AG Felmy

Main research topics
Physiology of neuronal circuits

- Neurophysiology of auditory brainstem pathways
- Development and function of neuronal circuits
- Synaptic transmission and postsynaptic integration
- Morphometric analysis of single cell structures

In our brain neuronal circuits generate the representation of our environment. These representations therefore depend on the interplay of synaptic connectivity and biophysical properties of individual neurons within a neuronal network and ensemble. The understanding of neuronal connectivity and function is hence crucial to decipher how we perceive our environment.

My lab tries to understand mechanistically how neurons in well-defined circuits generate output that underlies the representations of a sensory percept. We therefore study synaptic evoked input output functions from the presynaptic release mechanisms via EPSC to EPSP transformation, postsynaptic integration of excitation and inhibition to the finally generated action potential. We compare these results with sensory evoked, neuronal activity patterns. With this approach we are able to determine the mechanisms of information transfer at specified junctions within a neuronal network or pathway and understand its functional meaning.

Or lab focuses on neurons in the auditory brainstem pathways, as the well documented structure-function relationship is a key feature to understand the interactions between different neuronal populations. Auditory brainstem pathways are also amazing in their biophysical properties, as they need to extract from only amplitude- and frequency modulated air pressure waves and binaural cues the required information to generate the wonderful auditory space of our everyday life. To accomplish this task it appears that neurons in the auditory brainstem are highly adapted to a specific computational feature. These adaptations generate various biophysical models, such as fast or slow integrators, rapid synaptic transmission or well-defined neuromodulations that we investigate in detail with neurophysiological techniques to finally understand how our brain generates our auditory space.
Ongoing work in the lab

- Influence of distinct synaptic components on action potential generation in the ventral nucleus of the lateral lemniscus.
- What the EPSC really tells a neuron: required excitatory input number and time for action potential generation in various auditory brainstem nuclei.
- Deciphering the biophysics and functions of the intermedial nucleus of the lateral lemniscus.
- Synaptic integration and biophysical properties of neurons in the medial superior olive
- Developmental and experience dependent alterations of calcium influx sites the medial superior olive.
- Contribution of the fast depolarization after potential to burst like firing in neurons of the medial enthorinal cortex.

Experimental expertise

- in vitro and in vivo electrophysiology and pharmacology
- Calcium imaging
- Confocal microscopy
- Immunofluorescence
- Quantitative cell reconstruction
- Changing sound environment with noise exposure

Publications
Publications indexed by pubmed.