus operandi* of the nuclear pore complex (NPC), which regulates macromolecular traffic between the nucleus and the cytoplasm. As a physical pore ~50nm in diameter, the biological marvel of the NPC lies in its ability to restrict or promote cargo translocation via biochemical selectivity and not size exclusion *per se*. Moreover, unlike synthetic nanopores, the NPC does not clog *in vivo* - in spite of the molecular complexity of the cellular environment.
Towards this goal, we have tethered the key NPC proteins (i.e., natively unfolded phenylalanine-glycine (FG)-rich domains) to nanostructured pores so as to mimic the size and topography of the NPC. In doing so, we have correlated the nanomechanical responses of the FG–domains to the biochemical interactions governing nuclear transport using a combined fluorescence/atomic force microscope (AFM). Our results - heuristically validated within individual NPCs *in situ* - show that the FG-domains resemble a polymer brush (i.e., barrier) which reversibly collapses during (un)binding interactions with transport receptors that ferry cargo in and out of the nucleus.
To test the generality of such a mechanism, we have substituted the FG-domains and transport receptors with polyethylene glycol (PEG) and PEG-associated IgG antibodies (anti-PEG), respectively. Here, our selection of PEG is based on its non-fouling properties and relative molecular inertness. True to form, the PEG gives rise to a brush-like barrier that repels non-specific molecules from the pore periphery. In the presence of other non-specific molecules, we find that only the anti-PEG is able to access the pore via specific binding interactions with the PEG chains. Our finding is underscored by observing that the anti–PEG can act as cargo-specific molecular chaperones able to ferry secondary antibodies into the pore.
In closing, our results highlight possible functionalities in which polymer brushes can be used as non-fouling, selective gates in nanoporous membranes. On a technical note, the combination of nanofabrication, AFM and fluorescence allows for the direct correlation of local nanomechanical effects, which result from biochemical interactions at the nanoscale.

3D-fibrin hydrogel matrices as scaffold and release systems.

Heike Hall
Eidgenössische Technische Hochschule Zürich

Fibrin matrices occur at any wound site and form the natural blood clot. In vitro 3D-fibrin hydrogel matrices can be formed and their mechanical as well as their chemical composition can be varied in order to generate 3D-hydrogel matrices that degrade with different times or that are able to provide (bio)chemical guidance cues recognized by cells. The (bio)chemical guidance cues are either immobilized homogeneously through the entire matrix or in a gradient manner. Therefore 3D-fibrin hydrogel matrices represent isotropic and highly anisotropic matrices, respectively. In addition such matrices can be used as drug delivery systems where drug release can be controlled and triggered by cellular activity.

Stamps, chips and miniaturized assays

E. Delamarche, R. Lovchik and L. Gervais
IBM Research – Zürich

Proteins on surfaces play an important role for applications in diagnostics, biotechnology, environmental monitoring, pharmaceutical research, and research in life sciences at large. I will briefly describe some concepts for patterning proteins on surfaces at lengthscales of 100 nm for cell research (microcontact printing), a few micrometers for miniaturized immunoassays (micromosaic immunoassays), tens of micrometers for point-of-care diagnostics (capillary-driven microfluidics), hundreds of micrometers for pathology (microfluidic probe), and areas of millimeters in size for research on neurodegenerative diseases (microfluidic chips).

Theme 3: Assembly 16.30 – 17.45

Modelling polymer adsorption / complexation processes, nanoparticle surface properties, and aggregation of colloidal particles. Applications to aquatic ecosystems

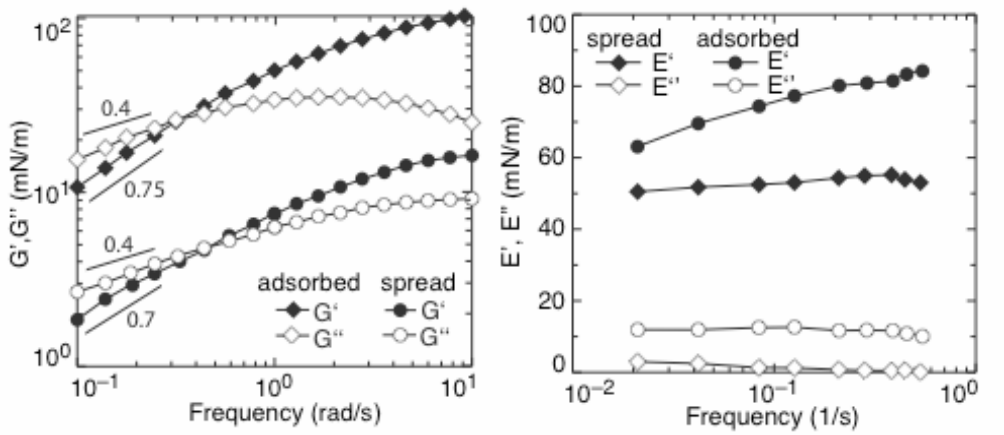
S. Stoll
Université de Genève

Adsorption, complexation, and aggregation processes in aquatic ecosystems are of great importance for the interpretation and predictions of the reactivity of chemical species and of their ecotoxicological impact. The transport and fate of both nutrients and toxic compounds largely depends on their interactions with colloidal particles, biopolymers as well as the complexes and aggregates they form. Because of the complexity and large number of biophysical and chemical factors influencing these processes, as well as to the fact that natural colloids include several components, no simple analytical theory can directly be derived and applied to all these dynamic processes.
Nonetheless, due to the development of computer modelling and the introduction of soft matter concepts, numerical and theoretical models have been applied only relatively recently for investigating the dynamic behaviour of colloidal suspensions in aquatic ecosystems. These models have proved to be important and represent convenient tools for i) the systematic investigation of some of the physicochemical factors (pH, temperature, solution ionic strength, particle concentration and chemical surface properties) influencing the morphology of the complex structures induced by perikinetic aggregation (bridging flocculation by polymers, salt-induced coagulation, heteroaggregation, etc) and ii) when addressing fundamental issues such as polyelectrolyte properties, colloid surface charge variations, and formation of fractal structures.
Some of the simulations, theoretical and experimental models used to investigate these physico-chemical processes will be presented. The models depend upon whether the problem under consideration is defined at a microscopic or mesoscopic level and on the appropriate degree of complexity and rigour that is required to solve real practical problems of interest.

Interfacial rheology of coacervated protein-polysacchaide-surfactant systems: The uneasy role of dilatation

P. Fischer, E. Erni, J. Gigl, N. Dürr-Auster
Eidgenössische Technische Hochschule Zürich

Interfacial rheological behavior of surface active hydrocolloids as well as protein-polysaccharide and hydrocolloid-surfactant complexes is reviewed considering the role of shear and dilatational components of the interfacial stress dissipation. We discuss the different rheological response of Gum Arabic, modified starches, pectin-soy protein isolate complexes and polyglycerol ester forming interfacial aggregates. The rheological response to shear and dilatational deformation of model air-water interfaces were assessed using oscillatory shear rheometry, oscillating pendant drop method, and Langmuir trough methods. Depending on the structural properties of the interface, frequency dependent dynamic experiments show viscous to elastic behaviour normally within a narrow deformation regime. The dynamic dilatational behaviour, similar to bulk shear and extensional viscosity, is not directly accessible form the behavior observed in the shear experiments: Comparing different interfacial structures and their mechanical behavior we propose a route to understand the relation of shear and dilatational properties.



Shear and dilatational interfacial rheological data of spreaded and absorbed polyglycol ester.

Fabrication of solid-coated microcapsules with unique microstructural and mechanical properties

Philip N. Sturzenegger, Urs T. Gonzenbach and Ludwig J. Gauckler
Eidgenössische Technische Hochschule Zürich

Micro-encapsulation holds the potential to overcome a number of challenges in technology ranging from targeted administration of chemicals to screening active agents from environmental influence. Although a variety of surfactant and polymer based encapsulation methods were already developed, there is still room for improvement. Inorganic particle-stabilized systems are potential candidates to provide new solutions due to their outstanding properties and great freedom in materials selection. We present a processing route for the fabrication of solid-coated microcapsules and their unique microstructural and mechanical properties. Using a method which we recently developed, inert alumina and reactive calcium aluminate particles are partially hydrophobized to be strongly adsorbed to a liquid-liquid interface, leading to homogeneous emulsion formation. After dilution, particle-coated droplets are obtained and strengthened. This process allows for the fabrication of capsules with dimensions in the order of tenths of micrometers with controlled degrees of permeability through the particle shell.

Micromechanical testing of calcium aluminate capsules reveals an unexpected degree of elasticity. Consequently, these microcapsules are not only interesting candidates for encapsulation and controlled release of various chemical compounds, but also as building blocks for structural applications.

Lipid membranes on surfaces and ultra-stable core-shell nanoparticles as nanomaterials

E. Reimhult
Eidgenössische Technische Hochschule Zürich

I will give an overview over the two main research areas in our group: self‐assembly of lipid membranes on solid support for biophysical characterization and biosensor applications, and assembly of dispersant grafted functional nanoparticles. Focus will be on one recent example from each area.
First, I will describe the assembly of supported lipid bilayers containing lipids with polymers grafted to the headgroup. These membranes display novel behavior under compression as well as demonstrate that in the interplay between lipids, attached polymers and the substrate, the polymer interactions can dominate the mechanical properties of the membrane. This deviates from the common picture of membrane mechanics which has been focused on the main lipid phase. Given the often high density of lipopolymers in many biological membranes this opens questions about whether biological membranes can behave in a similar fashion with implications for cell biology, and we are proceeding to probe membranes self‐assembled from cell‐derived lipopolysaccharides.
Second, I will describe how careful characterization of colloidal suspensions of superparamagnetic iron oxide nanoparticles (SPIONs) for biomedical imaging led us to improve anchor chemistry of dispersants by taking inspiration from naturally occurring metal ion harvesters. We found that nitrocatechol anchors can be used to attach both hydrophilic (steric repulsive polymers) and hydrophobic (alkyl) monolayer shells, which are irreversibly bound to the surface even under extreme conditions. We are now applying these particles not only to biomedical imaging, but also as well‐characterized building blocks for assembly into membrane superstructures.

Antioxidant nanoreactors: a way to fight oxidative stress

Cornelia G. Palivan
Universität Basel

All Reactive oxygen species, such as the superoxide radical anion (O_2^-), are responsible for oxidative stress in cells, which has been implicated in the pathogenesis of many cardiovascular and pulmonary diseases. Superoxide dismutase (SOD), a natural enzyme that converts the superoxide anion into H_2O_2, cannot be a candidate drug, as it is quickly eliminated from the bloodstream. Attempts have been made to improve delivery by protecting the protein either by encapsulation in liposomes or in polymeric microparticles, but these conventional approaches have drawbacks, such as uncontrolled release of the antioxidant agent.
We introduced the concept of antioxidant nanoreactors based on encapsulation of SOD in oxygen-permeable nanovesicles formed by self-assembly of amphiphilic block copolymers poly-(2-methyloxazoline)-poly(dimethylsiloxane)-poly(2-methyloxazoline). In this way the enzyme is both active inside the polymerosomes and protected from the proteolytic attack. Here we present how we optimize the antioxidant nanoreactors by encapsulating low molecular weight SOD-mimics (SODm), or by modifying the molecular properties of the vesicles in order to increase their ability to detoxify O_2^-.

The nanovesicles, successfully encapsulated the protein/mimic during their self-assembling process, as proved by confocal laser-scanning microscopy and fluorescence-correlation spectroscopy. Electron paramagnetic resonance spectroscopy showed that no structural changes appeared in the geometry of the metal binding region once inside the inner space of the nanovesicles. SOD/SODm remain entirely functional in the hollow cavity of the vesicles as proved by activity tests. Due to the versatility of the chemistry of these polymeric carriers we controlled several parameters, such as membrane permeability, or vesicles size, and thus improved their efficiency in catalyzing O_2^-.
Simple and robust, the antioxidant nanoreactor provides a selective shielding of sensitive enzymes/mimics from proteolytic attack and therefore a new direction for developing drug delivery applications.

Posters

Theme 1: Colloids & Polymers

(T1-1) Physical fractals and apollonian packings

Francesco Varrato
Ecole Polytechnique Fédérale de Lausanne

(T1-2) Effective forces in square well and square shoulder fluids

Davide Fiocco
Ecole Polytechnique Fédérale de Lausanne

(T1-3) Phase separation in a binary mixture of eye lens proteins: relevance for cataract formation

Nicolas Dorsaz
Ecole Polytechnique Fédérale de Lausanne

(T1-4) A structural signature of glass transition

Majid Mosayebi
Eidgenössische Technische Hochschule Zürich

(T1-5) Network induced glassy dynamics in colloidal gels

Emanuela Del Gado
Eidgenössische Technische Hochschule Zürich

(T1-6) Elasticity of arrested colloidal suspensions: homogenous and heterogeneous glasses

Alessio Zaccone
Eidgenössische Technische Hochschule Zürich

(T1-7) Reaction-limited aggregation kinetics of Brownian particles at arbitrary concentrations

Alessio Zaccone
Eidgenössische Technische Hochschule Zürich

(T1-8) Effect of superplasticizers on cement model systems

Lucia Ferrari, Josef Kaufmann and Frank Winnifeld
Eidgenössische Materialprüfungs- und Forschungsanstalt

(T1-9) Poly-N-isopropyl acrylamide as a probe for water-alcohol interactions

I. Bischofberger
Université de Fribourg

(T1-10) Effect of the coil to globule transition on the electrostatic and hydrodynamic interactions of charged PNiPAM microgels

M. Braibanti
Université de Fribourg

(T1-11) Thermoresponsive Hybrid Microgel Particles with Intrinsic Optical and Magnetic Anisotropy

C. Dagallier
Université de Fribourg

(T1-12) Characterization of ultra-stable PEG-iron oxide core-shell nanoparticles

Esther Amstad
Eidgenössische Technische Hochschule Zürich

(T1-13) Confinement-induced ordering of complex fluids

Kim Nygard
Paul Scherrer Institut

(T1-14) Conformational entropy in a lattice model of polymers: effects on the local structure and the Theta point universality class.

Carlo Maffi
Ecole Polytechnique Fédérale de Lausanne

(T1-15) Scaling theory and simulations of tethered polymers

Orit Peleg
Eidgenössische Technische Hochschule Zürich

(T1-16) Monte Carlo simulations of polyelectrolytes with explicit counterions and salt particles. Titration curves and conformations.

Fabrice Carnal
Université de Genève

(T1-17) Energy Elastic Effects in Flowing Polymeric Liquids, and the Concept of Nonequilibrium Temperature

Markus Hütter, Clarisse Luap and Hans Christian Oettinger
Eidgenössische Technische Hochschule Zürich

(T1-18) Conservation of hydrodynamic long-time tails in a Maxwell fluid.

Matthias Grimm
Ecole Polytechnique Fédérale de Lausanne

Theme 2: BioPhysics

(T2-1) On the Energetics of Individual DNA Molecules in Solution

Conrad Escher and Hans-Werner Fink
Universität Zürich

Low Energy Electron Holography

(T2-2) Tatiana Latychevskaia, Jean-Nicolas Longchamp, Matthias Germann, Conrad Escher, Hans-Werner Fink
Universität Zürich

(T2-3) Coherent Diffraction Microscopy with Low Energy Electrons

Elvira Steinwand, Jean-Nicolas Longchamp, Hans-Werner Fink
Universität Zürich

(T2-4) Optical Trapping Microrheology in Cultured Human Cells"

Elena Bertseva, Peter Schmidhauser
Ecole Polytechnique Fédérale de Lausanne

(T2-5) Membrane permeability: A novel “on-chip” membrane permeation assay

D. Lombardi, M. Ittig, P.S. Dittrich
Eidgenössische Technische Hochschule Zürich

Theme 3: Assembly

(T3-1) Nanometer-scale direct-write 3D patterning using probes

Felix Holzner
IBM Research Zürich and ETH Zürich

(T3-2) Structural Characterization of Radiation-Grafted Block Copolymer Films, Using SANS Technique

Urs Gasser
Paul Scherrer Institut

(T3-3) Correlation between Morphology, Water Uptake, and Proton Conductivity in Radiation Grafted Proton Exchange Membranes

Sandor Balog
Paul Scherrer Institut

(T3-4) FG-domain surface density and its influence on the cooperative binding of transport receptors: Implications for the nuclear pore complex

Larisa Kapinos, Orit Peleg, Martin Kröger, Roderick Y.H. Lim
Universität Basel & Eidgenössische Technische Hochschule Zürich

(T3-5) Characterisation of supported poly(ethylene glycol) lipid bilayers

Stefan Kaufmann
Eidgenössische Technische Hochschule Zürich

(T3-6) How to decrease O_2- levels using nanoreactors based on enzyme mimics?

V. Balasubramanian, O. Onaca, P. Tanner, W. Meier, C.G. Palivan
Universität Basel

(T3-7) Metal functionalised vesicles for sensing His-tag proteins

R. Nehring, P. Tanner, A. Mantion, A. F. Thünemann, C.G. Palivan, W. Meier
Universität Basel