Biomedical Optics: Advanced Imaging Methodology Development and Applications
Session co-chairs: Elizabeth Hillman, Columbia University, and Xin Yu, Max Planck Institute for Biological Cybernetics

Biomedical optics describes the use of light to interrogate biological tissues. The field is highly interdisciplinary, combining physics, engineering and computation with biology and medicine. Applications span from microscopy for biomedical research, to clinical imaging techniques for cancer detection. In larger tissues, it becomes necessary to account for the scattering of light – an area that has had to borrow models and wave-front correction strategies from fields such as astronomy. A major influence on the field in the past decade has been the development of novel fluorescent proteins and light-activatable channels that can be genetically transfected into living organisms. These genetic approaches enable cells to be turned on and off with light, while chemical signaling such as increases in intracellular calcium can be observed as changes in fluorescence intensity at the cellular and macro-scale level. As a result, biomedical optics techniques have been particularly advanced in line with neuroscience applications to enable widespread, high-speed imaging of neural activity in animal models. In humans, biomedical optics approaches can detect changes in the absorption of hemoglobin in the blood, offering a simpler and cheaper alternative to functional magnetic resonance imaging. The speakers in this session will span the breadth of this growing field, showcasing technology development, applications and computational approaches that are at the forefront of multi-scale in-vivo functional imaging using light.