BP 3: Protein Structure and Dynamics

Time: Thursday 10:00–11:00 Location: H1

Invited Talk BP 3.1 Thu 10:00 H1

SARS-CoV-2 induced membrane remodeling in infected cells revealed by in celullo cryo-ET — Steffen Klein, Liv Zimmermann, Sophie Winter, Mirko Cortese, Moritz Wachsmuth-Melm, Christopher Neufeldt, Berati Cerikan, Megan Stanifer, Steeve Boulant, Ralf Bartenschlager, and •Petr Chlanda — Heidelberg University Hospital, Heidelberg, Germany

Coronavirus replication in the host cell causes extensive remodeling of cellular membranes. To better understand the governing mechanisms of SARS-CoV-2 membrane remodeling during RNA replication and virus assembly we visualized hubs of virus replication and assembly using cryo-electron tomography of infected cells. Our data reveal the architecture of double-membrane vesicles which are associated with viral genome replication. Viral RNA filaments inside these compartments show a diameter consistent with double-stranded RNA and displayed frequent branching, likely representing secondary structures. Virion assembly sites were found at cisternae enriched in spike trimers and viral ribonucleoprotein complexes (vRNPs) at the cytoplasmic side. We further structurally analyzed the viral genome in newly assembled virions and revealed that the viral RNA is encased by multiple individual cylindrical vRNPs. We propose that this arrangement allows the incorporation of the unusually large coronavirus genome into the virion while maintaining high steric flexibility between the vRNPs during virion assembly.

BP 3.2 Thu 10:30 H1

Size-dependent deviations from the colloidal prediction: about the diffusion of proteins in a cellular environment — •Christian Beck[1,2], Felix Roosen-Runge[3], Tilo Seydel[2], and Frank Schreiber[1] — [1]Institut für Angewandte Physik, Universität Tübingen, 72076 Tübingen, Germany — [2]Institut Laue-Langevin, 38042 Grenoble Cedex 9, France — [3]Department of Biomedical Science, Malmö University, Sweden

Diffusive properties are of fundamental importance for biological processes. For their quantitative understanding, the short-time diffusive properties are of huge interest. Previous studies investigated the volume fraction dependence of short-time diffusive properties for different pure proteins solutions [1] and recently in controlled poly-disperse cell-like environments [2]. In cooperation with the ILL life science group, we now investigated the diffusive properties of different sized proteins in the presence of deuterated lysate. In contrast to the previous study [2], the apparent global diffusion of the different proteins investigated does significantly deviate from the total volume fraction dependence of the pure protein solutions. While small proteins have a higher diffusion coefficient in the presence of lysate compared with the pure protein solution, big proteins, however, are slowed down. These results give a new insight into the diffusive properties of proteins in cells and might contribute significantly to a quantitative understanding of biological processes.

[1] M. Grimaldo, et al., Quart. Rev. Biophys. 52 (2019) e7, 1;
[2] M. Grimaldo, et al., J. Phys. Chem. Lett. 10 (2019) 1709

BP 3.3 Thu 10:45 H1

Scattering techniques: powerful tools to elucidate the molecular mechanisms of Wilson's disease — •Olga Matsarskaia — Institut Laue-Langevin, Grenoble, France

Copper (Cu) is an essential element for mammals and its metabolism is thus tightly regulated [1]. In the case of Wilson's disease, however, Cu metabolism is impaired, leading to abnormal Cu levels in the body [2]. Severe, often lethal, consequences ensue, such as liver and neurological damage [3,4] as well as the destruction of hemoglobin (Hb) and red blood cells (RBCs) [5]. The latter two symptoms are believed to be due to Cu-induced aggregation of Hb [6,7]. The current understanding of Wilson's disease is predominantly phenomenological. Thus, this project applies an interdisciplinary array of techniques including neutron and X-ray scattering to deepen the understanding of this highly complex condition. Scattering data recently obtained using human RBCs and purified human Hb will be presented, demonstrating real-time effects of Cu addition to these systems. The results obtained will be discussed in the broader context of medical research with the goal of inspiring an interdisciplinary dialogue between fundamental science and clinical applications.

[1] Löffler & Petrides, Springer Heidelberg (2007); [2] Riordan & Roger, J.Hepatol. (2001) 34, 433-48; [3] Ala et al., The Lancet (2007), 369, 397-408; [4] Gitlin, Gastroenterol. (2003), 125, 1868-77; [5] Ferenci, Metab. Brain Dis. (2004), 19, 229-39; [6] Rifkind, Blood (1965), 26, 433-48; [7] Jandl, Engle, Allen, J. Clin. Invest. (1960), 39, 1818-36