Towards holistic imaging and rapid phenotyping of complex biological systems

Abstract: Holistic measurement of diverse functional, anatomical, and molecular traits that span multiple levels, from molecules to cells to an entire system, remains a major challenge in biology. In this talk, I will introduce a series of technologies including CLARITY (Chung, 2013), SWITCH (Murray, 2015), MAP (Ku, 2016), stochastic electrotransport (Kim, 2015), SHIELD (Park, 2019), and eFLASH (Yun, 2019) that enable integrated multiscale imaging and molecular phenotyping of both animal tissues and human clinical samples. I will discuss how we engineer (1) the physicochemical properties of biological tissues, (2) molecular interactions, and (3) molecular transport all together to achieve integrated organ-wide molecular phenotyping at unprecedented speed and resolution. I will also discuss how these tools can be deployed synergistically to study a broad range of biological questions. We hope that these new technologies will accelerate the pace of discovery in biomedical research.

Bio: Kwanghun Chung is currently an Associate Professor of Chemical Engineering at MIT, as well as a Core Member of the Institute for Medical Engineering and Science (IMES) and the Picower Institute for Learning and Memory. He received his B.S. in Chemical Engineering from Seoul National University in 2005, and then moved to Georgia Institute of Technology for his Ph.D. training under the mentorship of Dr. Hang Lu. Following his graduation in 2009, Dr. Chung joined the Karl Deisseroth Lab at Stanford University for post-doctoral training in 2010. In 2013, Dr. Chung established his independent group at MIT and has been leading an interdisciplinary team to develop and apply novel technologies for holistic understanding of large-scale complex biological systems. Chung was the recipient of the Presidential Early Career Award for Scientists and Engineers (PECASE) 2019, the NIH New Innovator Award 2016, the McKnight Technological Innovations in Neuroscience Award 2016, the Packard Fellowships for Science and Engineering Award 2015, the NARSAD Young Investigator Award 2015, the Yumin Awards for Creativity 2014, the Searle Scholars Award 2014, and the BWF Career Award at the Scientific Interface 2012.