



Life Sciences Seminar

Quantitative modeling of bile secretion and transport in the liver

Oleksandr Ostrenko (Technische Universität Dresden)

Host: Carl-Philipp Heisenberg

Transport processes are essential for proper function of secretory organs or glands, including liver, pancreas, and salivary glands. Aberrant transport is associated with diseases, like primary sclerosing cholangitis (PSC) in the liver, that have been a matter of clinical and translational studies for a long time. Bodily fluid secretion is a result of an intricate combination of active transport by the epithelial cells and passive transport along a chemical potential gradient. The former involves vesicular trafficking that relies on small intracellular compartments, called vesicles, and transmembrane transporter proteins as their cargo, and active pumping of osmolytes by respective transporter protein. For the latter, osmosis drives the water flux directed against the chemical potential gradient induced by osmolyte excess in the duct and, thereby, sets the secreted fluid in motion. Previous studies offer some qualitative insight into the secretory process, but a detailed quantification has not yet been possible. Due to the highly intricate geometry of the respective organs and non-linearity of the underlying biophysical theory, currently, neither experimental nor theoretical studies have arrived at a detailed quantitative understanding of the processes underlying secretion. During my PhD, I developed a biophysical model to describe transport processes in the mammalian secretory organs and glands. First, I derived a model for osmosis-driven fluid outflow from a channel with porous walls and then used analytic tools to study it. Then I used my model to study and predict bile secretion and transport in the murine liver based on data from intravital microscopy revealing a (minor) contribution of peristalsis to bile flow. Finally, I applied my model to a long-standing issue in the field of hepatology concerning administration of ursodeoxycholic acid (UDCA) in patients with PSC.

Monday, June 25, 2018 11:00am - 12:15pm

IST Austria Campus Meeting room 2nd floor / Bertalanffy Bldg. (I04.2OG - LAB)



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