Physiological Properties of Neurons in the Medial Amygdala

Yanan Wu[1], Rongfeng Hu[2,3] and Weizhe Hong[2,3*]

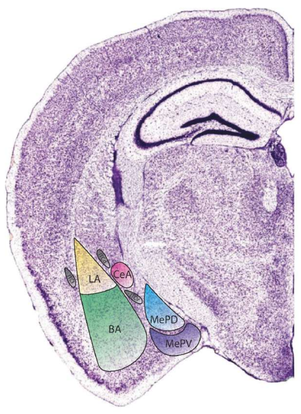
[1]School of Life Sciences, Fudan University, Shanghai, 200437, China

[2]Department of Biological Chemistry [3]Department of Neurology, David Geffen School of Medicine, University of California Los Angeles, Los Angeles, CA 90095, USA

[*]whong@ucla.edu

Introduction

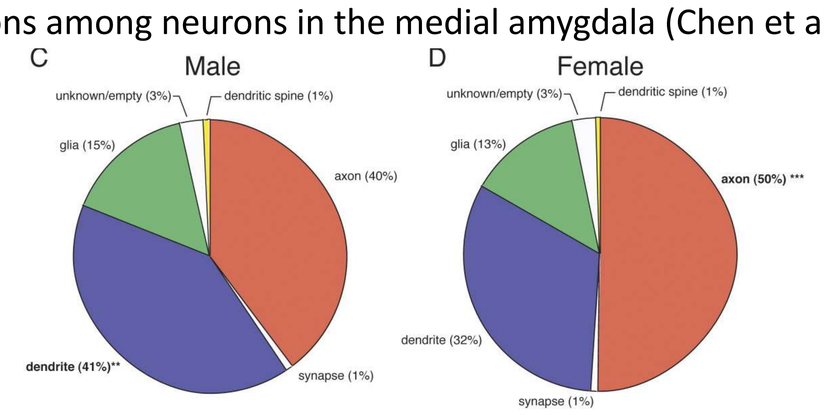
Medial Amygdala and Behavior



The amygdala is a conserved structure compose of multiple sub-nucleus (Janak et al., 2015). Recently, the roles of the medial amygdala in innate social and emotional behaviors have been reported (Hong et al., 2014)(Chen et al., 2019). By processing sensory information from olfactory system, the medial amygdala mediates social behaviors like grooming and parenting. Its function in sex-specific social behaviors has been highlighted.

Physiological Feature

The medial amygdala is one of the sexually dimorphic brain regions. Morphological differences between sexes have been reported (Cooke et al., 2007). High heterogeneity in molecular level implies distinctive populations among neurons in the medial amygdala (Chen et al., 2019).

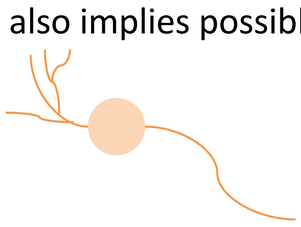


Although the medial amygdala has been known to mediate several types of behaviors, little is known about its underlying neuronal mechanisms. Our project aims to analyze physiological properties of neurons in the medial amygdala, including its electrophysiological parameters and projection sites.

Previous characterization of neurons in the medial amygdala using electrophysiological data (Keshavarzi et al., 2014) has mainly focused on male, here we introduce female mice into this characterization.

Summary

We used in-vitro electrophysiology to record neuron activity in the medial amygdala. Our preliminary results coordinate with the high heterogeneity previously reported. iDISCO imaging illustrates the projection pattern of neurons that serves as an important part of physiological properties, and also implies possible functional connectivity among brain subsets.



Molecule
Morphology
Physiology

+

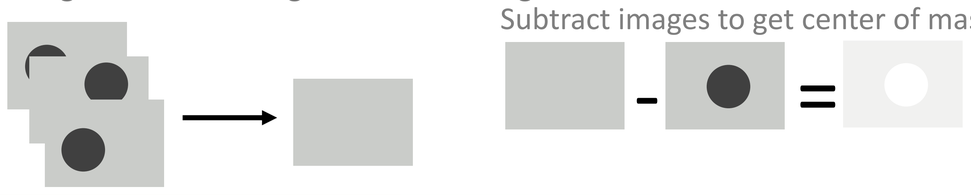
Projection pattern
Behavior
…

Automatic Tracking

We use subtraction, fast Fourier transform and low-pass filter to track the mass center of mouse on a frame basis. The heatmap and data analysis were then conducted using location information.

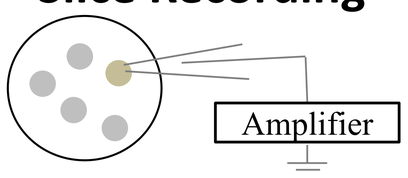
Average 100 frames to get reference image

Subtract images to get center of mass



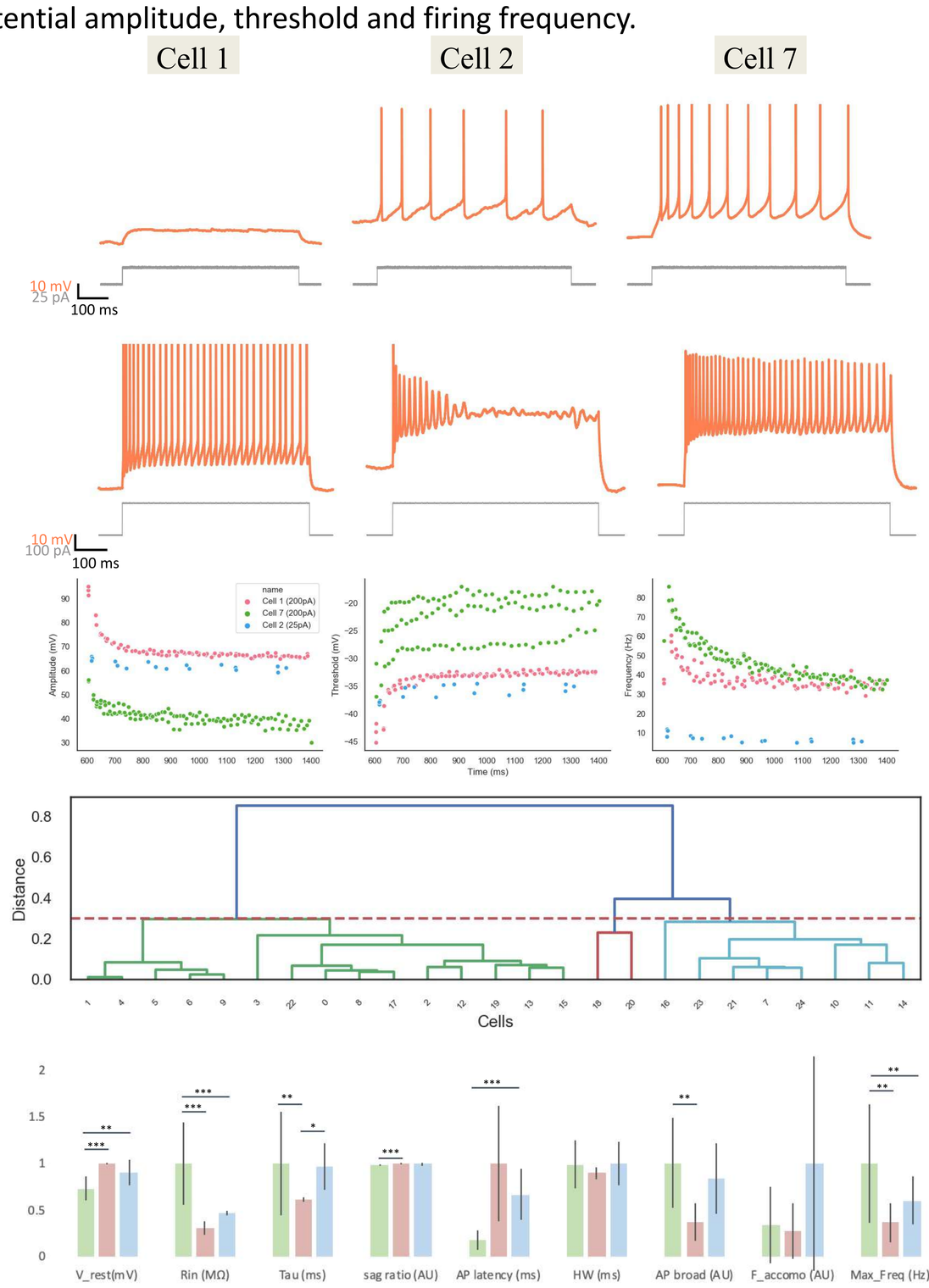
Results

Slice Recording



current-clamp: keep injecting current into the cell and see how the membrane potential change accordingly.

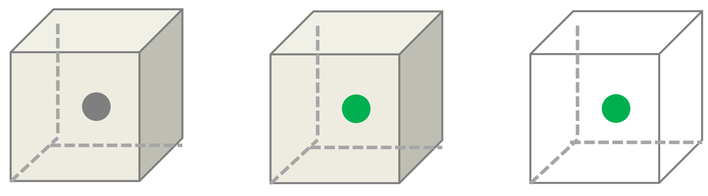
We injected 25pA and 200pA current into cells for 800ms and the traces are shown below. Neurons in the medial amygdala tend to have different action potential amplitude, threshold and firing frequency.

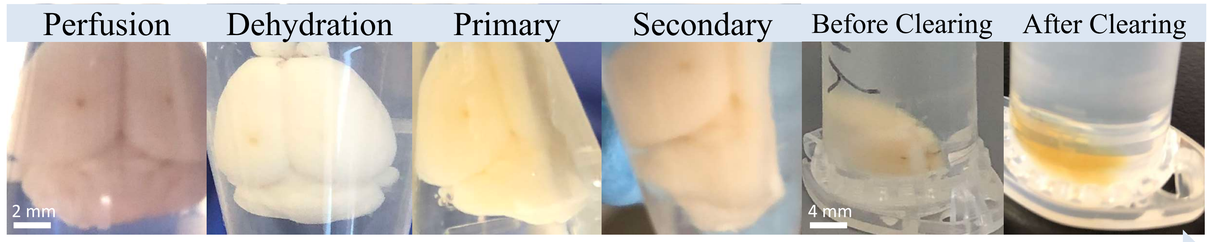


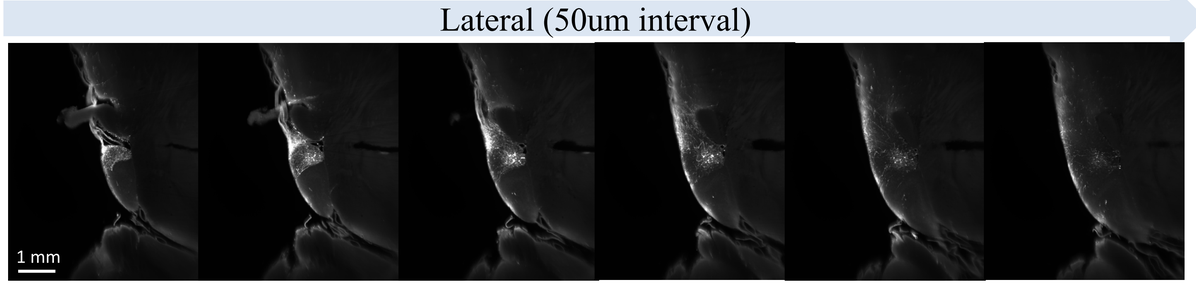
iDISCO

iDISCO enables whole-mount immunolabeling with volume imaging of large cleared samples. We tested this method on antero-traced MeA neurons.

PFA fixation
Immunolabeling
Clearing
Imaging







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