SFB 1551

Polymer Concepts in Cellular Function

Bringing together polymer and life scientists to apply polymer research concepts to the field of biology

Live Phase Separation
Interactive Experience by the Wittmann Lab

Phase separation (PS) describes a physical phenomenon where a solution demixes into two separate liquids with different densities. About 10 years ago, it was discovered that PS of proteins is used to spatially organise cells. In this way, droplets can accumulate components necessary for given processes at the right location, e.g. during transcription or DNA repair, or create protective environments during stress. The Wittmann lab explores the molecular interactions that drive protein PS and their function. While PS is important to organise cellular reactions in healthy cells, dysregulation can drive neurodegenerative disorders including ALS and Huntington's disease. Join Sina and Felizitas to make your own protein droplets!

How Blue Skies Inspire Polymer Scientists
Interactive Experience by the Morsbach Lab

Light scattering occurs in our everyday lives when we look up at the sky and perceive it as blue. This phenomenon, discovered in the late 19th century, continues to inspire polymer scientists. The principles of light scattering in the atmosphere can also be applied to particles in a solution, providing fundamental information on the molecular structure. Guess what? This actually presents the opportunity to capture molecular changes that are indicative of a particular disease! Join Svenja and Laila to discover what their mystery solution might be.

The Language of Proteins
Interactive Experience by the Andrade Lab

Proteins are essential cellular machines made from chains of 20 different amino acids. The sequence and interaction of these amino acids determine the protein's structure and function. Despite already knowing the amino acid sequences for all 20,000 human proteins, we have only determined half of their structures and functions. Protein sequences can form alpha-helices and beta-strands or become flexible/disordered regions. Initially thought unimportant, these flexible regions are now known to contribute to protein functions. Understanding protein sequences can help us predict their functions, which is crucial for addressing diseases. Interested in decoding the language of proteins through computational methods? Join Eric to find out!

Exploring Hidden Patterns in Nature and Society
Interactive Experience by the te Vrugt Lab

Throughout the workshop, we will experiment with three models to uncover the mathematical principles behind complex phenomena. We'll explore models for the predictable spread of heat, the spontaneous formation of natural patterns, and the critical dynamics of disease spreading, as well as the application of these models to biological systems like polymer organisation in cells. Prepare to discover the interconnectedness of these mathematical concepts and their relevance to both nature and society. Don't miss this chance to explore the intersection of mathematics, physics, and biology!

DNA Sequencing & Beyond
Interactive Experience by the Gerber Lab

DNA, the largest biopolymer in nature, can reach lengths of up to 10 cm (as seen in human chromosome 1). It is intricately bundled into chromatin to fit efficiently into the nucleus, impacting gene function and regulation. Modelling DNA is challenging due to its size and complexity. The Gerber Lab aims to address these challenges by generating sequencing data, creating chromatin-interaction matrices, and using long-read sequencing for detailed analysis. Their goal is to develop predictive chromatin models and identify factors influencing chromatin folding. Ultimately, they aim to link microscopic genetic and epigenetic changes to significant structural alterations and disease. With Susanne, Alejandro and Anne, you'll observe live DNA sequencing and explore the entire process.

The Soft Matter of Life
Interactive Experience by the Michels Lab

Soft matter, including viscoelastic materials that exhibit properties between liquids and solids, plays a crucial role in biological systems. Biopolymers such as proteins, nucleic acids, and polysaccharides exhibit viscoelasticity, enabling cells to respond to mechanical stress in a dynamic way to regulate vital processes, such as growth, differentiation, healing, and apoptosis. Intrinsically disordered regions of proteins and interactions between proteins and RNA drive phase separation in cells, forming dynamic, viscoelastic biomolecular condensates. These condensates organise biochemical processes without the need for a membrane. The identification of these "membraneless organelles" revolutionised our understanding of cellular organisation and function. Join Jasper to explore this groundbreaking connection in modern biology.

Centre for Healthy Ageing

MAX PLANCK INSTITUTE FOR POLYMER RESEARCH

Universität Stuttgart

imb Institute of Molecular Biology

DFG Deutsche Forschungsgemeinschaft German Research Foundation

MAX-PLANCK-INSTITUT FÜR BIOPHYSIK

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Wiggly Spaghetti in the Brain
Introductory Lecture by the Lemke Lab

We have all heard about DNA, RNA and proteins; some of us might even have had our own genome sequenced. But somehow, possessing this information is not yielding the solutions we have been hoping for. More recently, rather basic phenomena have been discovered, revealing that there is much more to biomolecules than anticipated. In this workshop, over lunchtime, we will not only offer you some salad dressing and wiggly spaghetti but will reveal how these same items can exemplify game-changing phenomena that are shedding light on the molecular basis of cellular dysfunction in ageing and disease.

Visualising Biopolymers
Interactive Experience by the Ritz Lab

How far can we push the boundaries of visualisation? Beyond the cell? Beyond the organelle? Beyond a single molecule? The Ritz Lab specialises in cutting-edge microscopy techniques that provide unparalleled detail, enabling detailed quantification and dynamic analysis of biopolymers in vitro and in vivo. Join us to transcend traditional microscopy. Step into the realm of Fluorescence Correlation Spectroscopy and witness the intricate dance of molecules firsthand. Put on our VR glasses to explore the compartments of a real cell. Prepare to be amazed!

How Life Uses Physical Phenomena to Regulate Genes
Interactive Experience by the Schick Lab

The Schick and Speck labs present an interactive experience featuring transcriptional condensates, highly dynamic, membrane--less compartments within the nucleus that regulate gene expression. Through VR microscopy, observe the behaviour of transcriptional condensates. Engage with simulations of phase separation developed in collaboration with Thomas Speck's lab, and explore the mechanisms behind these structures. Join Sandra and Samuel to decode the dynamic dance of transcriptional condensates and uncover their impact on gene regulation and cellular functions.

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POLYMERIC MATTER — *Across length scales* — LIVING MATTER

Theory of molecular polymer physics | Mesoscopic effects | Soft matter, complex systems | Biomolecules, molecular mechanisms | Cell biology | Whole organism