Optical access to auditory cortex for use in *in-vivo* two-photon calcium imaging

Raj Shah[1], Beth McCarry[2], Brigid Deck[1], Santiago Jaramillo[3]

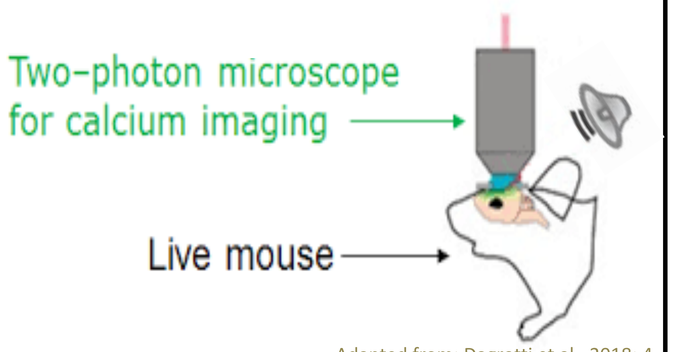
Department of Human Physiology[1], Department of Physics[2], Department of Biology[3]

UNIVERSITY OF OREGON

Motivation

In order to understand how the brain processes sounds, we can use *in-vivo* two-photon calcium imaging to measure the activity of hundreds of individual neurons simultaneously while sounds are presented.

Figure 1:



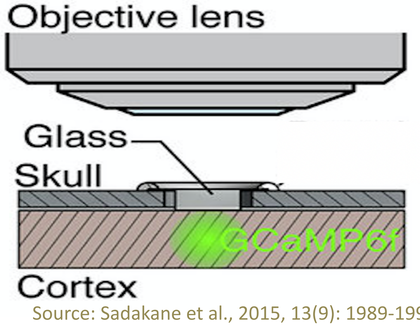
Adapted from: Dagrotti et al., 2018: 4

Methods

Optical access is achieved via implantation of a 3mm cranial window through surgical intervention.

Concentration of calcium in a cell is a reliable indicator for the neural activity, so GCaMP was used as a fluorescent calcium sensor.

Figure 2:

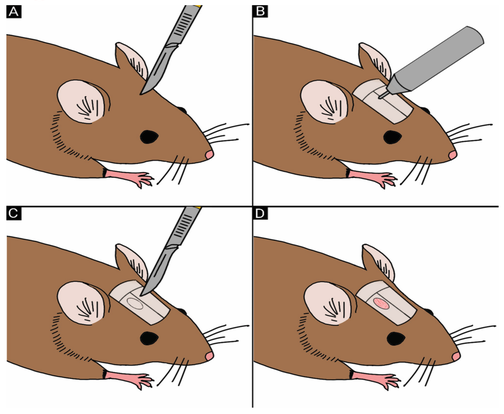


Source: Sadakane et al., 2015, 13(9): 1989-1999

Surgery

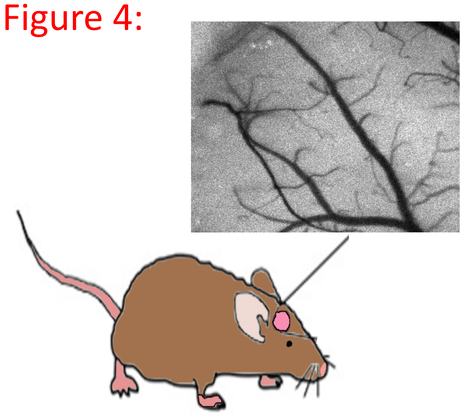
With the auditory cortex (AC) being on lateral aspect of brain and not easily accessible, partial dissection of temporal muscle allowed for increased access.
Due to inflammation and pain caused by invasiveness of surgery, drug protocol was modified to increase survival rates.

Figure 3:



Source: de Miranda et al., 2018: 315-327

Figure 4:



Adapted from: Cabrales and Carvalho, 2010: 45

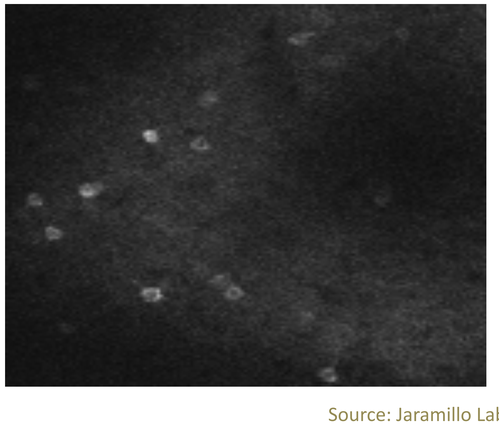
Imaging

With a cranial window implanted, we can image activity of auditory cortical neurons using two-photon microscope while the mouse is awake.

Figure 5:

Source: Jaramillo Lab

Figure 6:



Source: Jaramillo Lab

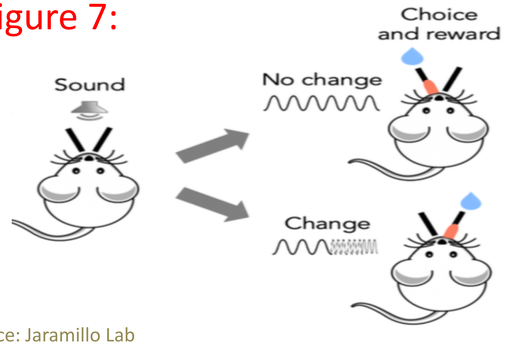
Results

By overcoming the challenges of surgery, we were able to successfully implant a cranial window over the AC, which has allowed us to use two-photon calcium imaging to measure the activity of auditory cortical neurons while the mouse is awake.

Future Directions

By measuring the activity of neurons from the AC of awake mice in response to changes in sound, this data will see if our ability to detect changes in sound is dependent on the activation of neurons in the AC.

Figure 7:



Source: Jaramillo Lab

Acknowledgments

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