Allen Cell Types Database

http://celltypes.brain-map.org/

A multimodal database of single cell characterization to enable data-driven approaches to classification. Key features include: whole cell patch clamping, raw images and morphological reconstructions, a variety of abstract point models as well as biophysically detailed compartmental models, and single cell RNA sequencing data.

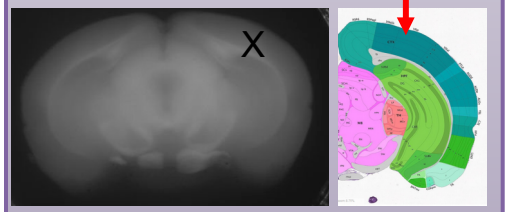
Single Cell Characterization: Electrophysiology & Morphology

A comprehensive dataset is acquired for each neuron. Here is an example of the multimodal data generation from one single experiment (Specimen 162961.04.02)

Mouse Metadata

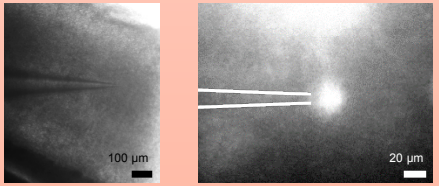
Genotype	Nr5a1:Ai14
Sex	M
Age	P56

Neuron Registration

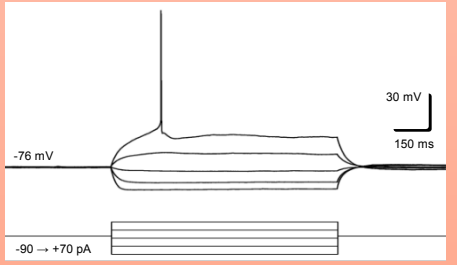


Cell location is marked on the block face images to register to the Allen Reference Atlas

Electrophysiology

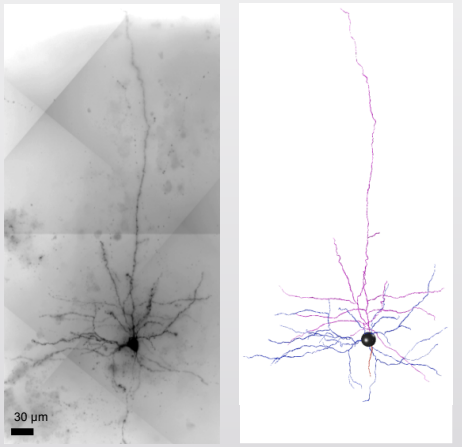


Recording location and Cre label are verified by images



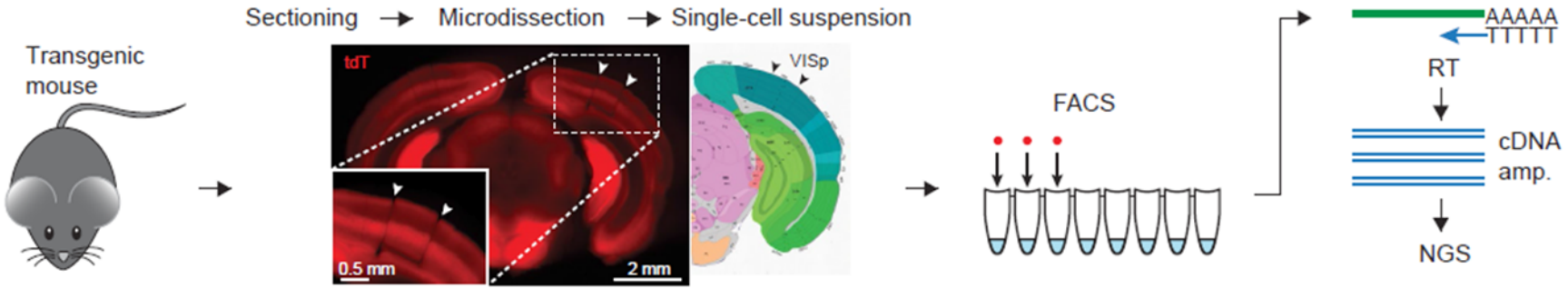
Raw and summary Ephys data for sub and suprathreshold activity

Cell Imaging, Reconstruction



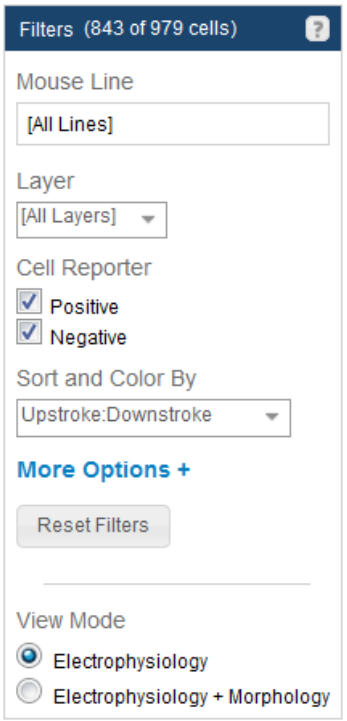
63X image stack acquired for every well-filled neuron. Reconstructions prioritized based on Ephys and fill.

Transcriptomics: Isolating and profiling cells



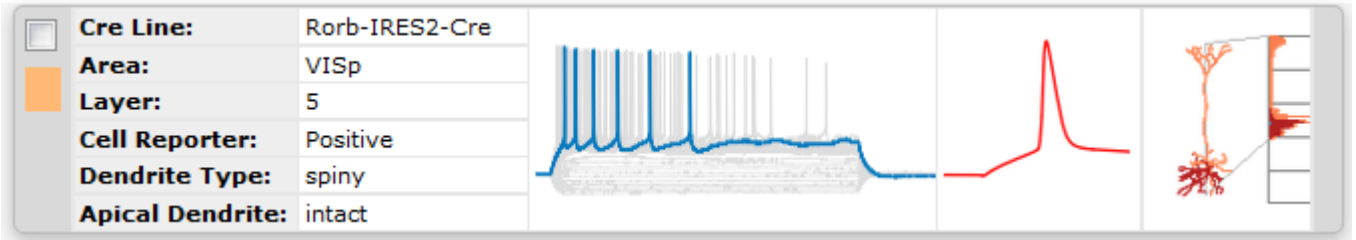
How to most effectively navigate and mine the Allen Cell Types Database

Electrophysiology & Morphology



- Search for cells of interest using the Filters panel (Cre line, layer, ephys or morphological features) on the website. Click here for more information on advanced search features.

- Clicking on a cell panel (see above) will take you to cell characterization data including stimuli, cell responses, models, links to download the NWB file for that experiment, as well as morphological images, reconstructions and features (when available).

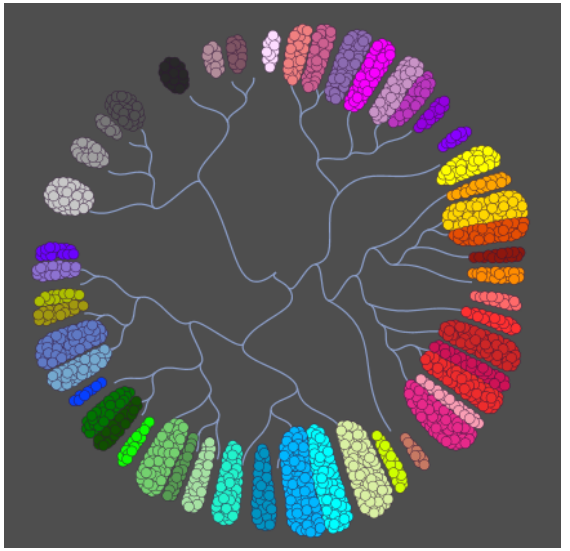


- Use the Allen SDK for sample code demonstrating how to download neuronal model parameters from the Allen Brain Atlas API and run your own simulations using stimuli from the Allen Cell Types Database or custom current injections:
    - Biophysical Models
    - Generalized LIF Models

How to most effectively navigate and mine the Allen Cell Types Database

Single Cell RNA Sequencing

- Prototype cell type classification was performed based on transcriptomics from single cells isolated from the primary visual cortex and is described here and here.



- Follow up studies are in progress and include RNA Sequencing from single cells isolated from the lateral geniculate complex, the primary visual cortex and from the anterior lateral motor area. From this page, you can download gene level FPKM values (as might be used in a heatmap display of gene expression for neurotransmitters) or access FPKM and TPM values for each sample.
- What analyses can you perform?
    - Compare the transcriptome of your cell to identify similar cells
    - Identify marker genes of cell types
    - Look at expression patterns of functional categories of genes (i.e. ion channels, GPCRs etc.)

Allen Brain Observatory

http://observatory.brain-map.org/visualcoding

The Allen Brain Observatory is an *in vivo* survey of physiological activity in the mouse visual cortex, featuring representations of visually evoked calcium responses from GCaMP6-expressing neurons in selected cortical layers, visual areas and Cre lines.

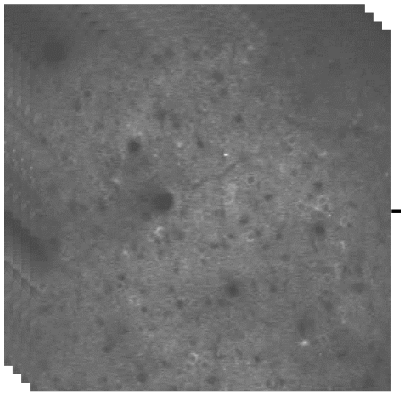
Visual Stimulus Set

Static and Drifting Gratings:
spatial & temporal frequency tuning
and orientation/direction selectivity

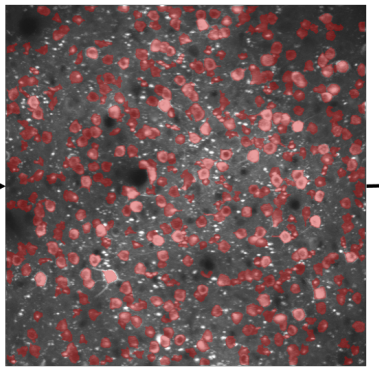
Natural Scenes and Movies:
responses to naturalistic stimuli

Locally Sparse Noise:
spatial receptive field

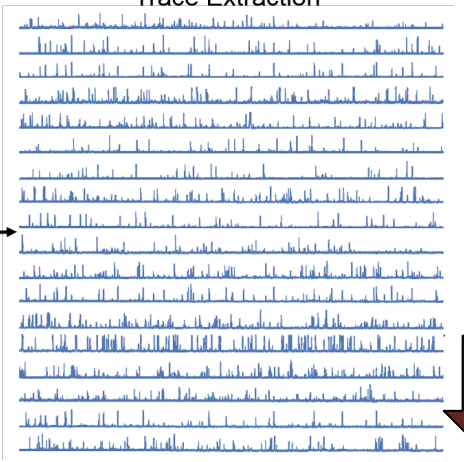
2P Calcium Imaging Over Time



Cell Segmentation



Trace Extraction



Session A

Stimulus	min
Drifting Gratings	30
Natural Movie 1	5
Natural Movie 3	20
Spontaneous Activity	5
Inter-stim gray	2
Total	**62**

A: 10 | 10 | 5 | 10 | 5 | 10 | 10

Session B

Stimulus	min
Static Gratings	25
Natural Images	25
Natural Movie 1	5
Spontaneous Activity	5
Inter-stim gray	2
Total	**62**

B: 8 | 8 | 5 | 8 | 8 | 5 | 9 | 9

Session C

Stimulus	min
Locally Sparse Noise 4 deg	37
Natural Movie 1	5
Natural Movie 2	5
Spontaneous Activity	10
Inter-stim gray	1
Total	**58**

Session C2

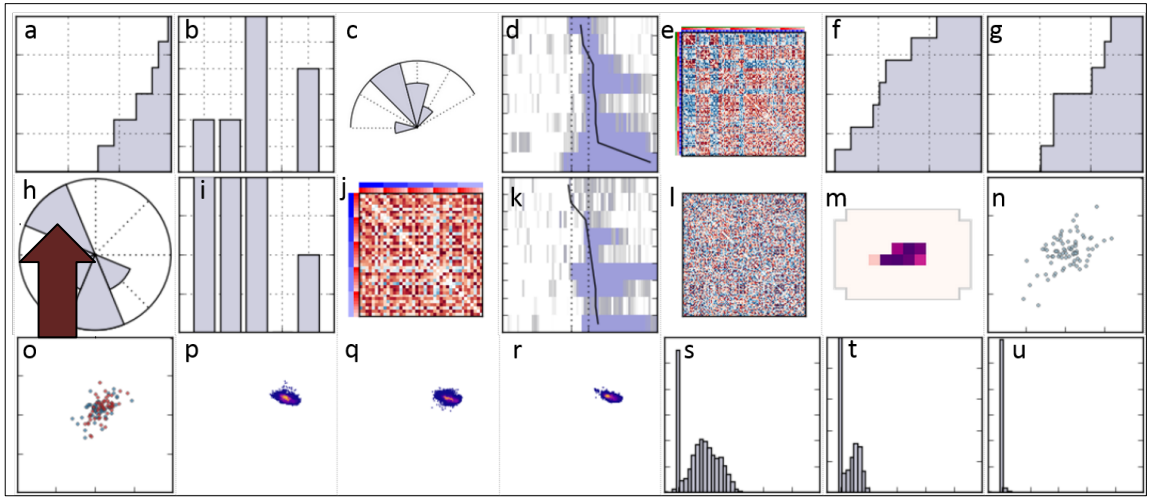
Stimulus	min
Locally Sparse Noise 4 deg	24
Locally Sparse Noise 8 deg	23
Natural Movie 1	5
Natural Movie 2	5
Spontaneous Activity	10
Inter-stim gray	1
Total	**60**

2016

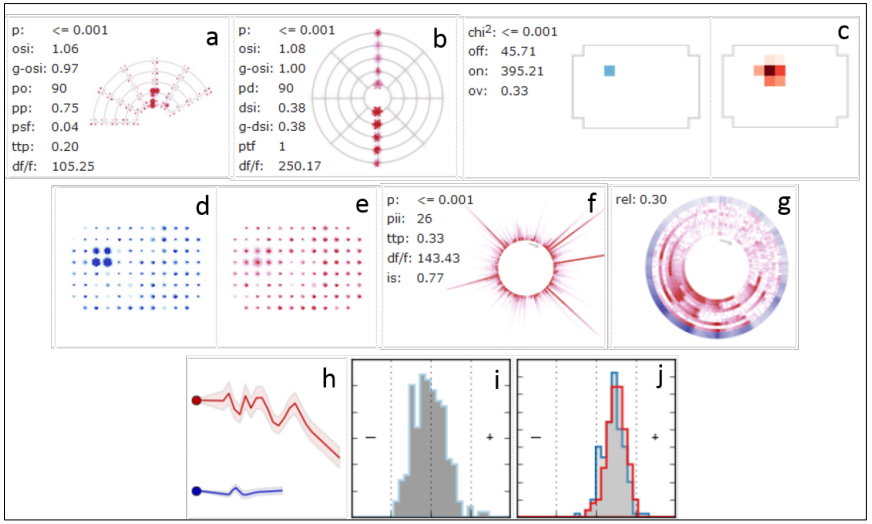
C: 12 | 5 | 5 | 12 | 5 | 5 | 13

2017

C2: 8 | 7 | 5 | 5 | 8 | 7 | 5 | 5 | 7 | 8



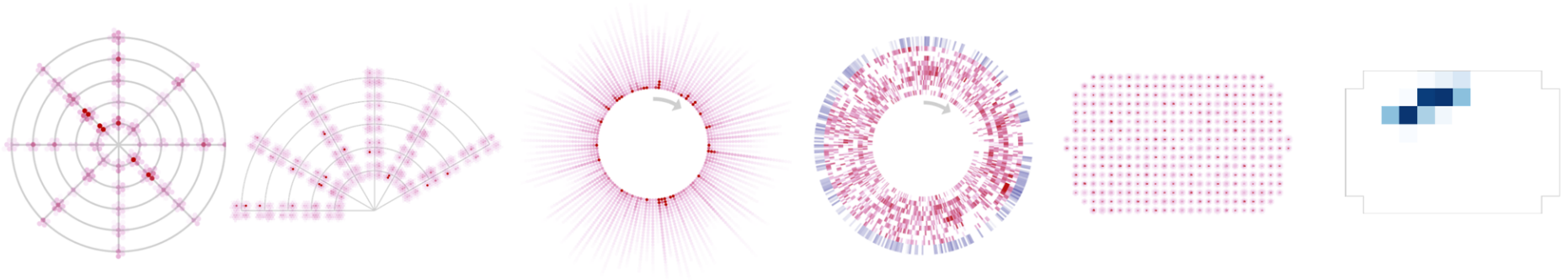
Population Responses



Cell Responses

How to most effectively navigate and mine the Allen Brain Observatory – Visual Coding data set

- Browse the Visual Stimuli (Drifting Gratings, Static Gratings, Natural Scenes, Natural Movies & Locally Sparse Noise) from the website to understand each stimulus, data analysis of the calcium responses, and the creation of the visualization.



- Browse or search for experiments (mouse line, area of visual cortex, depth) or for cells with desired responses. See Documentation and Online Help for more information.

- Download the computed features of a subset of cells (use the jupyter notebook located here) as a .csv file

- Use the AllenSDK to access the NWB files for any of these experiments: to compute your own metrics, work with the fluorescent traces or analyze the eye tracking data
-
- NWB file contents include: ROI masks, raw fluorescence for each ROI, ΔF/F for each ROI, running speed, eye tracking, motion correction (and more)

CRCNS.org – Collaborative Research in Computational Neuroscience - Data sharing

http://crcns.org

A public repository hosting freely available neurophysiology and behavioural data useful for computational neuroscience. Includes data from a variety of species and brain regions and species.

Features

- Hosts about 83 data sets, 4.3 TB, 3,200 files
- Primarily in-vivo neurophysiology and behavioral data
- Publications made using data:
    - 68 peer-reviewed Journal
    - 45 Conference papers or posters
    - 2 Book chapters
    - 1 Masters thesis
    - 12 archive pre-prints

  128+ total publications
- Funded by NSF and LBNL (Lawrence Berkeley National Laboratory)
- Data hosted at NERSC (National Energy Research Scientific Computing Center)
- Yearly downloads (from July 2016-July 2017):
    - about 4,900 files, 7.33 TB.

Current work/ future plans

- Standardize format for storing data and metadata
- Make contribution process more efficient
- Integrate with HPC (High Performance Computing) environment at NERSC
- Implement robotic tape storage for very large datasets
- Develop new portal software to improve searching and browsing data

Currently hosted datasets

Currently, 83 data sets. Total size about 4.3 TB.

Visual cortex	(16) - Monkey, Cat, mouse, Human (fMRI)
Auditory cortex	(2) – Rat
Frontal cortex	(1) – Rat
Parietal cortex	(1) – Monkey.
Prefrontal cortex	(4) – Rat
Motor cortex	(3) – Mouse
Somatosensory cortex	(3) – Mouse
Orbitofrontal cortex	(2) – Rat
Hippocampus	(12) – Rat, Monkey
Thalamus	(1) – Mouse
Retina	(1) – Mouse
LGN	(1) - Mouse
Brainstem	(1) – Mouse
Avian brain	(6) - Zebra finch; auditory and motor areas
Insect brain	(1) - Grasshopper auditory receptor
Eye movements	(1) - Human
EPFL Neural Decoding Challenges	(4) - rat cortex, monkey LGN and retina
DREAM (Data base for Reaching experiments)	(15) - Human and Monkey
Methods	(4) - Calcium imaging
Simulation	(1) - Rat hippocampus

NeuroMorpho.Org

http://neuromorpho.org/

NeuroMorpho.Org is a centrally curated inventory of digitally reconstructed neurons associated with peer-reviewed publications. It contains contributions from over 200 laboratories worldwide and is continuously updated as new morphological reconstructions are collected, published, and shared. To date, NeuroMorpho.Org is the largest collection of publicly accessible 3D neuronal reconstructions and associated metadata.

One slide giving an overview of the resource, example datasets, etc.

One slide discussing current work/future plans

Optional 3rd slide…

General requests:

- Please favour graphical content over text where possible

- Please don't use animation (use multiple slides if required)

- Try to keep to font Arial

- Save slides as .pptx (Powerpoint 2007-2013); slides will be concatenated into a single PDF presentation