occurs or not during supercontraction. Furthermore, although it has already been established that supercontraction induces a disorientation of the molecular units, this effect has not been quantified yet. Therefore, we will investigate and quantify, for different species, the conformational and orientational variations of the silk proteins induced by supercontraction. To achieve our goals, we will use Raman spectromicroscopy, a technique that as long been proven to be a useful tool to probe silk. Moreover, the effects of drawing speed on the magnitude of supercontraction will also be examined.

2906-Pos Board B513

Extracting Information on Molecular Interactions using Data from Binary Mixtures

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One general question in chemical and biological physics is how mixed molecular species behave compared to single-component systems. Here we investigate how binary solution mixtures affect the interaction between lipid membranes. Experimentally, by X-ray scattering, it is observed that the equilibrium spacing in multilamellar lipid vesicles although highly regular is very sensitive to the chemical composition of aqueous solutions. In order to understand the role of various ionic species on membrane equilibrium spacings, one can consider ''competition'' measurements in which the fraction of ionic components is varied at constant total concentration. A complete description of such measurements often requires a complicated theory with a large number of parameters. Here we show that experimental data curves can be parameterized with simple power functions using a mixing parameter and two mixing exponents. These phenomenological parameters are quite general and are a good measure of the cooperativity or competition of ionic or molecular species in binary mixtures.

2907-Pos Board B514

Principles and Applications of Functional Lipidic Biomaterials in Molecular Recognition, Membrane Protein Crystallization and Drug Delivery

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We have designed and synthesized a library of lipids with novel functionalities in order to correlate lipid molecular structure with the ensuing nanomaterial dynamics, stability and phase behavior. The designed lipids were assembled as within lipidic mesophases and their dispersions, forming functional biomaterials that were employed in areas ranging from molecular recognition, sequestration and enrichment of nucleic acids to biosensing. An exciting new class of biomaterials that are based on cyclopropanated lipids was developed. These form stable lipidic cubic phases (LCPs) at low temperature, opening the way to conduct biophysical and biochemical investigations on temperature sensitive bio-macromolecules, specifically membrane proteins. Furthermore, pH-sensitive lipidic matrices for hydrophilic as well as hydrophobic drug incorporation and release were designed, as well as stimuli-responsive lipids that can be incorporated into biomaterials. Efficient pH- and light-induced binding, release and sequestration of hydrophilic dyes were demonstrated. Significantly, these processes could be activated sequentially, thereby achieving high degree of temporal and dosage control. The scope of lipidic materials for drug delivery was expanded to azobenzene-containing hexagonal phases, in which ''on demand'' single-step as well as sequential light-triggered release and retention of embedded dye molecules were demonstrated. Finally, cubosomes were stabilized and functionalized with a novel, designed biotin-based block copolymer, resulting in dispersed biomaterials that were applied against the human adenocarcinoma cell line HeLa. These cubosomes are able to simultaneously transport paclitaxel, a potent anti-cancer drug, and a hydrophobic fluorescent dye in active targeting of cancer cells. Such biotinylated cubosomes are potentially applicable in diagnosis, drug delivery and monitoring of therapeutic response for active targeting versus cancer cells.

2908-Pos Board B515

Electrospun Biodegradable Scaffold Made of Poly(Hydroxybutyrate-Co-Hydroxyvalerate) & Bovine Serum Albumin

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Electrospinning is a technology for electrostatic formation of polymer nano- and micro- fibers. We used this method to prepare blend scaffold from a biodegradable polymer, poly(hydroxybutyrate-co-hydroxyvalerate) (PHBV), and a model globular protein, bovine serum albumin (BSA). These polymers were mixed at 70:30 ratio in a common solvent (1,1,1,3,3,3-hexafluoroisopropanol) and electrospun. Blend solution-cast film and single-component electrospun films were used as control ones. We analyzed the film properties: morphology, dissolution kinetics, hydrophilicity, cytocompatibility. In contrast to the ordinary single-component electrospun films, the blend films consisted of several types of fibers: PHBV round fibers, BSA flat ribbons and the fine network. When the films were immersed in water, BSA dissolution rate from the blend was lower than from the solution-cast film. Vero cell viability and hydrophilicity was higher on the electrospun films than on the solution-cast ones. The obtained electrospun blend materials introduces a new class of polyester-protein blends. It can be used in tissue engineering.

2909-Pos Board B516

Role of Charge and Ligand-Receptor Binding in Specific Targeting of Peptide-Tagged Cationic Liposome Nanoparticles for Gene Delivery

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Cationic liposomes (CLs) are a common synthetic carrier of DNA and short-interfering RNA for gene delivery and silencing, with clinical trials ongoing. Optimization of transfection efficiency requires understanding of the interactions between cellular membranes and CL–nucleic acid nanoparticles (CL-NA NPs), which affect NP binding, uptake, endocytic trafficking, and endosomal escape. PEGylation (PEG: polyethylene glycol) sterically stabilizes CL-NA NPs, and the attachment of targeting ligands (e.g. peptides) to the distal end of the PEG chains may enable targeted gene delivery (Majzoub et al., *Biomaterials* 2014, **35**, 4996**;** Majzoub et al., *Biochim Biophys Acta* 2015, **1848**, 1308). We used linear and cyclic peptides containing variations of the RGD and C-end rule motifs (e.g. iRGD and RPARPAR) to target integrin and/or neuropilin-1 receptors, respectively (Ewert et al., *Bioorg Med Chem Let* 2016, **26**, 1618;Teesalu et al., *Front Oncol* 2013, **3**, 216; Simón-Gracia et al., *Biomaterials* 2016, **104**, 247).

To achieve specific targeting, one must decouple ligand effects from the non-specific electrostatic attraction of our cationic liposome NPs. To this end, we prepared NPs of varied membrane charge densities and charge ratios (resulting in NP surface charges that range from highly positive to slightly negative), tagged with different ligands at a variety of ligand densities. We evaluated the cell binding, uptake, endocytic trafficking, and transfection efficiency of our NPs using flow cytometry, colocalization with Rab proteins (markers of membrane-bound organelles) (Majzoub, Wonder et al., *J Phys Chem B* 2016, **120**, 6439), and gene expression measurements. Preliminary *in vivo* experiments in a mouse model of peritoneal carcinomatosis demonstrated tumor homing by iRGD-tagged CL–DNA NPs.

2910-Pos Board B517

Structured DNA Nanoparticles for Spatially Controlled Antigen Presentation

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Synthetic nanoparticles (NPs) can be designed to organize and display antigens to mimic natural protein architectures such as viruses and toxins. These synthetic lipid- and polymer-based NPs have a range of applications in biophysical science, including the controlled display of multivalent antigen assemblies to probe immune cell function. However, existing NPs used for antigen presentation do not allow for precise control over the 3D structural organization and stoichiometry of surface-displayed molecules. The recent emergence of scaffolded DNA origami NPs represents a promising tool to assemble complex molecular architectures consisting of numerous antigen subtypes organized in 3D with nanometer-scale structural fidelity that can be chosen to mimic viruses and toxins. For example, DNA-NPs can be used to help investigate the relative roles of 3D antigen spacing to stimulate B-cell, T-cell, or dendritic cell activation. Here, using a versatile design and synthesis procedure for programming arbitrary DNA-NPs on the 5-100 nanometer-scale, we control peptide and protein antigen presentation for immune cell assays. DNA-NP-protein assembly structure is characterized using a combination of TEM and cryoEM for up to 60 to