BP 25: Bioinspired Systems

Time: Thursday 11:00–12:00 Location: H13

BP 25.1 Thu 11:00 H13

Bottom-up assembly of synthetic cell-based tumor immune microenvironments in pancreatic cancer organoids — •Oskar Staufer — University of Oxford, Kennedy Institute of Rheumatology, Oxford, United Kingdom

Understanding the communication and interactions between tumour and immune cells is pivotal for holistic understanding of tumour biology and therapy. I present strategies to recreate immune cells, the defining elements of the tumor immune microenvironment (TIME), as synthetic cells by bottom-up assembly from their single molecular building blocks. The programmable synthetic cells are introduced into tumor organoids to function as lifelike leukocyte mimics presenting immune effector functions. By this, a molecularly defined artificial TIME (ART-TIME) is created inside tumor models. The central objective of this approach is to reduce the complexity of the intricate TIME composition to a comprehensible and systematic level by applying a novel bioinspired systems approach. This strategy links TIME architectures to cancer adaptation and immune evasion for quantitative description of therapy resistance. ART-TIME strive to de-convolute the dynamic complexity of the tumor immune microenvironment towards a rational dissection. Strategies for stable incorporation of synthetic cells into organoids, chemical, biophysical and ultrastructural characterizations of the synthetic immune cells as well as their molecular interactions with cancer cells inside the organoids are presented.

BP 25.2 Thu 11:15 H13

Frustrated frustules: geometrical frustration in *Coscinodiscus* diatom frustules — •Maria Feofilova and Eric Dufresne — Vladimir-Prelog-Weg 5, 8093 Zürich, Switzerland

Diatoms are single-celled organisms with a cell wall made of silica, called the frustule. Their elaborate patterns have fascinated scientists for years, however little is known about the biological and physical mechanisms involved in their organizations.

In this work, we take a top-down approach and examine the micron-scale organization of diatoms from the *Coscinodiscus* family. We find two competing tendencies of organization, which appear to be controlled by distinct biological pathways. On one hand, micron-scale pores organize locally on a triangular lattice. On the other, lattice vectors tend to point globally toward a center of symmetry. This competition results in a frustrated triangular lattice, populated with geometrically necessary defects whose density increases near the center.

BP 25.3 Thu 11:30 H13

Structured keratin films as artificial nail plate model — •Kim Thomann, Andreas Späth, and Rainer H. Fink — Lehrstuhl für Physikalische Chemie II, Friedrich-Alexander Universität Erlangen-Nürnberg, Egerlandstr. 3, D-91058, Erlangen, Germany

Human fingernails can be studied ex vivo only in form of clippings which offer limited insight as they do not necessarily reflect the behavior of the whole nail. Keratin films (KFs) may potentially serve as human fingernail substitute, which is especially relevant for the medical and cosmetics sector. In order to model the nail's adhesive characteristics, structured and unstructured films from keratin extracted from human hair and nails were produced. The fingernail being the reference, the KFs were characterized with a number of complementary techniques, including SEM, confocal microscopy, contact angle (CA) measurements, XPS, ATR-FTIR and SAXS. In terms of composition, the prepared films show good resemblance, regardless of keratin origin. The nail's microstructured topography is well matched by the structured KFs. CA measurements revealed that the surface free energy is in the same range for both KF types. However, the structured KFs fit the nail's component composition better. Thus, the structured KFs represent a good approach to achieve a satisfying model in terms of wetting while combining both composition and topography aspects. The research is funded by the BMBF within project 05K19WE2.

BP 25.4 Thu 11:45 H13

Memory effect of red blood cells in a 3D microfluidic chip — •Amirreza Gholivand[1,2] and Minne Paul Lettinga[1,2] — [1]Forschungszentrum Jülich, IBI-4, Jülich, Germany — [2]KU Leuven, Laboratory of Soft Matter and Biophysics, Leuven, Belgium

The significance of healthy blood vessels and blood flow for proper brain functioning is becoming more recognized, for example due to its involvement in the development of human neurodegenerative disorders, notably Alzheimer's disease. Therefore, it is of interest to develop a platform to investigate blood flow and blood cell behavior through the brain vasculature.

Here we present model 3-D microfluidic channels to study the RBCs flow through different vessels geometry and their flow dynamics. RBCs in microcirculation and at bifurcation may attain different memory effect, which we studied systematically varying the interaction strength between the red blood cells and the complexity of flow geometries. To this end, we make use of a novel technique, Selective Laser-induced Etching (SLE), which can produce 3D structures in glass with any desirable shape. To study the shape memory of the vessels the second generation of the bifurcation has been implemented with a parallel and perpendicular orientation relative to the first bifurcation. Using ultrafast microscopy in combination with velocimetric analysis, we identify a new memory effect, where there is a shift in the maximum velocity, depending on the orientation of the downstream bifurcation.