Laboratory of neuronal and circuit plasticity

Biography

Our lab is interested in how the brain computes sensory information and how these computations change with the experience of the animal. We study both the structure and the function of neurons mainly in two sensory modalities – olfaction and audition. Our animal model is the mouse.

Research

Population dynamics in the mouse primary auditory cortex

Sensory processing in the mammalian brain is carried out by large populations of neurons. We use both single cell electrophysiology and in vivo two-photon calcium imaging in mice to study the functional organization, dynamical principles, and functional plasticity of neural population in the primary auditory cortex.

In particular we are interested in understanding how sensory coding changes following learning and
following natural experiences that are behaviorally relevant. We have several projects that aim to target and manipulate neuronal subpopulations in the cortex. In particular we combine molecular methods (like viruses and transgenic mice) with electrophysiology and optical physiology.

**Olfactory coding**

The olfactory bulb (OB) is the first relay station for olfactory processing in the brain. Odor representations in the OB are shaped by a very dense and heterogeneous local network. In order to understand how odor information is processed by the OB our approach is to dissect this circuit into distinct neuronal subpopulations and to study their sensory physiology in-vivo. To this end we use various molecular-genetic tools combined with in-vivo calcium imaging and targeted electrophysiology. Our long term goal is to understand how odor coding in the OB changes in face of new external demands.

**Newborn neurons in the Olfactory bulb**

While in most parts of the brain new neurons are not generated, few neurogenic niches are maintained also in the adult. One of these regions is the olfactory bulb (OB). Little is known about the functional role of this unique form of network plasticity. We use various genetic tools in combination with in-vivo imaging to study how these neurons develop and maintain, in vivo. Specifically, we use two-photon time lapse imaging and to study periglomerular neurons under various experimental conditions.

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