Speaker: Dr. Simon Ausländer, ETH Zürich (Basel campus, CH)

Title: Engineering of Mammalian Cell Control Systems Based on Gene Switches & Circuits

Abstract:
Synthetic gene switches are genetically-encoded biosensors that provide mammalian cells the ability to specifically detect biomolecules and in response fine-tune protein expression levels in an input-output relationship. Especially the design of gene switches responding to disease-related input molecules in the physiological concentration range offers great opportunities for cell-based biomedical applications. Customized mammalian cell lines engineered with such gene switches can be implemented into diagnostic tests to monitor diseases by quantifying specific blood-derived biomarkers. When microencapsulated and implanted into mice, engineered cells can also be used in cell therapy in order to autonomously detect disease states and produce a therapeutic response.

The next generation of engineered cells will advance from one-input to multi-input signal integration transforming cells into sophisticated decision-making systems capable of performing complex information-processing tasks. Biological components, such as gene switches, are connected to each other to build gene circuits that are programmed by a set of different input signals for higher-order gene expression control in human cells. Post-transcriptional RNA controllers, cell-cell communication systems and 3D cell culture setups are new approaches that facilitate the design of large and complex gene circuits. In future, engineered cells will have the ability to logically respond to various disease-relevant input molecules at the same time thereby increasing the diagnostic precision as well as therapeutic intervention portfolio.