

# 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.

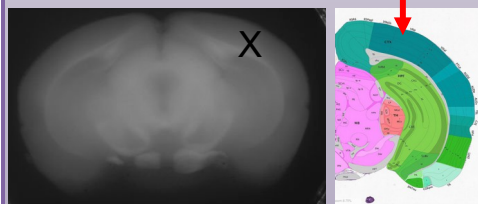
# Single Cell Characterization: Electrophysiology & Morphology

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

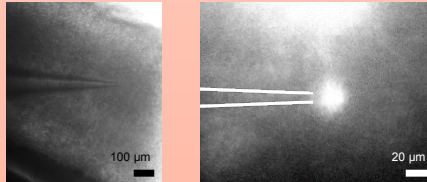
Genotype	Nr5a1:Ai14
Sex	M
Age	P56

## Neuron Registration

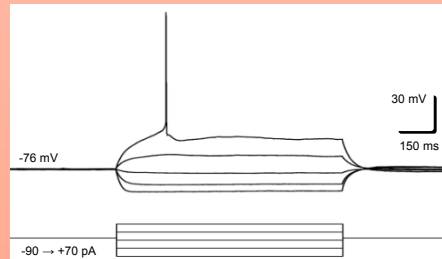


Cell location is marked on the block face images to register to the Allen Reference Atlas

## Electrophysiology

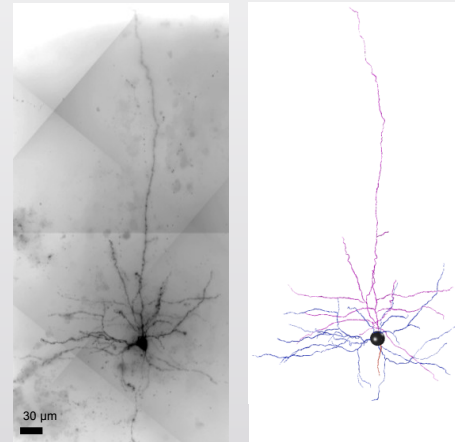


Recording location and Cre label are verified by images



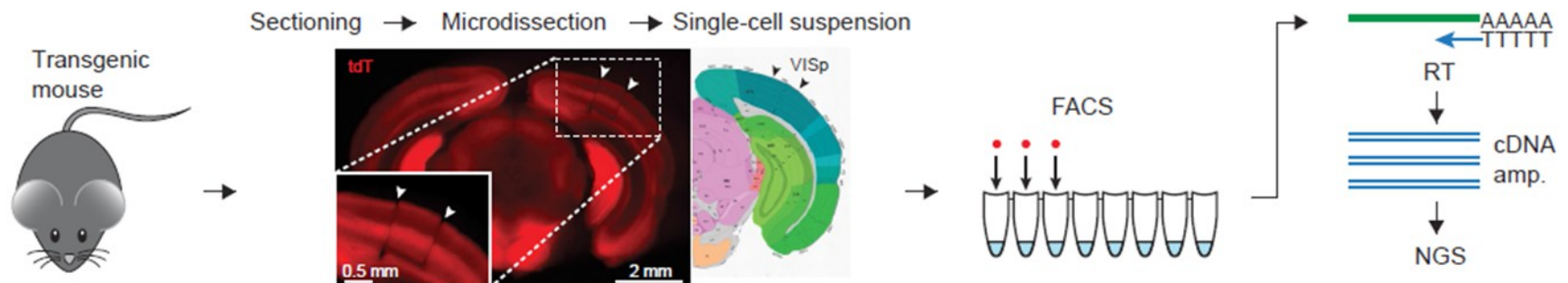
Raw and summary Ephys data for sub and suprathreshold activity

## Cell Imaging, Reconstruction



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

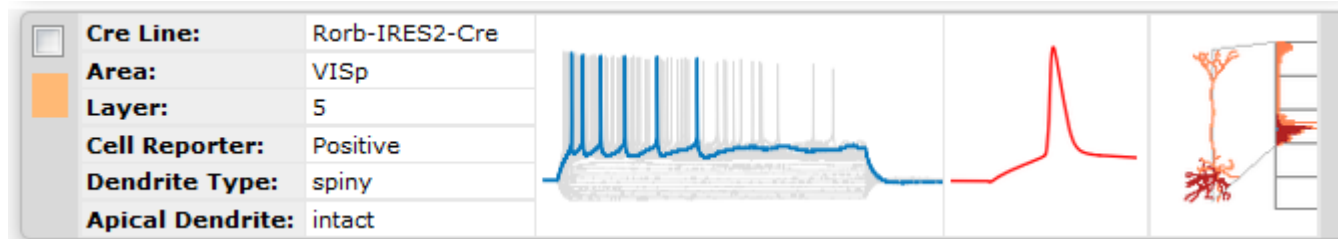
# Transcriptomics: Isolating and profiling cells



# 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).



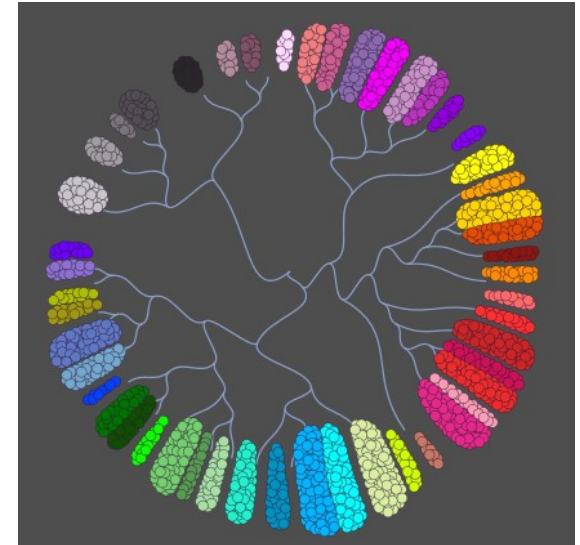
A filters panel for the Allen Cell Types Database. The top bar indicates 'Filters (843 of 979 cells)' with a help icon. The panel includes sections for 'Mouse Line' (a dropdown menu set to '[All Lines]'), 'Layer' (a dropdown menu set to '[All Layers]'), and 'Cell Reporter' (checkboxes for 'Positive' and 'Negative', both checked). Below these is a 'Sort and Color By' dropdown menu set to 'Upstroke:Downstroke'. A 'More Options +' link and a 'Reset Filters' button are also present. At the bottom, the 'View Mode' section has two radio buttons: 'Electrophysiology' (selected) and 'Electrophysiology + Morphology'.

- 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.)



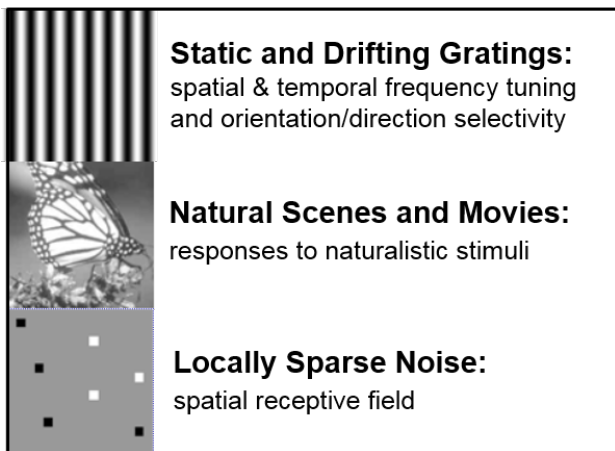
# Allen Brain Observatory

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

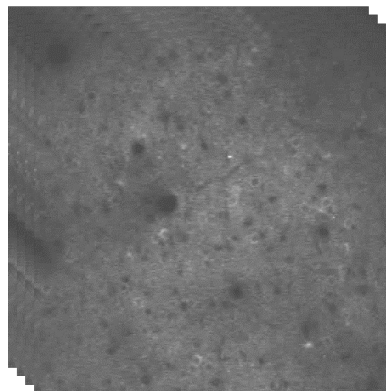
The Allen Brain Observatory is an *in vivo* survey of physiological activity in the mouse visual cortex, featuring representations of visually evoked calcium responses from GCaMP6-expressing neurons in selected cortical layers, visual areas and Cre lines.



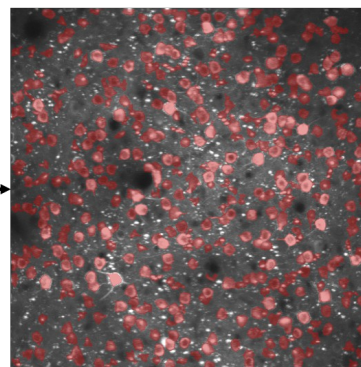
## Visual Stimulus Set



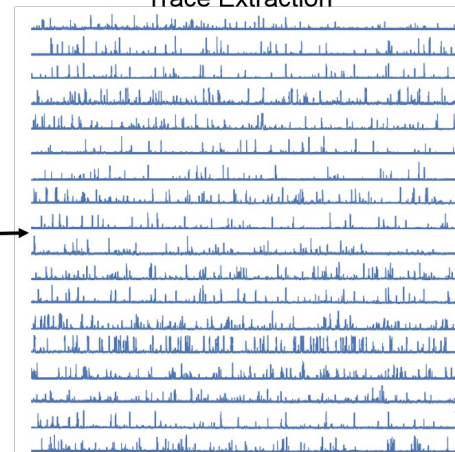
## 2P Calcium Imaging Over Time



## 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
<b>Total</b>	<b>62</b>



### Session B

Stimulus	min
Static Gratings	25
Natural Images	25
Natural Movie 1	5
Spontaneous Activity	5
Inter-stim gray	2
<b>Total</b>	<b>62</b>



### 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
<b>Total</b>	<b>58</b>

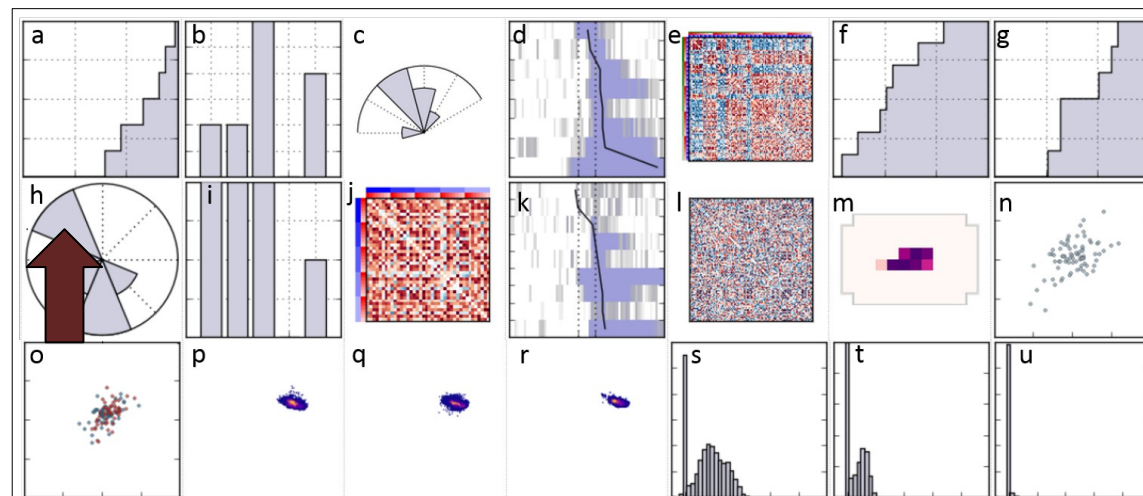


### 2017

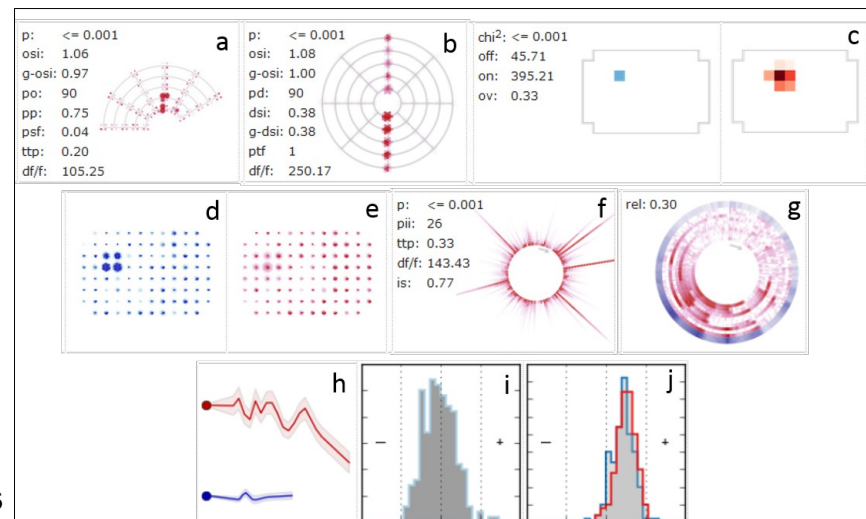


### Session C2

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
<b>Total</b>	<b>60</b>



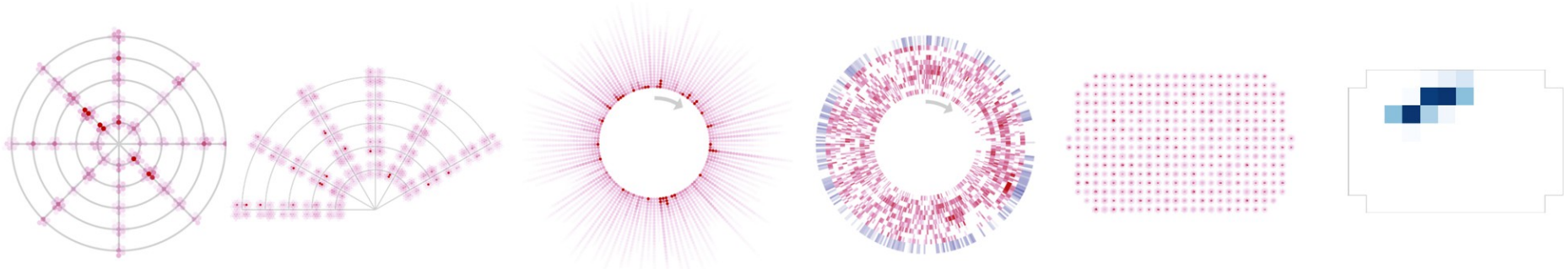
## Population Responses



## 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,  $\Delta F/F$  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-prints128+ 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.



# NeuroMorpho.Org



Version 7.1 - Released: 03/30/2017 - Content: 62304 neurons

Total number of downloads: 7005485

Total site hits since August 1, 2006: 215624

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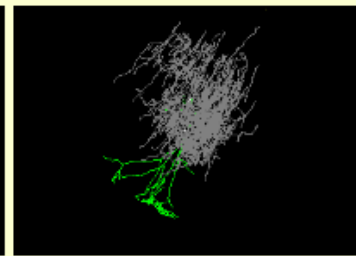
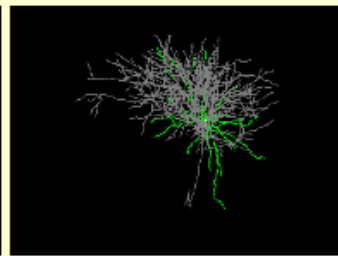
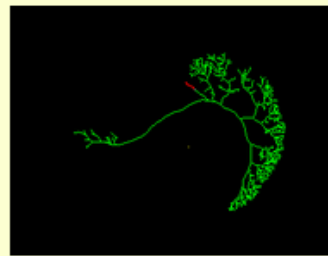
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Reconstructions from 206 brain regions

> 1.6M hours of manual reconstructions

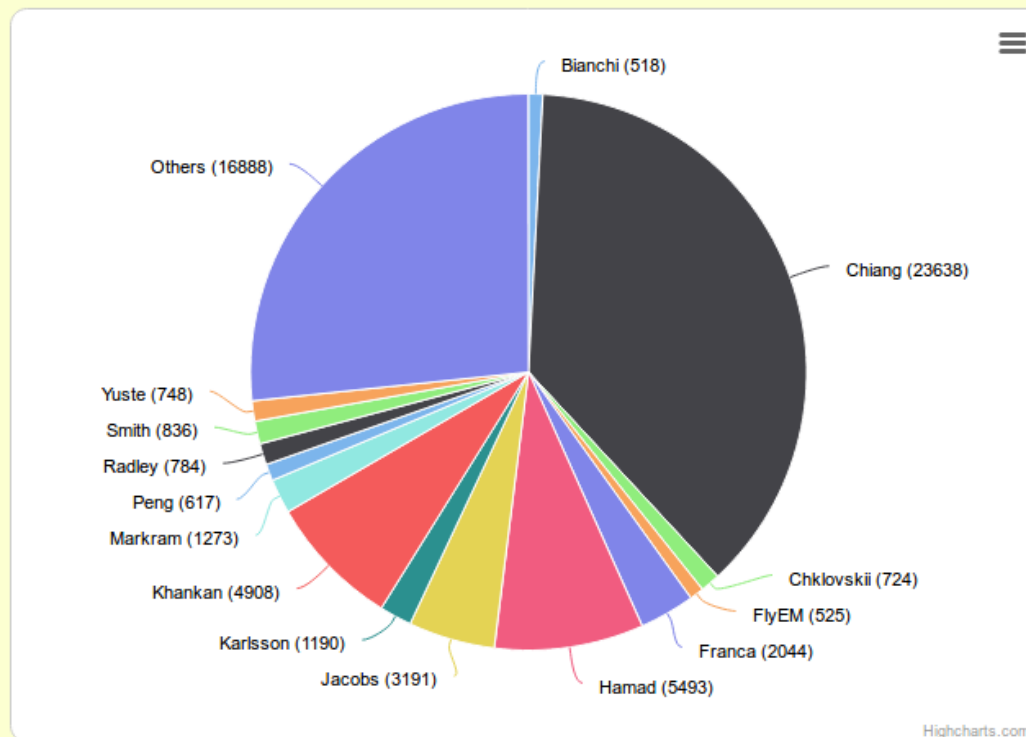


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The goal of NeuroMorpho.Org is to provide dense coverage of available reconstruction data for the neuroscience community. Data sharing through NeuroMorpho.Org enables the full and continuing research potential of existing digital reconstruction data.

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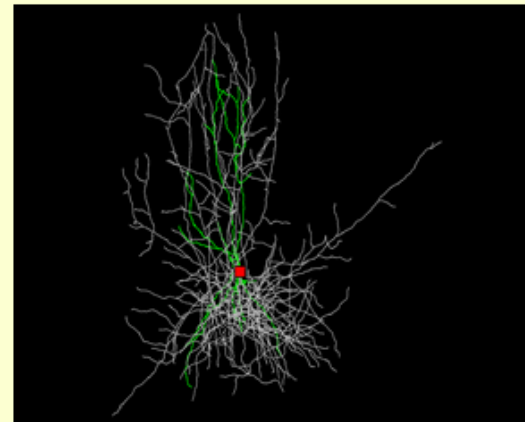
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## Details about selected neuron

NeuroMorpho.Org ID : NMO\_37851

Neuron Name : MTC141001A-IDB

Archive Name : Markram

Species Name : rat

Strain : Han Wistar

Structural Domains : Dendrites, Soma, Axon

Physical Integrity : Dendrites Complete, Axon Moderate

Morphological Attributes : No Diameter, 3D, Angles

Min Age : 14.0

Max Age : 14.0

Gender : Male

Min Weight : Not reported

Max Weight : Not reported

Development : young

Primary Brain Region : neocortex