Laboratory of Neural Circuit Dynamics

Animal behavior is governed by dynamic patterns of activity in the astonishingly complex neuronal circuits of the various brain regions. Our current understanding of how these neuronal circuits operate, how they interact to process information, and how they continually adapt to the needs of the whole organism still remains rudimentary. We only begin to grasp the cellular and circuit mechanisms underlying higher brain functions such as sensory feature discrimination, context-dependent decision-making, adaptation of behavior through learning, or fine-control of motor output. In our research group we study neural circuit function and principles of computation in the mammalian brain, with a particular focus on advancing and applying optical imaging methods for in vivo measurements and manipulations of brain dynamics. We investigate both the local cellular micro-level with the help of high-resolution microscopies as well as the more global 'mesoscale' brain network using large-scale imaging tools. Our specific goals are to better understand sensory and motor representations in the brain, to reveal principles of single-cell and neural circuit computation, and to decipher the neural codes governing information processing as well as circuit plasticity.

Fritjof Helmchen is Professor of Neuroscience and Co-Director of the Brain Research Institute. His research is focused on the development and application of optical methods, in particular two-photon microscopy, to study neural activity on the subcellular, cellular, and circuit level. His group has pioneered several microscopy techniques, including 3D, high-speed, and multi-area in vivo two-photon imaging, and has contributed to recent advancements in the study of cortical microcircuits. He is recipient of an ERC Advanced Grant and the Cloetta Prize 2015 and serves as scientific board member of the Betty and David Koetser Foundation and since 2018 as president of the Professor Dr Max Cloëtta Foundation. Fritjof Helmchen is member of the SNSF Research Council since 2018 and currently Director of the Neuroscience Center Zurich(ZNZ). For the FENS 2020 Virtual Forum he serves as chair of the Scientific Programme Committee.

Contact