Colloquium

Tools for analyzing and controlling complex biological systems

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Host: Graduate Student and PostDoc Associations

Understanding and repairing complex biological systems, such as the brain, requires new technologies that enable such systems to be observed and controlled with great precision, across extended spatial and temporal scales. We are discovering new molecular principles that are leading to such technologies. For example, we recently discovered that it was possible to physically magnify biological specimens manyfold, in an even way, by embedding them in dense swellable polymers, mechanically homogenizing the specimens, and then adding water to isotropically swell the specimens. In this method, which we call expansion microscopy (ExM), we enable scalable, inexpensive diffraction-limited microscopes to do large-volume nanoscopy, in a multiplexed fashion – important, for example, for brain mapping. As another example, we discovered that microbial opsins, genetically expressed in neurons, could enable their electrical activities to be precisely driven or silenced in response to millisecond timescale pulses of light. These tools, called optogenetic tools, are enabling causal assessment of the contribution of defined neurons to behaviors and pathologies in a wide variety of basic science settings. Finally, we have developed new methods of directed evolution, and discovered mutant forms of optogenetic tools that enable precision fluorescent imaging of the high-speed voltage of neurons in the living brain. We share all these tools freely, and aim to integrate the use of these tools so as to lead to comprehensive understandings of neural circuits.

Monday, November 4, 2019 04:00pm - 05:00pm
Raiffeisen Lecture Hall, Central Building

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