BP 50: Biotechnology and bioengineering

Time: Thursday 17:30–18:45 Location: H 1058

BP 50.1 Thu 17:30 H 1058

Real-time deformability cytometry: On-the-fly mechanical phenotyping for label-free cell functional assays — •Oliver Otto[1], Philipp Rosendahl[1], Alexander Mietke[1,2], Stefan Golfier[1], Angela Jacobi[1], Christoph Herold[1], Daniel Klaue[1], Nicole Töpfner[1], Salvatore Girardo[1], Elisabeth Fischer-Friedrich[2], and Jochen Guck[1,3] — [1]Biotechnology Center, Technische Universität Dresden, Dresden, Germany — [2]Max-Planck-Institute of Molecular Cell Biology and Genetics, Dresden, Germany — [3]Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom

The mechanical properties of cells are considered as a label-free, inherent marker of biological function in health and disease. Wide-spread utilization has so far been impeded by the lack of a convenient measurement technique with sufficient throughput, sensitive to cytoskeletal changes. Here, we introduce real-time deformability cytometry (RT-DC) for continuous mechanical single-cell characterization with analysis rates in excess of 100 cells/s. Cells are driven through a microfluidic channel leading to deformations due to hydrodynamic stresses only, described by an analytical hydrodynamic model. Experiments with RT-DC demonstrate sensitivity to cytoskeletal alterations and specificity for different cell cycle phases. RT-DC can also track the differentiation of hematopoietic stem cells into different lineages and identify cell types in whole blood by their mechanical properties. In summary, RT-DC enables continuous mechanical phenotyping of heterogeneous cell populations with a throughput comparable to standard flow cytometry.

BP 50.2 Thu 17:45 H 1058

Interaction between Polyelectrolytes and Proteins in aqueous solution. — •Shun Yu, Xiao Xu, Joachim Dzubiella, and Matthias Ballauff — Helmholtz-Zentrum Berlin, Intitute Soft Matter and Functional Materials

Complex self-assembling systems of interacting polyelectrolyte (PE) and proteins are a growing topic in recent research in pharmacy, biochemistry/-physics and medicine [1]. The adsorption of unwanted short polyelectrolytes upon proteins in blood plasma and thus hindering their function is a crucial medical problem. To improve the removal of low molecular weight toxins, a deeper understanding of the interaction between the toxin and the protein is crucial. We use Polyacrylic acid (PAA) as a model polymer and study its interaction with Human Serum Albumin (HSA) at a pH well above the isoelectric point of HSA. It has been recognised, that complex formation can occur at the "wrong side of pI", where both protein and polyelectrolyte are same charged [2]. Driving forces of the interaction can be very well studied using Isothermal Titration Calorimetry (ITC) to analyse binding strengths, entropy and enthalpy [3]. In the present work, we show a full thermodynamic analysis of the binding behavior and find a strong dependency of the interaction on ionic strenght and temperature. Moreover, theoretical modelling using MD simulations supports experimental results and quantifies the role of electrostatic field in the binding process.

[1] Kayitmazer et al., Soft Matter 9, 2553 (2013)
[2] Dubin et al., Separation & Purification Reviews 23, 1 (1994)
[3] Welsch et al., Polymer 12, 2835 (2013)

BP 50.3 Thu 18:00 H 1058

Diamondoid-functionalized Au(111) nanoelectrodes as probes for detecting DNA and mutations — •Ganesh Sivaraman[1], Rodrigo Garcia Amorim[2], Ralph Scheicher[2], and Maria Fyta[1] — [1]Institute For Computational Physics , University of Stuttgart, Germany — [2]Division of Material Theory, Department of Physics and Astronomy, Uppsala University, Sweden

Solid state nanopores embedded with gold electrodes have been proposed to be strong candidates for the electrical read out of DNA . However, reduction in the noise in the electrical measurement is critical for an error free read out of DNA. A possible solution would be to use functionalized nanopores by which the specific interaction of a "functionalizing molecule" with the DNA should increase the signal-to-noise ratio in the measurements. Recently, we have proposed that amine and thiol doped diamond-like cages, known as diamondoids, as a candidate for functionalizing molecule .

In the first part of this theoretical investigation, we characterize the structure, electronic, and transport properties of Au(111) electrodes and diamondoid-functionalization on the Au(111) electrode surface. In the second part, a small bias voltage is applied across the Au(111) electrodes. The aim is to use the tunneling current across the functionalized junction as a means for distinguishing between individual DNA nucleobases/mutations. We will evaluate the tunneling current across the electrodes by inserting separately the 4 nucleotides, one mutant, and one epigenetic marker between the electrodes.

BP 50.4 Thu 18:15 H 1058

Highly controllable synthetic neuronal circuits: Poly-L-lysine patterend semiconductor microtube substrates — •Jann Harberts[1], Aune Koitmäe[1], Gabriele Loers[2], Cornelius Bausch[1], Daniel Diedrich[1], David Sonnenberg[1], Christian Heyn[1], Wolfgang Hansen[1], and Robert H. Blick[1] — [1]CHYN & INF, University of Hamburg, Germany — [2]ZMNH, University Medical Center Hamburg-Eppendorf, Germany

Detailed understanding of the human brain is a central field of research. Due to high complexity of neuron interaction, the experimental set-up has to be reduced to a manageable amount of neurons with predefined axon growth.

It has been shown that microtubes can influence the direction of axon growth. The preparation is based on lattice mismatched layers. The arrangement of the tubes is defined by photolithography. Etching of the sacrificial material reduces the strain between the layers and creates tubes.

In order to produce controllable neuronal circuits we print poly-L-lysine (PLL), which supports cell adhesion, in front of the tube notches. The challenge is to find the right printer settings for PLL. We determined suitable parameters to print with PLL. The droplets we use reach a diameter of roughly 25μm. The advantage of this method is the flexibilty of pattering. It serves a fast way to adapt new patterns to different layouts, where the minimum definable drop spacing is 5μm. Printing droplets of PLL enhances the yield of the axonguiding through the tubes and creates a highly controlled neural network.

BP 50.5 Thu 18:30 H 1058

IR-Spectroscopy and Multivariate Data Analysis in Point of Care Testing — •Anja Niedermayr[1,2], Peter B. Luppa[3], Carsten Giebeler[4], and Alexander M. Gigler[1,2,5] — [1]Siemens AG, Corporate Technology, Otto-Hahn-Ring 6, 81739 München — [2]Sect. Crystallography, LMU München, Theresienstr. 41, 80333 München — [3]Klinikum rechts der Isar, TU München, Clinical Chemistry and Pathobiochemistry, Ismaninger Str. 22, 81675 München — [4]Pyreos Ltd., Scottish Micro Electronics Centre, West Mains Road, Edinburgh EH9 3JF, Scotland, UK — [5]Center for NanoScience (CeNS), LMU München, Schellingstr. 4, 80799 Munich

In medicine, an early decision on the right course of treatment can make the difference between life and death. Therefore, the rapid availability of test results is crucial. Devices that facilitate medical testing at or near the point of patient care (Point-of-care Testing, POCT) significantly reduce the turn around time. This will become increasingly relevant in modern day diagnosis and therapy. At this point, parallel POCT is available for only few parameters since every single analyte requires a highly specific indicator substance. Infrared spectroscopy enables a marker free, parallel analysis of various medical parameters in one unaltered sample. In combination with multivariate statistical modeling a precise quantitative prediction of the investigated substances can be achieved. The prediction's accuracy and reliability critically depends on the statistical method used to set up the model. Here, initial results of our study on the determination of selected high-content blood ingredients, i.e. alcohol and albumin, will be shown.