

The Allen Brain Observatory

CSHL Neural Data Analysis

JULY 23, 2019

Saskia de Vries
Assistant Investigator



Get AWS up and running.

<http://dev.dynbrain.org/>

token = CSHL19

Please shut down AWS when you are done working.
This token will remain valid for one week.





Mission:

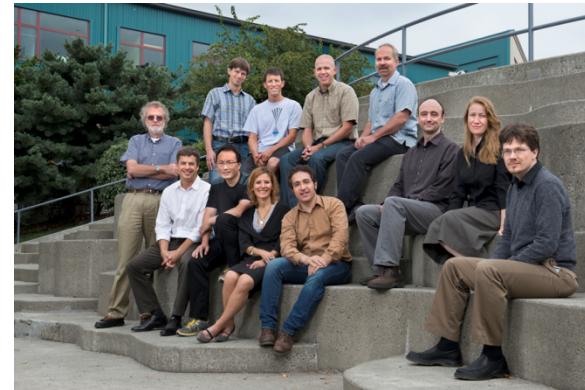
To accelerate the understanding of how the human brain works in health and disease.

Using a big science approach, **we generate useful public resources**, drive technological and analytical advances, and discover fundamental brain properties through integration of experiments, modeling, and theory.



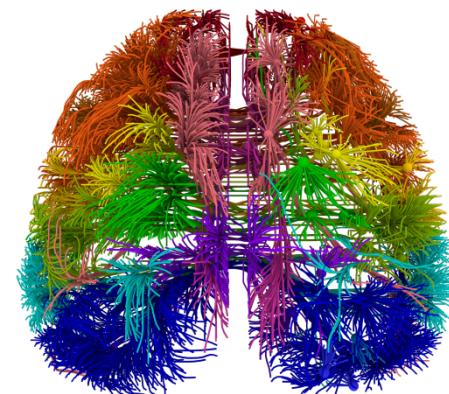
Allen Institute Guiding Principles

Team Science: Multi-disciplinary teams working towards common goal

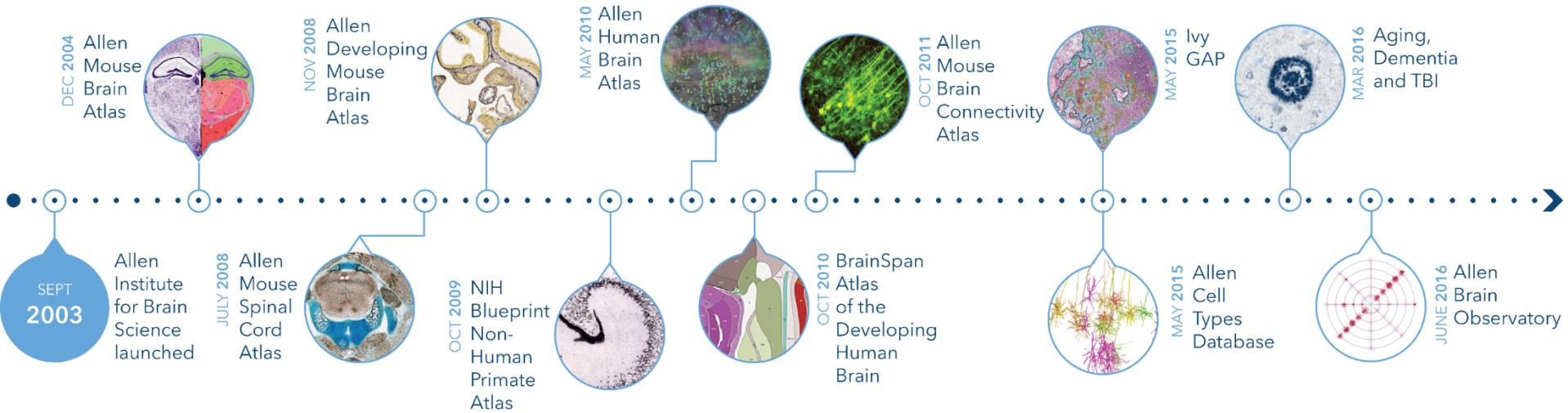


Big Science: Clear goals or milestones for large-scale projects

Open Science: All of our data, knowledge and tools are publicly available on brain-map.org.



Allen Institute Online Public Resources



- Once QC is complete, data is served online, available for public use
- Data analysis and mining are performed after data release





ALLEN INSTITUTE *for*
BRAIN SCIENCE

THANK YOU

We wish to thank the Allen Institute for Brain Science founder,
Paul G. Allen, for his vision, encouragement and support.

alleninstitute.org
brain-map.org

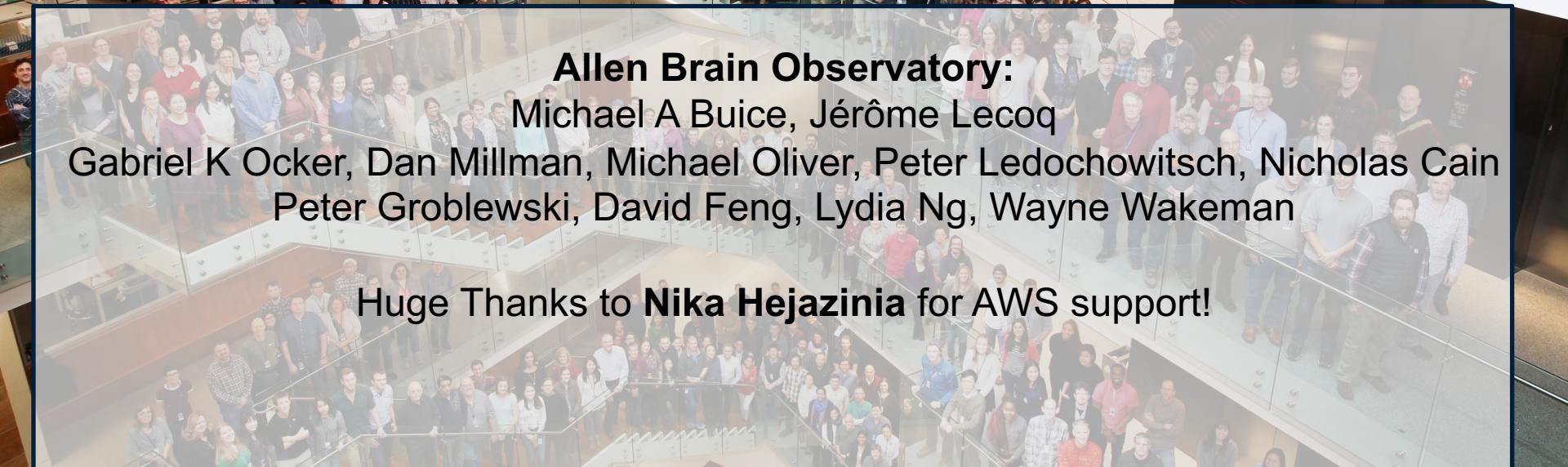


Allen Brain Observatory:

Michael A Buice, Jérôme Lecoq

Gabriel K Ocker, Dan Millman, Michael Oliver, Peter Ledochowitsch, Nicholas Cain
Peter Groblewski, David Feng, Lydia Ng, Wayne Wakeman

Huge Thanks to **Nika Hejazinia** for AWS support!

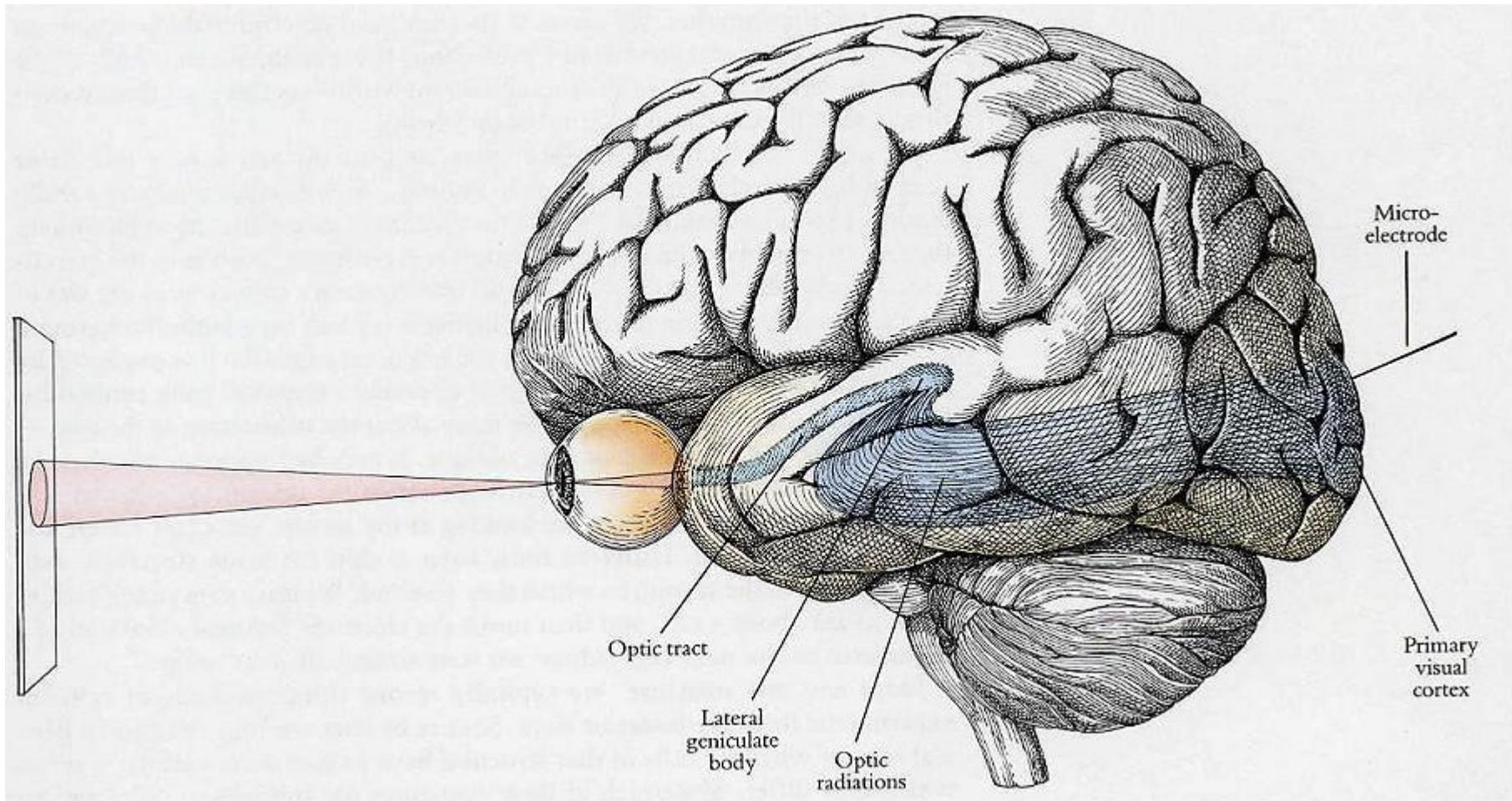


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Hubel (1988)



Hubel & Wiesel (1961)





Hubel & Wiesel (1959, 1962)

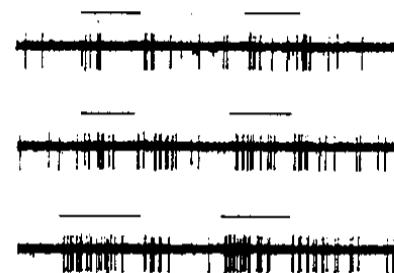
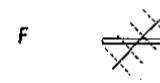
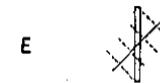
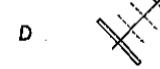
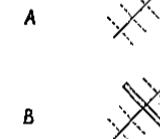
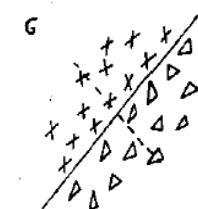
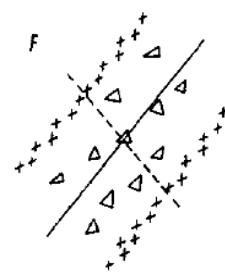
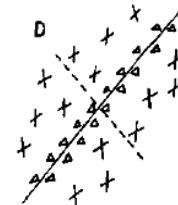
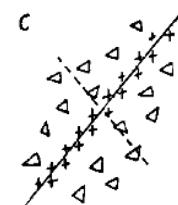


LGN

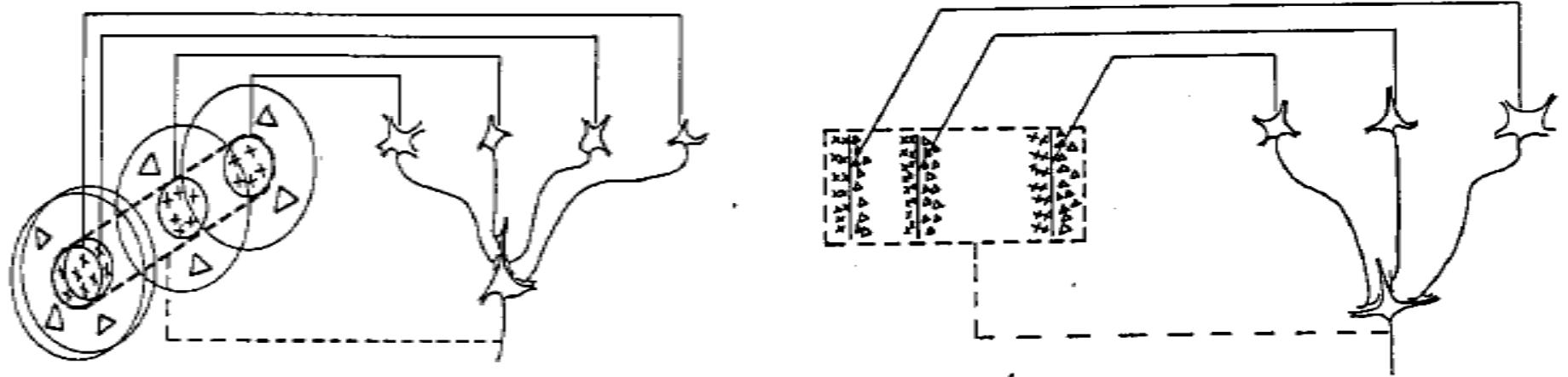
cortex

simple

complex



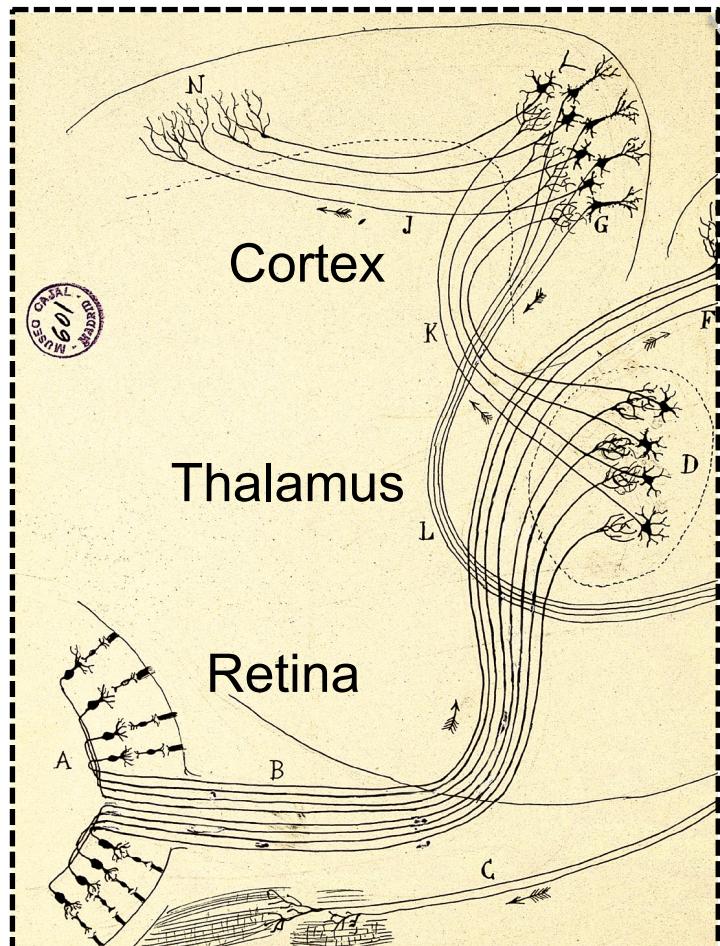
Hierarchical feedforward model



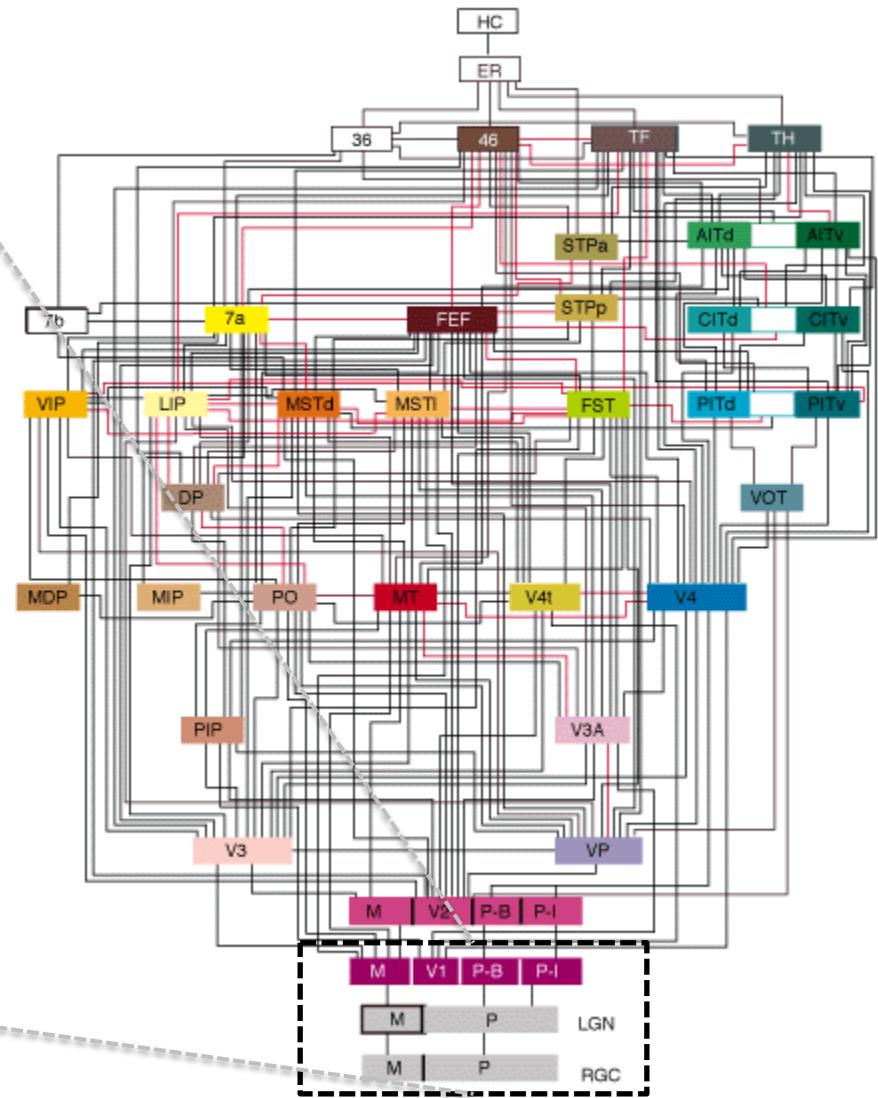
Hubel & Wiesel, 1962



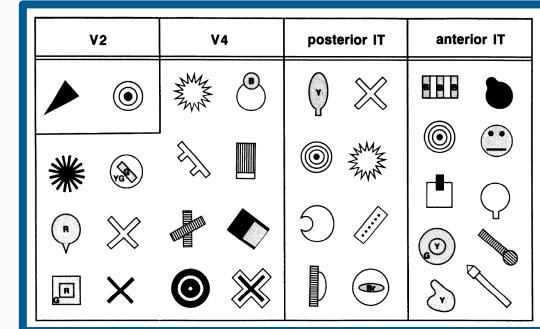
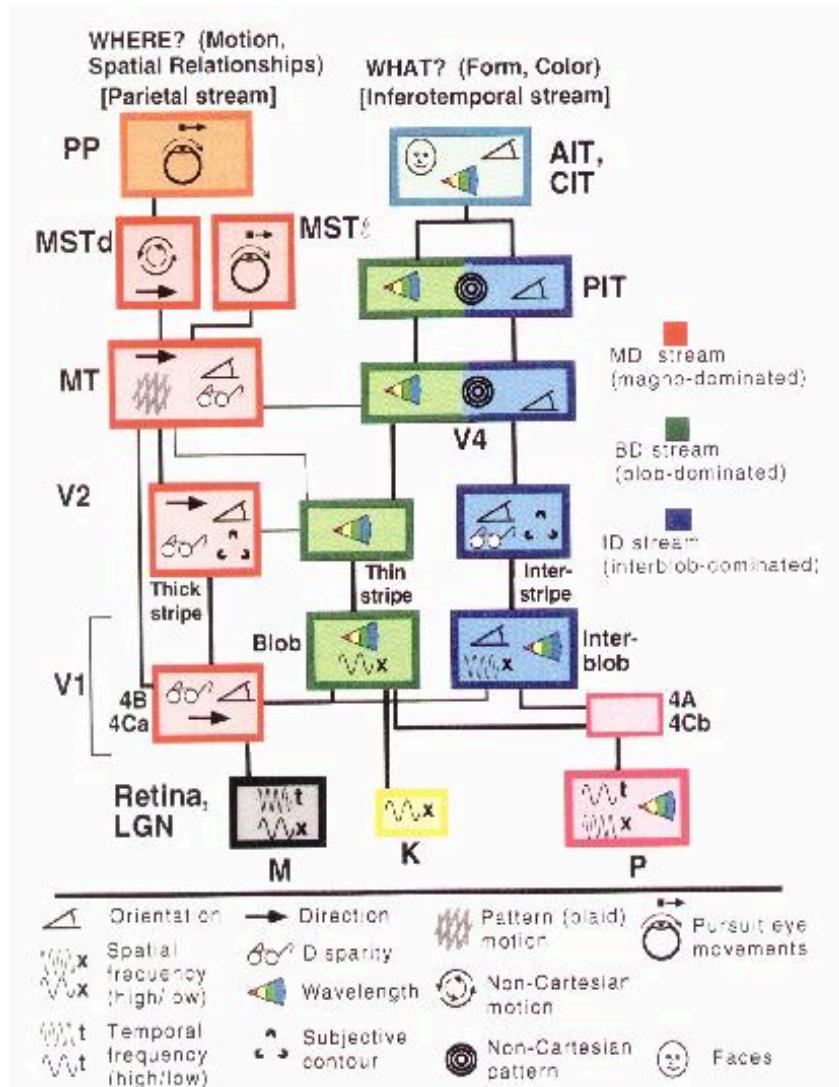
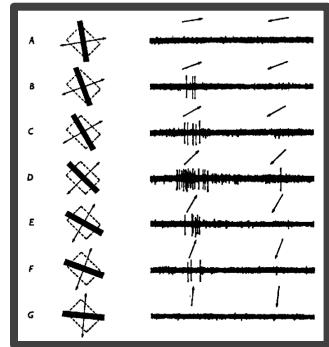
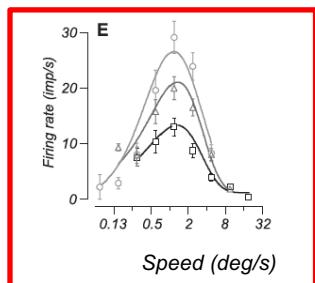
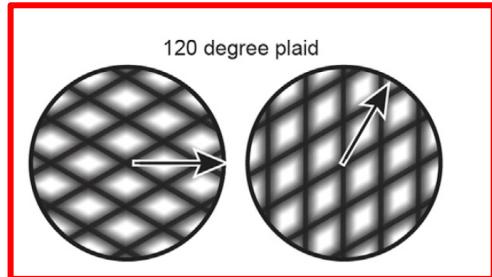
Visual Circuit



Ramon y Cajal, (1902)



Van Essen et al. (1992)



Van Essen & Gallant, 1994

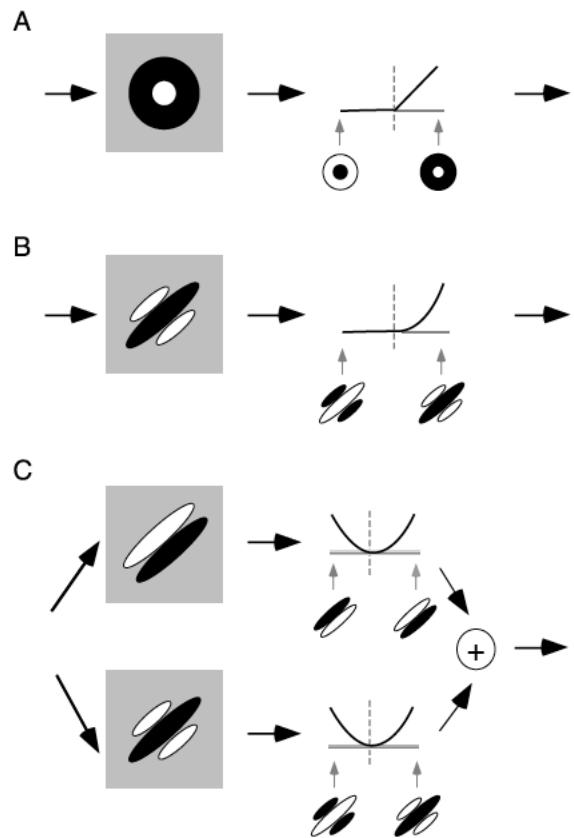


Questions

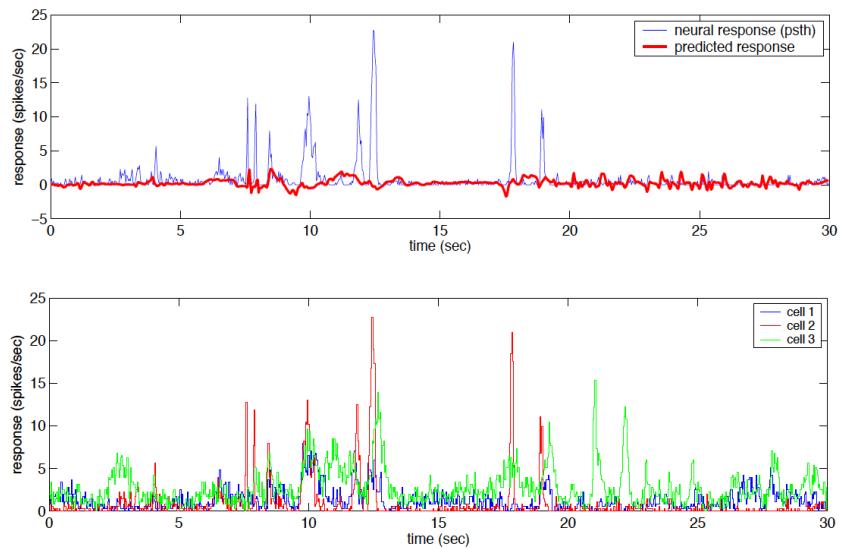
How is sensory information represented and transformed through the cortical circuit?

Are there functional streams in the mouse visual cortex?





Carandini *et al.* 2005



Olshausen & Field, 2004



Questions

How is sensory information represented and transformed through the cortical circuit?

Are there functional streams in the mouse visual cortex?

Can we model the responses of neurons to arbitrary stimuli?

Can we model the computations of the cortical circuit?



23 Problems in Systems Neuroscience

In: Problems in Systems Neuroscience. T.J. Sejnowski, L. van Hemmen, eds. Oxford University Press. (in press)

What is the other 85% of V1 doing?

At what point will we actually “understand” V1? This is obviously a difficult question to answer, but we believe at least three ingredients are required: 1) an unbiased sample of neurons of all types, firing rates, and layers of V1, 2) the ability to observe simultaneously the activities of hundreds of neurons in a local population, and 3) the ability to predict, or at least qualitatively model, the responses of the population under natural viewing conditions. Given the extensive feedback connections into V1, in addition to the projections from pulvinar and other sources, it seems unlikely that we will ever understand V1 in isolation. Thus, our investigations must also be guided by how V1 fits into the bigger picture of thalamo-cortical function.



some proposals for testing them.

THE ALLEN BRAIN OBSERVATORY



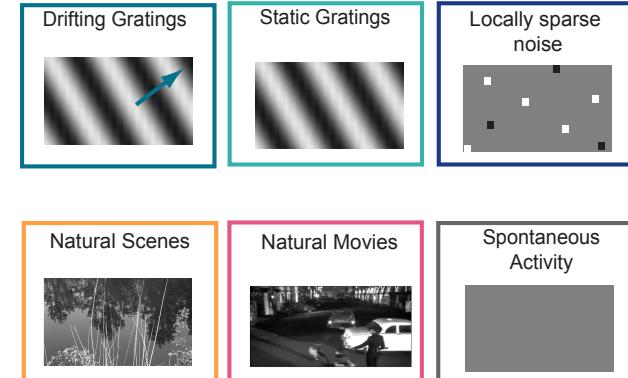
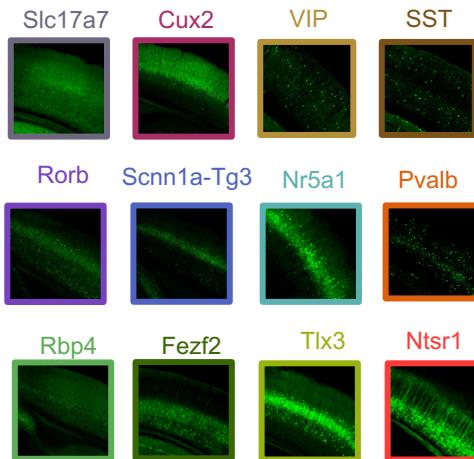
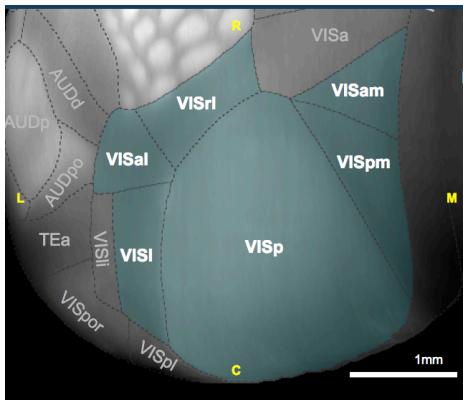
Allen Brain Observatory: Visual Coding

A physiological survey of visual representation in the mouse cortex

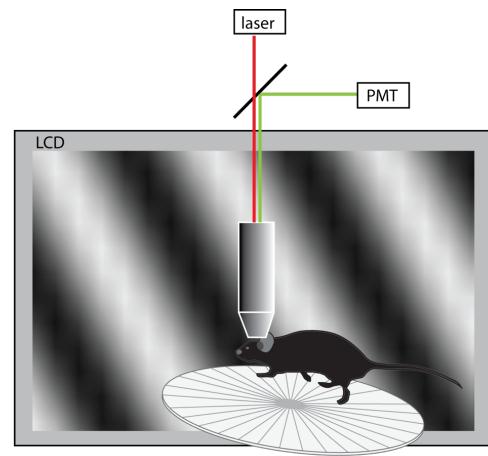
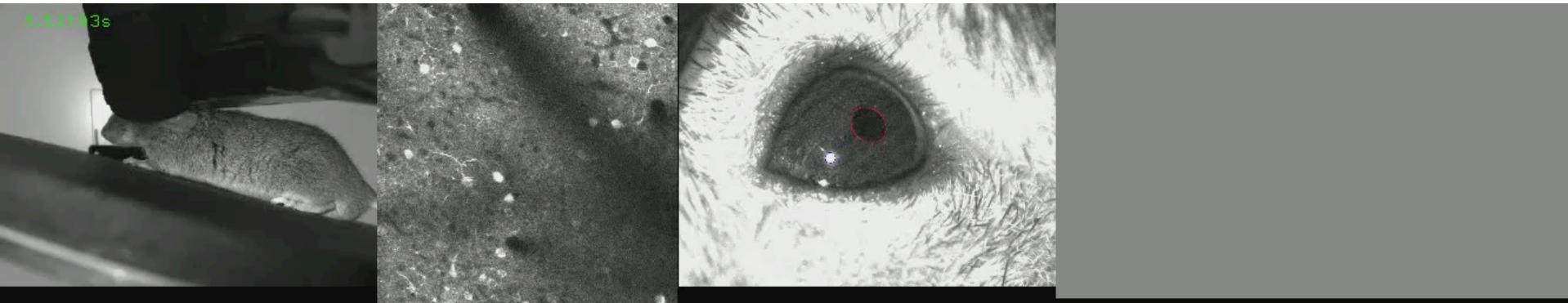
Are there functional streams in the mouse visual cortex?

Are there functional differences between transgenically defined Cre lines?

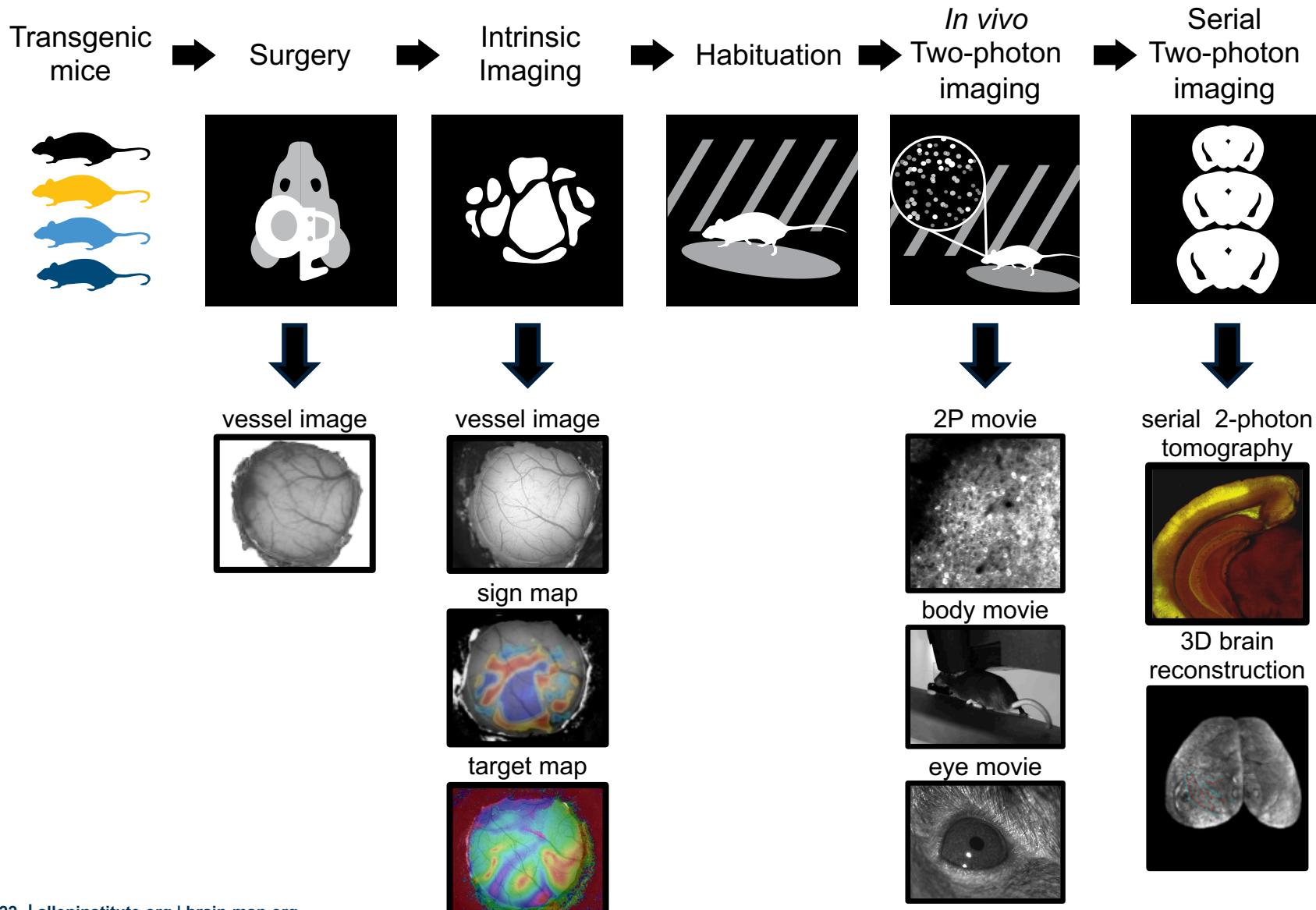
Can we build predictive models to capture the visually evoked activity?



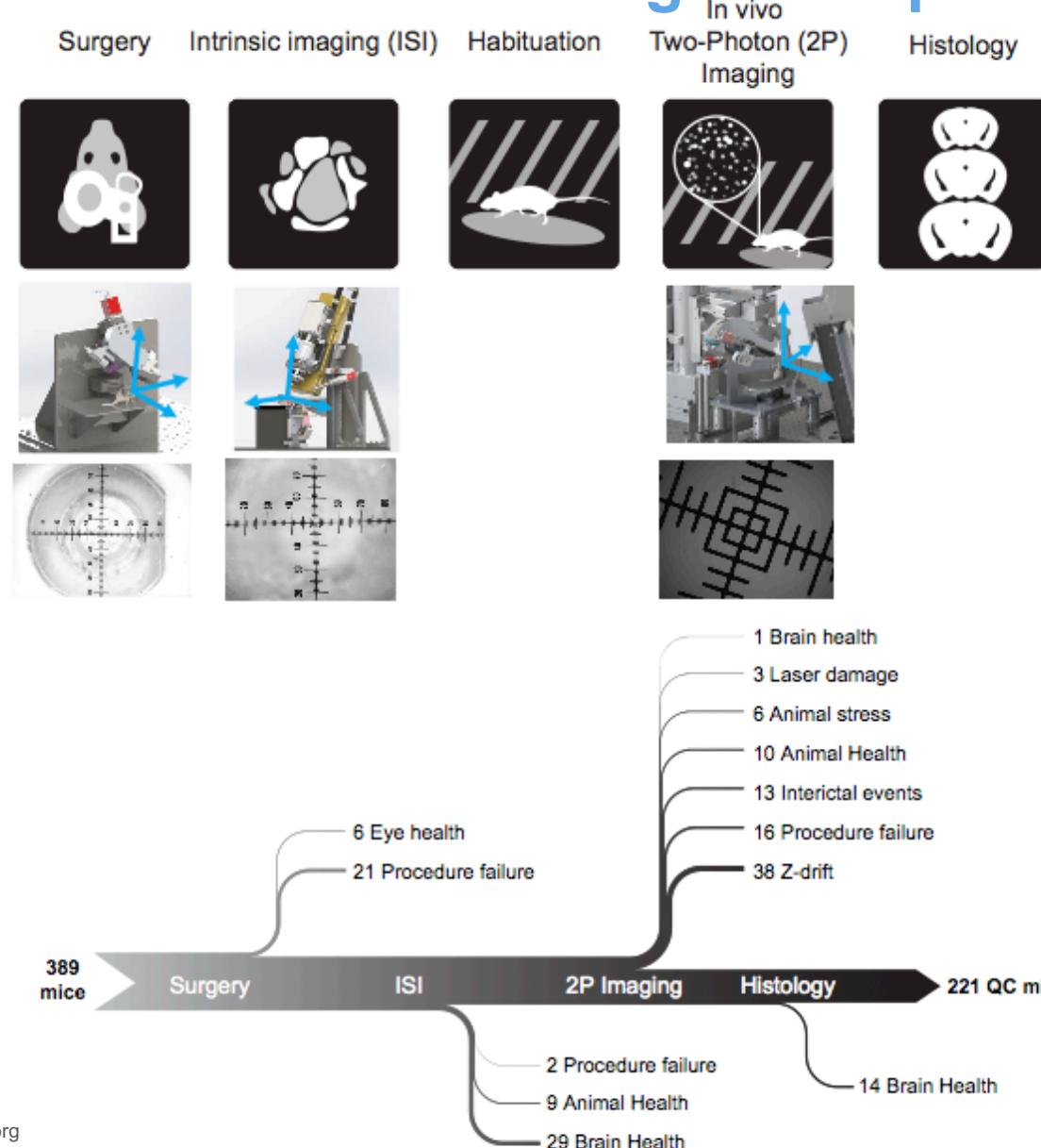
2-photon calcium imaging in an awake mouse



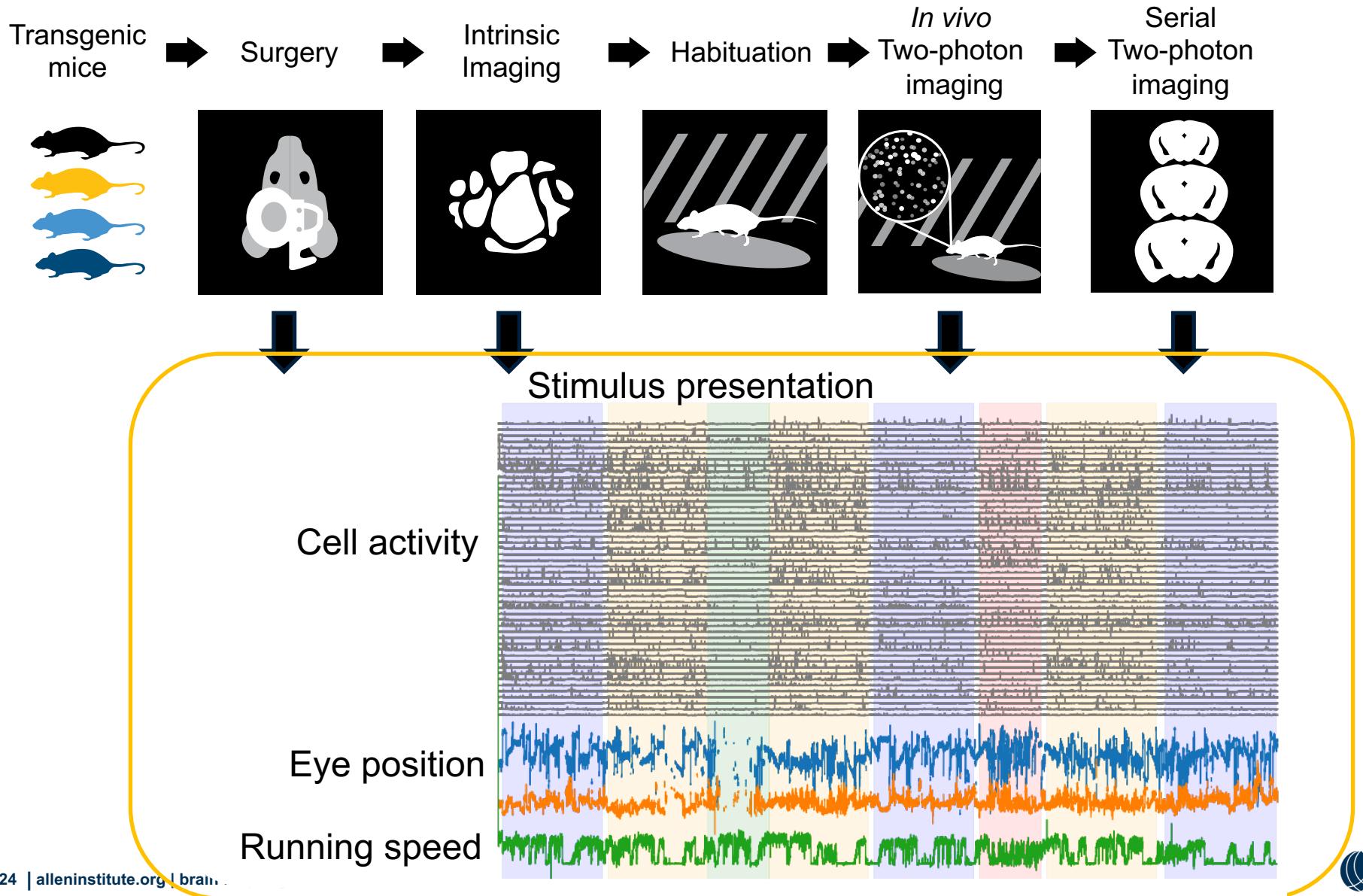
High-throughput pipeline data collection



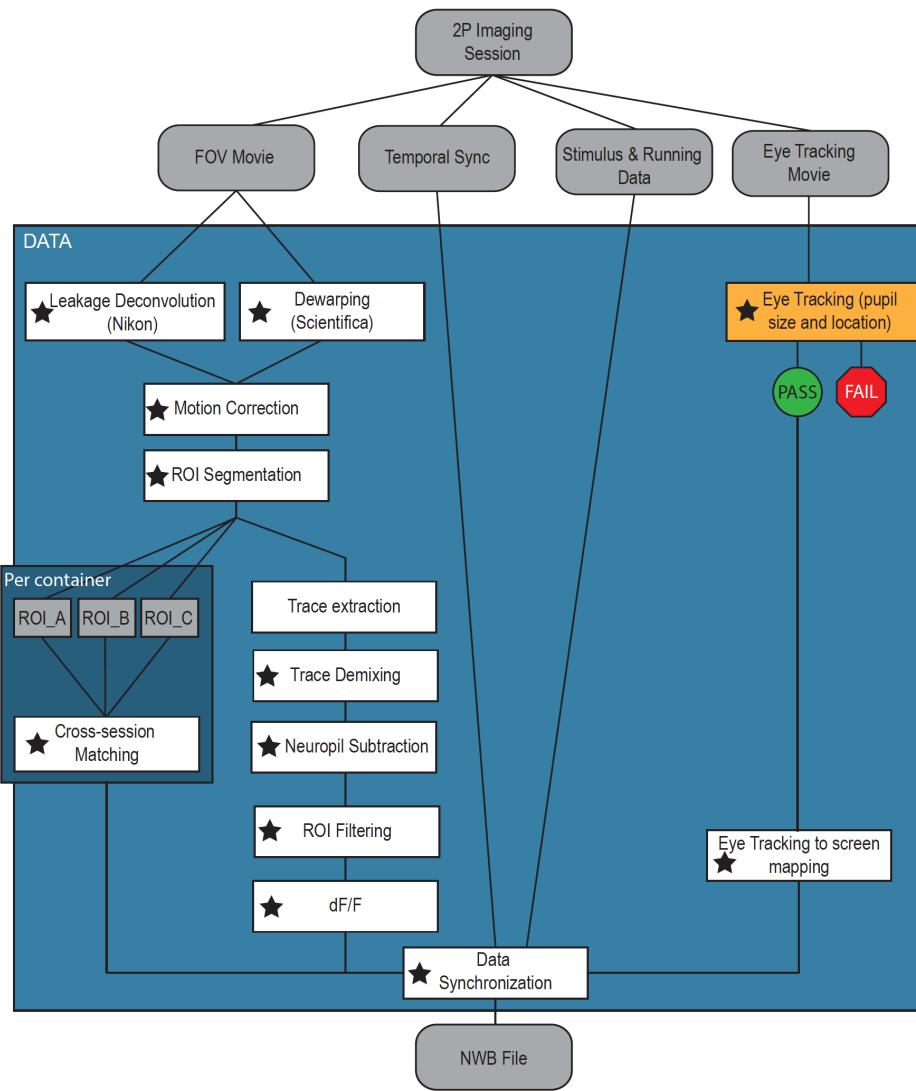
Standardized data collection depends on registered hardware and rigorous quality control



High-throughput pipeline data processing



Pipeline image processing



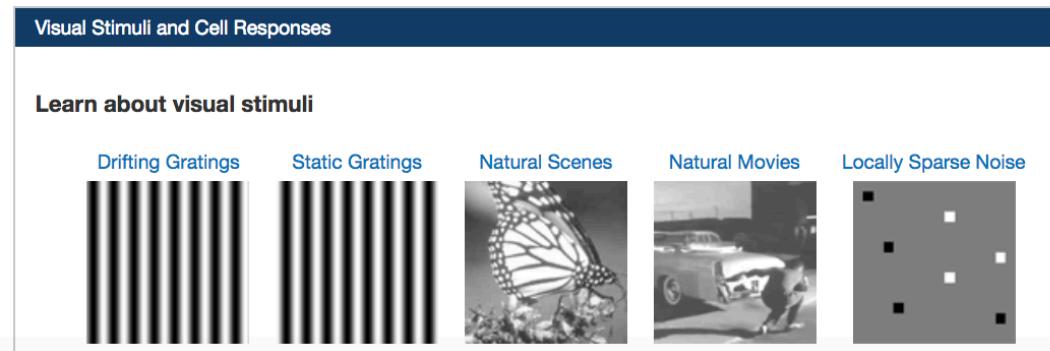
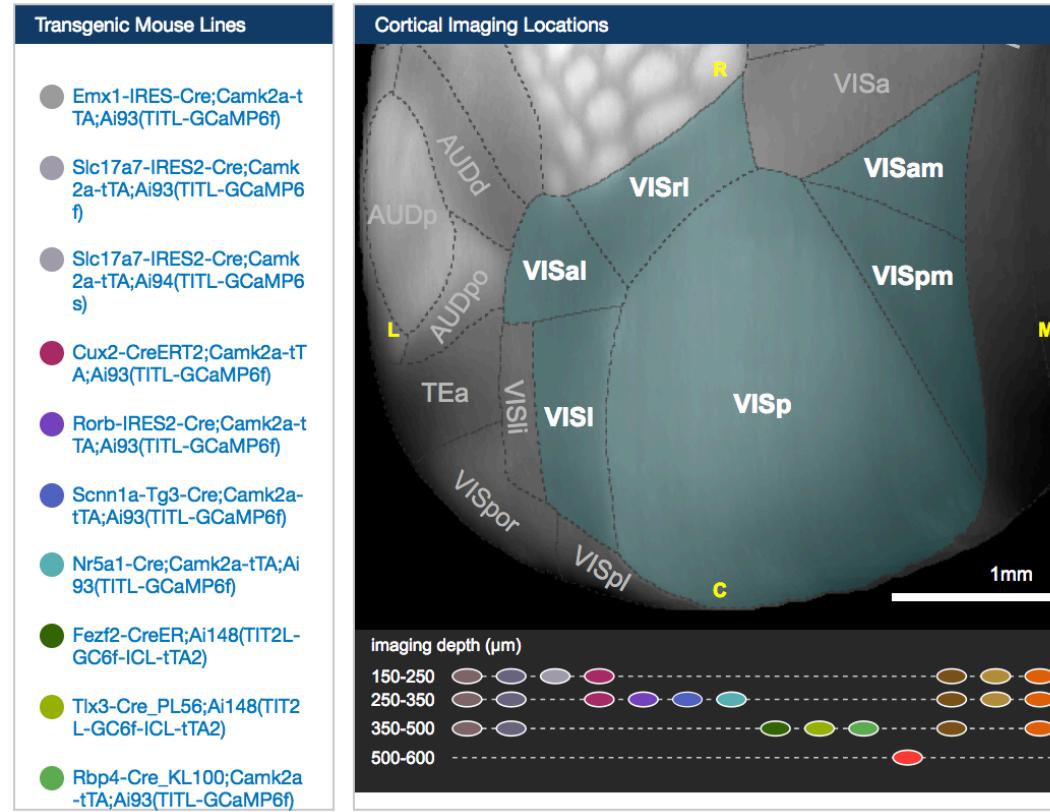
Data from each experiment is contained in an NWB file

Neurodata Without Borders (NWB) file contents

- Max projection image
- ROI masks
- Cell specimen IDs
- Raw fluorescence for each ROI
- Surrounding neuropil trace and r value
- Global $\Delta F/F$ trace for each ROI
- Stimulus table
- Stimulus template
- Mouse's running speed
- Pupil position and area
- Motion correction (x & y pixels)
- Meta data (cre line, visual area, imaging depth, experiment container, mouse ID, age, sex, etc)



Allen Brain Observatory Visual Coding



Allen Brain Observatory Visual Coding Dataset

Cre line	Layers	E/I	F/S	VISp	VISI	VISal	VISpm	VISam	VISrl	Total
Emx1-IRES-Cre; Camk2a-tTA; Ai93	2/3,4,5	E	F	3073 (10)	2098 (8)	1787 (7)	835 (4)	457 (3)	3011 (9)	11261 (41)
Slc17a7-IRES2-Cre; Camk2a-tTA; Ai93	2/3,4,5	E	F	4840 (17)	3230 (16)	374 (2)	1970 (15)	235 (2)	137 (2)	10786 (54)
Slc17a7-IRES2-Cre; Camk2a-tTA; Ai94	2/3,4,5	E	S	1419 (3)						1419 (3)
Cux2-CreERT2; Camk2-tTA; Ai93	2/3, 4	E	F	5081 (16)	2792 (11)	3103 (13)	2361 (13)	1616 (11)	1829 (12)	16782 (76)
Rorb-IRES2-Cre; Camk2a-tTA; Ai93	4	E	F	2218 (8)	1191 (6)	1242 (6)	764 (7)	735 (8)	1464 (5)	7614 (40)
Scnn1a-Tg3-Cre; Camk2a-tTA; Ai93	4	E	F	1873 (9)						1873 (9)
Nr5a1-Cre; Camk2a-tTA; Ai93	4	E	F	578 (8)	421 (6)	220 (6)	331 (7)	171 (6)	1658 (6)	3379 (39)
Rbp4-Cre_KL100; Camk2a-tTA; Ai93	5	E	F	458 (7)	485 (7)	441 (6)	509 (6)	355 (8)	102 (4)	2350 (38)
Fezf2-CreER;Ai148	5	E	F	407 (4)	981 (5)					1388 (9)
Tlx3-Cre_PL56;Ai148	5	E	F	1181 (6)	946 (3)					2127 (9)
Ntsr1-Cre_GN220;Ai148	6	E	F	573 (6)	719 (7)		581 (5)			1873 (18)
Sst-IRES-Cre;Ai148	4, 5	I	F	266 (17)	301 (15)	24 (1)	247 (14)		46 (2)	884 (49)
Vip-IRES-Cre;Ai148	2/3, 4	I	F	352 (17)	315 (17)		387 (16)			1054 (50)
Pvalb-IRES-Cre;Ai162	4,5	I	S	322 (16)	139 (5)					461 (21)
Total				22641 (144)	13618 (106)	7191 (41)	7985 (87)	3569 (38)	8247 (40)	63251 (456)



Allen Brain Observatory Visual Coding Dataset

Cre line	Layers	E/I	F/S	VISp	VISI	VISal	VISpm	VISam	VISrl	Total
Emx1-IRES-Cre; Camk2a-tTA; Ai93	2/3,4,5	E	F	3073 (10)	2098 (8)	1787 (7)	835 (4)	457 (3)	3011 (9)	11261 (41)
Slc17a7-IRES2-Cre; Camk2a-tTA; Ai93	2/3,4,5	E	F	4840 (17)	3230 (16)	374 (2)	1970 (15)	235 (2)	137 (2)	10786 (54)
Slc17a7-IRES2-Cre; Camk2a-tTA; Ai94	2/3,4,5	E	S	1419 (3)						1419 (3)
Cux2-CreERT2; Camk2-tTA; Ai93	2/3, 4	E	F	5081 (16)	2792 (11)	3103 (13)	2361 (13)	1616 (11)	1829 (12)	16782 (76)
Rorb-IRES2-Cre; Camk2a-tTA; Ai93	4	E	F	2218 (8)	1191 (6)	1242 (6)	764 (7)	735 (8)	1464 (5)	7614 (40)
Scnn1a-Tg3-Cre; Camk2a-tTA; Ai93	4	E	F	1873 (9)						1873 (9)
Nr5a1-Cre; Camk2a-tTA; Ai93	4	E	F	578 (8)	421 (6)	220 (6)	331 (7)	171 (6)	1658 (6)	3379 (39)
Rbp4-Cre_KL100; Camk2a-tTA; Ai93	5	E	F	458 (7)	485 (7)	441 (6)	509 (6)	355 (8)	102 (4)	2350 (38)
Fezf2-CreER;Ai148	5	E	F	407 (4)	981 (5)					1388 (9)
Tlx3-Cre_PL56;Ai148	5	E	F	1181 (6)	946 (3)					2127 (9)
Ntsr1-Cre_GN220;Ai148	6	E	F	573 (6)	719 (7)		581 (5)			1873 (18)
Sst-IRES-Cre;Ai148	4, 5	I	F	266 (17)	301 (15)	24 (1)	247 (14)		46 (2)	884 (49)
Vip-IRES-Cre;Ai148	2/3, 4	I	F	352 (17)	315 (17)		387 (16)			1054 (50)
Pvalb-IRES-Cre;Ai162	4,5	I	S	322 (16)	139 (5)					461 (21)
Total				22641 (144)	13618 (106)	7191 (41)	7985 (87)	3569 (38)	8247 (40)	63251 (456)

6 Cortical brain areas



Allen Brain Observatory Visual Coding Dataset

Cre line	Layers	E/I	F/S	VISp	VISI	VISal	VISpm	VISam	VISrl	Total
Emx1-IRES-Cre; Camk2a-tTA; Ai93	2/3,4,5	E	F	3073 (10)	2098 (8)	1787 (7)	835 (4)	457 (3)	3011 (9)	11261 (41)
Slc17a7-IRES2-Cre; Camk2a-tTA; Ai93	2/3,4,5	E	F	4840 (17)	3230 (16)	374 (2)	1970 (15)	235 (2)	137 (2)	10786 (54)
Slc17a7-IRES2-Cre; Camk2a-tTA; Ai94	2/3,4,5	E	S	1419 (3)						1419 (3)
Cux2-CreERT2; Camk2-tTA; Ai93	2/3, 4	E	F	5081 (16)	2792 (11)	3103 (13)	2361 (13)	1616 (11)	1829 (12)	16782 (76)
Rorb-IRES2-Cre; Camk2a-tTA; Ai93	4	E	F	2218 (8)	1191 (6)	1242 (6)	764 (7)	735 (8)	1464 (5)	7614 (40)
Scnn1a-Tg3-Cre; Camk2a-tTA; Ai93	4	E	F	1873 (9)						1873 (9)
Nr5a1-Cre; Camk2a-tTA; Ai93	4	E	F	578 (8)	421 (6)	220 (6)	331 (7)	171 (6)	1658 (6)	3379 (39)
Rbp4-Cre_KL100; Camk2a-tTA; Ai93	5	E	F	458 (7)	485 (7)	441 (6)	509 (6)	355 (8)	102 (4)	2350 (38)
Fezf2-CreER;Ai148	5	E	F	407 (4)	981 (5)					1388 (9)
Tlx3-Cre_PL56;Ai148	5	E	F	1181 (6)	946 (3)					2127 (9)
Ntsr1-Cre_GN220;Ai148	6	E	F	573 (7)	520 (7)	520 (7)	520 (7)			1873 (18)
Sst-IRES-Cre;Ai148	4, 5	I	F	266 (17)	301 (15)	24 (1)	247 (14)		46 (2)	884 (49)
Vip-IRES-Cre;Ai148	2/3, 4	I	F	352 (17)	315 (17)		387 (16)			1054 (50)
Pvalb-IRES-Cre;Ai162	4,5	I	S	322 (16)	139 (5)					461 (21)
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6 Cortical brain areas

Excitatory and Inhibitory Neurons



Allen Brain Observatory Visual Coding Dataset

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Emx1-IRES-Cre; Camk2a-tTA; Ai93	2/3,4,5	E	F	3073 (10)	2098 (8)	1787 (7)	835 (4)	457 (3)	3011 (9)	11261 (41)
Slc17a7-IRES2-Cre; Camk2a-tTA; Ai93	2/3,4,5	E	F	4840 (17)	3230 (16)	374 (2)	1970 (15)	235 (2)	137 (2)	10786 (54)
Slc17a7-IRES2-Cre; Camk2a-tTA; Ai94	2/3,4,5	E	S	1419 (3)						1419 (3)
Cux2-CreERT2; Camk2-tTA; Ai93	2/3, 4	E	F	5081 (16)	2792 (11)	3103 (13)	2361 (13)	1616 (11)	1829 (12)	16782 (76)
Rorb-IRES2-Cre; Camk2a-tTA; Ai93	4	E	F	2218 (8)	1191 (6)	1242 (6)	764 (7)	735 (8)	1464 (5)	7614 (40)
Scnn1a-Tg3-Cre; Camk2a-tTA; Ai93	4	E	F	187 (29)	4 Cortical layers: layers 2/3 through 6					1873 (9)
Nr5a1-Cre; Camk2a-tTA; Ai93	4	E	F	578 (8)	421 (6)	220 (6)	331 (7)	171 (6)	1658 (6)	3379 (39)
Rbp4-Cre_KL100; Camk2a-tTA; Ai93	5	E	F	458 (7)	485 (7)	441 (6)	509 (6)	355 (8)	102 (4)	2350 (38)
Fezf2-CreER;Ai148	5	E	F	407 (4)	981 (5)					1388 (9)
Tlx3-Cre_PL56;Ai148	5	E	F	1181 (6)	946 (3)					2127 (9)
Ntsr1-Cre_GN220;Ai148	6	E	F	573 (7)	520 (7)	520 (7)	520 (7)			1873 (18)
Sst-IRES-Cre;Ai148	4, 5	I	F	266 (17)	301 (15)	24 (1)	247 (14)		46 (2)	884 (49)
Vip-IRES-Cre;Ai148	2/3, 4	I	F	352 (17)	315 (17)		387 (16)			1054 (50)
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Cux2-CreERT2; Camk2-tTA; Ai93	2/3, 4	E	F	5081 (16)	2792 (11)	3103 (13)	2361 (13)	1616 (11)	1829 (12)	16782 (76)
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Nr5a1-Cre; Camk2a-tTA; Ai93	4	E	F	578 (8)	421 (6)	220 (6)	331 (7)	171 (6)	1658 (6)	3379 (39)
Rbp4-Cre_KL100; Camk2a-tTA; Ai93	5	E	F	458 (7)	485 (7)	441 (6)	509 (8)	355 (8)	102 (4)	2350 (38)
Fezf2-CreER;Ai148	5	E	F	407 (4)	981					1388 (9)
Tlx3-Cre_PL56;Ai148	5	E	F	1181 (6)	946 (3)					2127 (9)
Ntsr1-Cre_GN220;Ai148	6	E	F	573	720 (7)	720 (7)	720 (7)			1873 (18)
Sst-IRES-Cre;Ai148	4, 5	I	F	266 (17)	301 (15)	24 (1)	247 (14)		46 (2)	884 (49)
Vip-IRES-Cre;Ai148	2/3, 4	I	F	352 (17)	315 (17)		387 (16)			1054 (50)
Pvalb-IRES-Cre;Ai162	4,5	I	S	322 (16)	139 (5)					461 (21)
Total				22641 (144)	13618 (106)	7191 (41)	7985 (87)	3569 (38)	8247 (40)	63251 (456)



Allen Brain Observatory Visual Coding Dataset

Cre line	Layers	E/I	F/S	VISp	VISI	VISal	VISpm	VISam	VISrl	Total
Emx1-IRES-Cre; Camk2a-tTA; Ai93	2/3,4,5	E	F	3073 (10)	2098 (8)	1787 (7)	835 (4)	457 (3)	3011 (9)	11261 (41)
Slc17a7-IRES2-Cre; Camk2a-tTA; Ai93	2/3,4,5	E	F	4840 (17)	3230 (16)	374 (2)	1970 (15)	235 (2)	137 (2)	10786 (54)
Slc17a7-IRES2-Cre; Camk2a-tTA; Ai94	2/3,4,5	E	S	1419 (3)						1419 (3)
Cux2-CreERT2; Camk2-tTA; Ai93	2/3, 4	E	F	5081 (16)	2792 (11)	3103 (13)	2361 (13)	1616 (11)	1829 (12)	16782 (76)
Rorb-IRES2-Cre; Camk2a-tTA; Ai93	4	E	F	2218 (8)	1191 (6)	1242 (6)	764 (7)	735 (8)	1464 (5)	7614 (40)
Scnn1a-Tg3-Cre; Camk2a-tTA; Ai93	4	E	F	187	4 Cortical layers: layers 2/3 through 6					1873 (9)
Nr5a1-Cre; Camk2a-tTA; Ai93	4	E	F	578 (8)	421 (6)	220 (6)	331 (7)	171 (6)	1658 (6)	3379 (39)
Rbp4-Cre_KL100; Camk2a-tTA; Ai93	5	E	F	458 (7)	485 (7)	441 (6)	509 (8)	355 (8)	102 (4)	2350 (38)
Fezf2-CreER;Ai148	5	E	F	407 (4)	981					1388 (9)
Tlx3-Cre_PL56;Ai148	5	E	F	1181 (6)	946 (3)					2127 (9)
Ntsr1-Cre_GN220;Ai148	6	E	F	573	720 (7)	52	52 (6)			1873 (18)
Sst-IRES-Cre;Ai148	4, 5	I	F	266 (17)	301 (15)	24 (1)	247 (14)		46 (2)	884 (49)
Vip-IRES-Cre;Ai148	2/3, 4	I	F	352 (17)	315 (17)	87 (16)	87 (16)			1054 (50)
Pvalb-IRES-Cre;Ai162	4,5	I	S	322 (16)	139 (5)					461 (21)
Total				22641 (144)	13618 (106)	7191 (41)	7985 (87)	3569 (38)	8247 (40)	63251 (456)



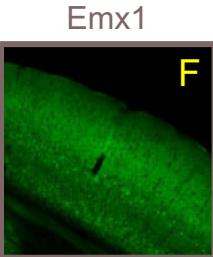
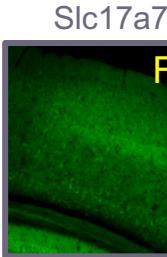
Allen Brain Observatory Visual Coding Dataset

Cre line	Layers	E/I	F/S	VISp	VISI	VISal	VISpm	VISam	VISrl	Total
Emx1-IRES-Cre; Camk2a-tTA; Ai93	2/3,4,5	E	F	3073 (10)	2098 (8)	1787 (7)	835 (4)	457 (3)	3011 (9)	11261 (41)
Slc17a7-IRES2-Cre; Camk2a-tTA; Ai93	2/3,4,5	E	F	4840 (17)	3230 (16)	374 (2)	1970 (15)	235 (2)	137 (2)	10786 (54)
Slc17a7-IRES2-Cre; Camk2a-tTA; Ai94	2/3,4,5	E	S	1419 (3)						1419 (3)
Cux2-CreERT2; Camk2-tTA; Ai93	2/3, 4	E	F	5081 (16)	2792 (11)	3103 (13)	2361 (13)	1616 (11)	1829 (12)	16782 (76)
Rorb-IRES2-Cre; Camk2a-tTA; Ai93	4	E	F	2218 (8)	1191 (6)	1242 (6)	764 (7)	735 (8)	1464 (5)	7614 (40)
Scnn1a-Tg3-Cre; Camk2a-tTA; Ai93	4	E	F	187	4 Cortical layers: layers 2/3 through 6					1873 (9)
Nr5a1-Cre; Camk2a-tTA; Ai93	4	E	F	578 (8)	421 (6)	220 (6)	331 (7)	171 (6)	1658 (6)	3379 (39)
Rbp4-Cre_KL100; Camk2a-tTA; Ai93	5	E	F	458 (7)	485 (7)	441 (6)	509 (8)	355 (8)	102 (4)	2350 (38)
Fezf2-CreER;Ai148	5	E	F	407 (4)	981					1388 (9)
Tlx3-Cre_PL56;Ai148	5	E	F	1181 (6)	946 (3)					2127 (9)
Ntsr1-Cre_GN220;Ai148	6	E	F	573	720 (7)	52	52			1873 (18)
Sst-IRES-Cre;Ai148	4, 5	I	F	266 (17)	301 (15)	24 (1)	247 (14)		46 (2)	884 (49)
Vip-IRES-Cre;Ai148	2/3, 4	I	F	352	315 (17)	297 (16)				1054 (50)
Pvalb-IRES-Cre;Ai162	4,5	I	S	322 (16)	139 (5)					461 (21)
Total				22641 (144)	13618 (106)	7191 (41)	7985 (87)	3569 (38)	8247 (40)	63251 (456)



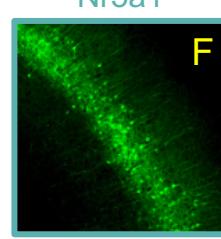
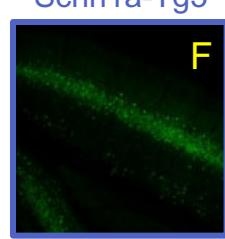
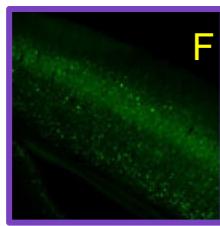
Excitatory Cells

Pan excitatory

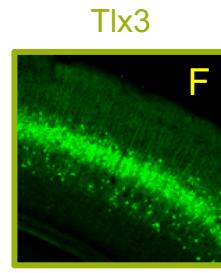
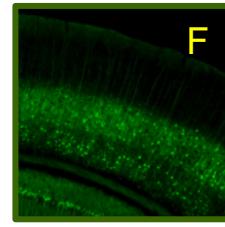
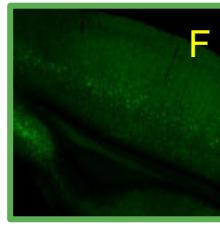


Layers 2/3 & 4

Layer 4



Layer 5

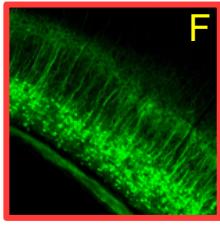


Ntsr1

Cortico-thalamic

Cortico-cortico

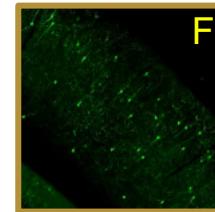
Layer 6



Cortico-thalamic
alleninstitute.org | brain-map.org

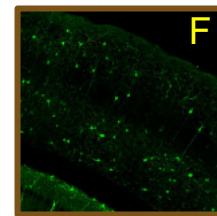
Inhibitory Cells

VIP



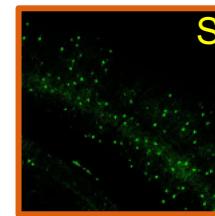
Layers 2/3 & 4

SST



Layers 4 & 5

Pvalb

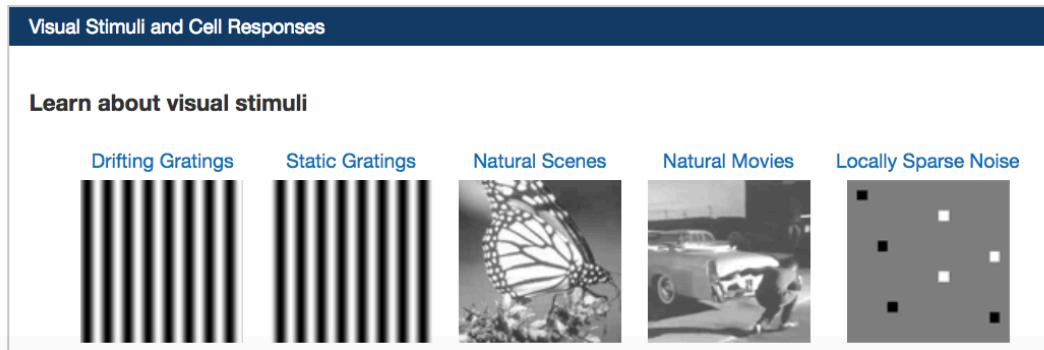
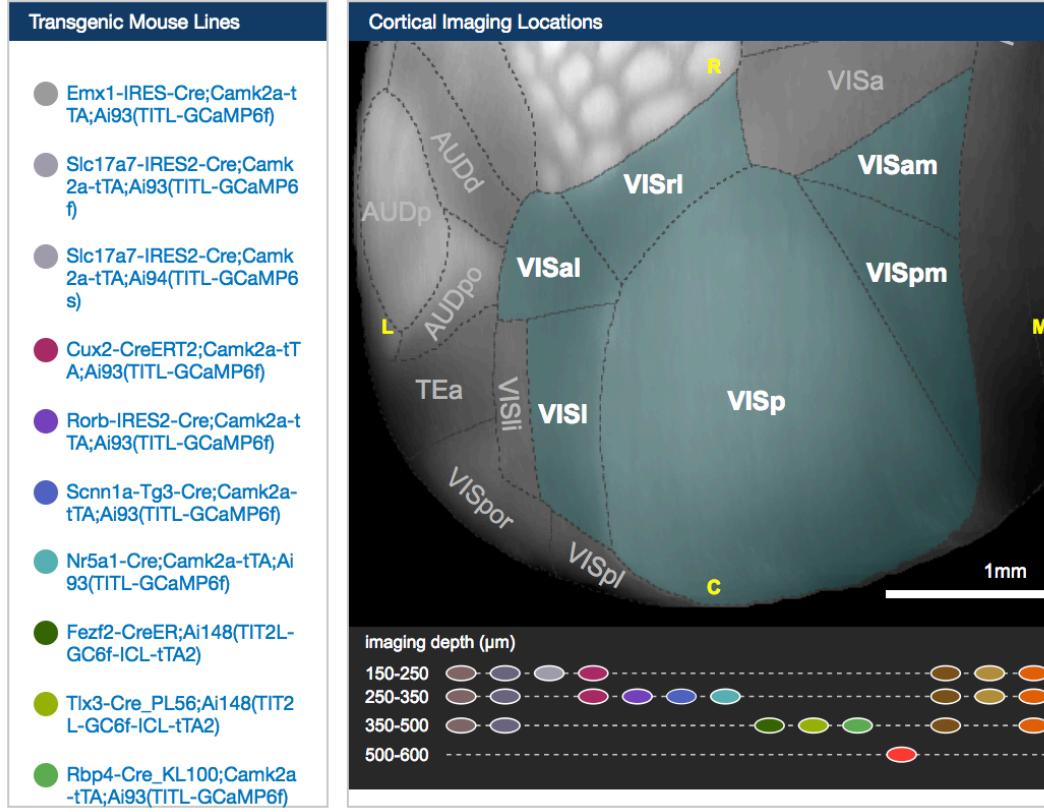


Layers 4 & 5

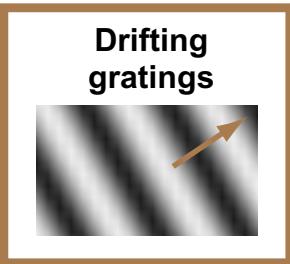
<http://observatory.brain-map.org/visualcoding/transgenic>
Documentation: Transgenic Line Catalog



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

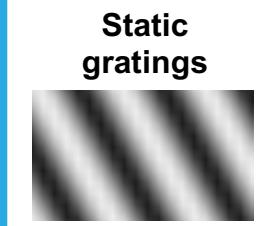


Visual Stimuli



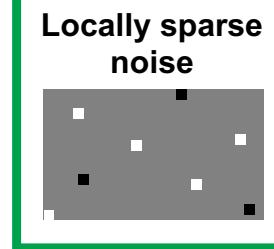
Drifting
gratings

8 directions
5 temporal frequencies
Spatial frequency = 0.04 cpd
Contrast = 80%
2 sec grating, 1 sec gray
15 trials



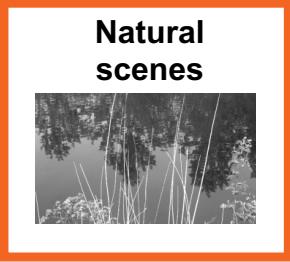
Static
gratings

6 orientations
5 spatial frequencies
Contrast = 80%
0.25 sec presentation
50 trials



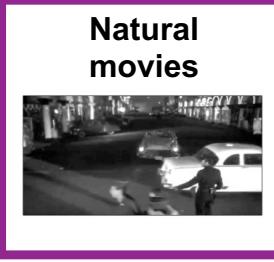
Locally sparse
noise

16 x 28 array of 4° & 8° squares
20° exclusion zone
0.25 sec presentation
~115 trials



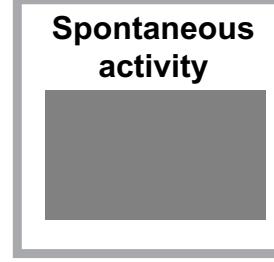
Natural
scenes

118 images
0.25 sec presentation
50 trials



Natural
movies

Two 30s clips
One 120s clip
10 trials

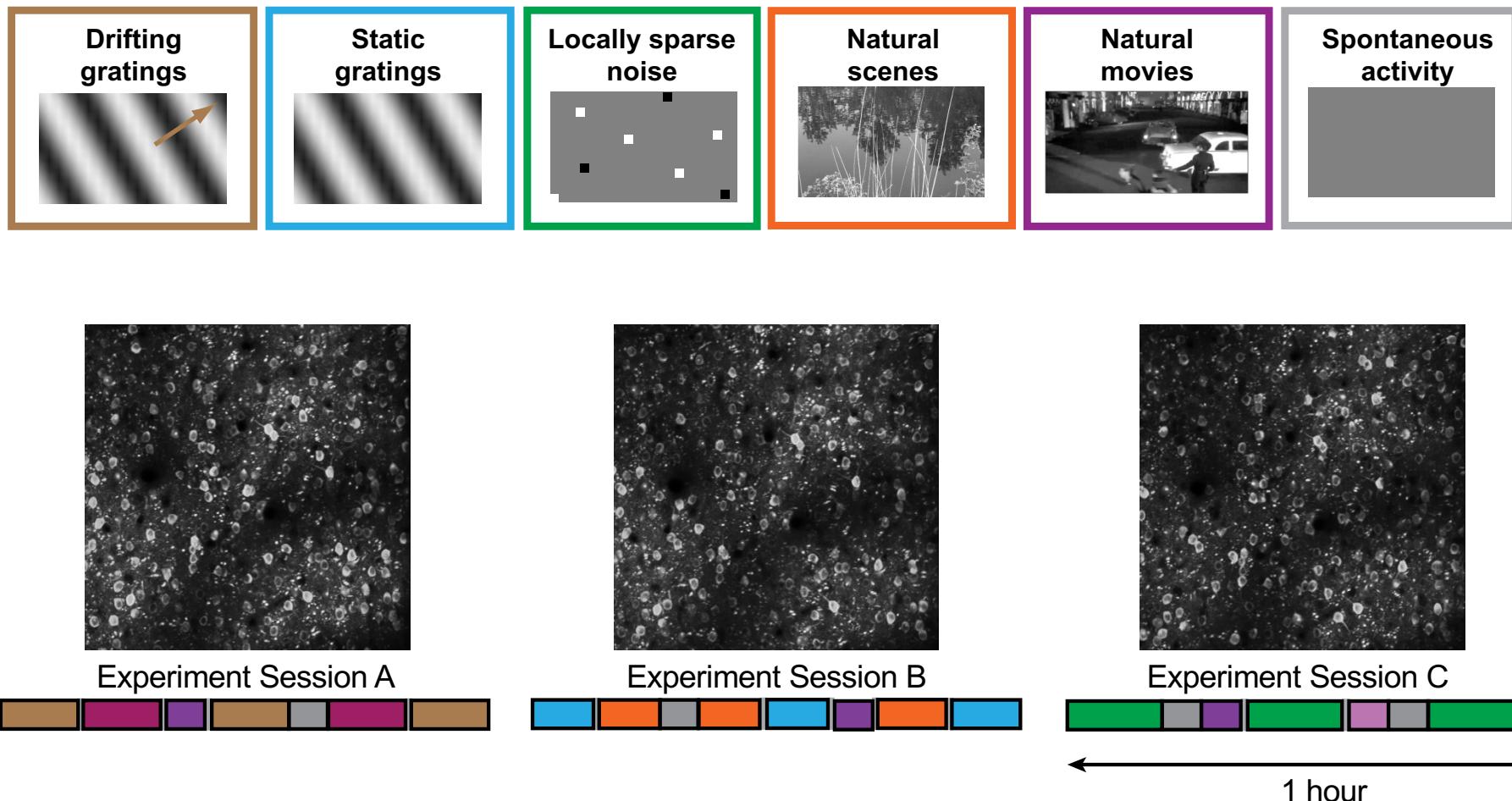


Spontaneous
activity

50 cd/m²
5 minutes



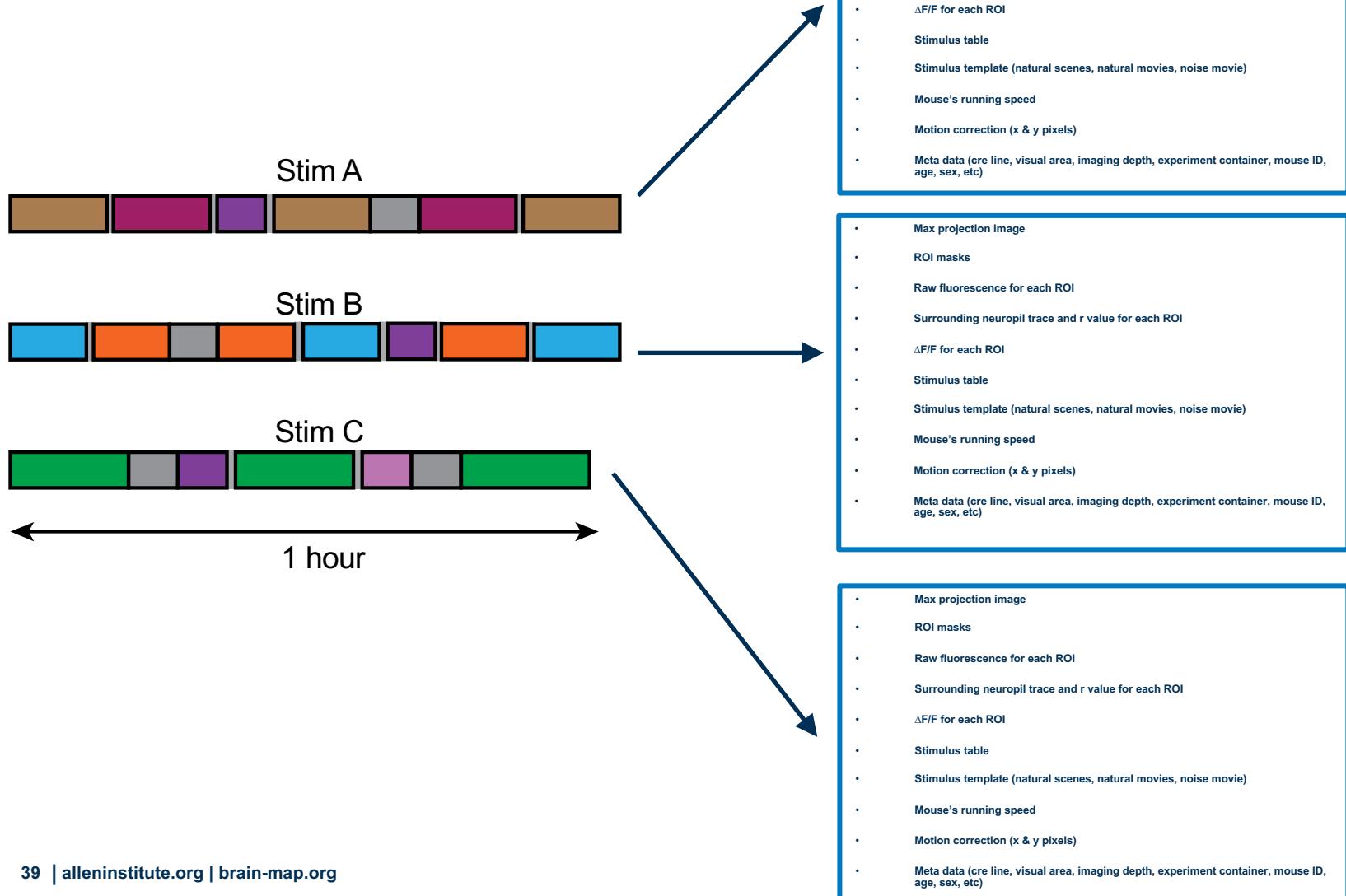
Stimuli are shown over 3 experimental sessions



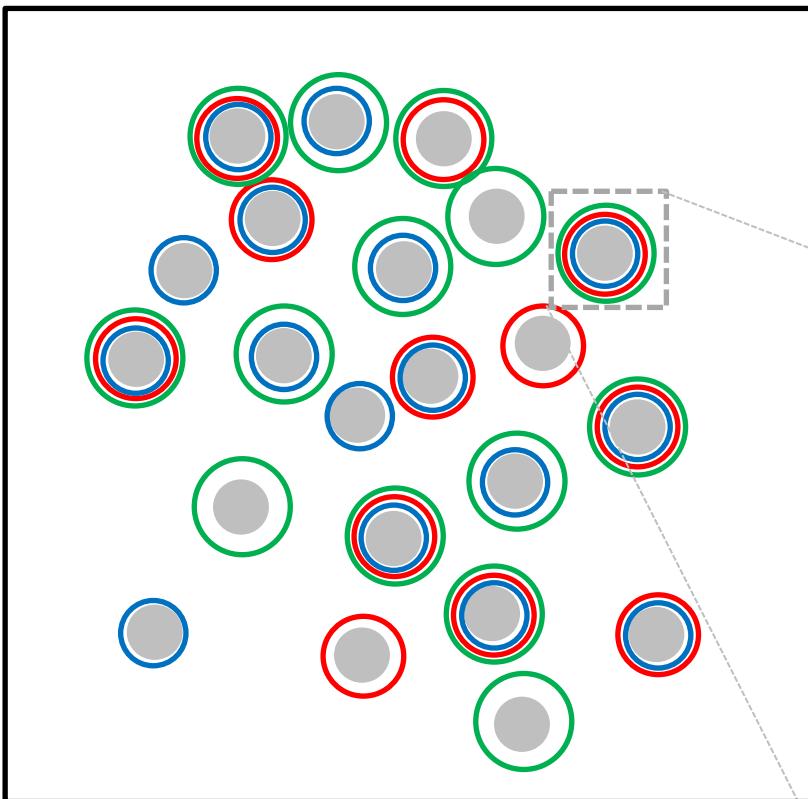
The three **experiment sessions** for each imaging location
make up a single **experiment container**



Each session has a NWB file. Each container has three NWB files



Cells can be present in one, two, or all three experiment sessions

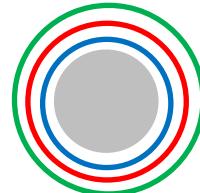


Experiment Container

Experiment Session A

Experiment Session B

Experiment Session C



Cell specimen id

Cell index

Cell index

Cell index

If a cell is not active in a given session, it cannot be detected for cell segmentation



More Information

The screenshot shows the Allen Brain Observatory website. At the top, there's a header with a back button, forward button, refresh button, and a search bar containing the URL 'observatory.brain-map.org/visualcoding/'. Below the header is a dark blue navigation bar with the text 'ALLEN INSTITUTE' and 'BRAIN ATLAS'. The main content area has a title 'ALLEN BRAIN ATLAS' and a 'DATA PORTAL' section. A navigation menu includes 'HOME', 'GET STARTED', 'BRAIN OBSERVATORY' (which is highlighted in a grey box), 'TOOLS', 'OVERVIEW', 'EXPERIMENTS', 'CELLS', 'SDK' (circled in red), 'TRANSGENIC CHARACTERIZATION', 'DOCUMENTATION' (circled in red), and 'HELP'. To the right of the menu is a search bar with a magnifying glass icon. The main content area features three panels: 'Transgenic Mouse Lines' (listing 'Cux2-CreERT2;Camk2a-tTA;Ai93(TITL-GCaMP6f)' and 'Rorb-IRES2-Cre;Camk2a-tTA;Ai93(TITL-GCaMP6f)'), 'Cortical Imaging Locations' (a brain map showing regions like AUDd, VISrl, VISA, and VISam), and 'Allen Brain Observatory' (with a sub-section 'About the Allen Brain Observatory' and a brief description). A red circle highlights the 'SDK' and 'DOCUMENTATION' links in the navigation menu.

Allen SDK Installation

<http://alleninstitute.github.io/AllenSDK/install.html>

Allen SDK information and tutorials:

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

Observatory documentation:

<http://help.brain-map.org/display/observatory/Documentation>

Questions and discussion:

<http://community.brain-map.org>



ALLEN BRAIN ATLAS DATA PORTAL

Search Online Help...

ALLEN BRAIN OBSERVATORY

Document	Description
Visual Coding Overview	Experimental design and methods used to perform a survey of physiological activity
Stimulus Set and Response Analysis	Detailed descriptions of sensory stimuli and data analysis methods
Transgenic Line Catalog	Summary of transgenic mouse lines used in this study
Transgenic Mouse Genotyping	Genotyping of the mice used in each experiment in this study
Acknowledgement of Collaborators	Recognition of collaborators and others who provided assistance

ⓘ Not Secure | help.brain-map.org/display/observatory/Documentation

[VisualCoding_Overview.pdf](#) + v.3 [Current]
 AllenInstitute/visual_coding_2p_targeted:
 analysis code for the targeted 2p experiments

ALLEN INSTITUTE for BRAIN SCIENCE

Allen Brain Observatory

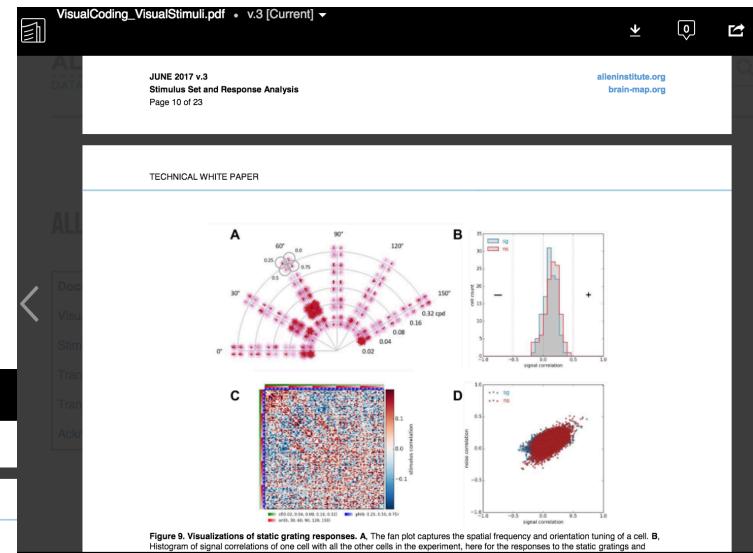
TECHNICAL WHITE PAPER: OVERVIEW

The Allen Brain Observatory presents a comprehensive physiological survey of the mouse cortex during sensory stimulation and behavior. This project systematically maps neurons across cortical areas and layers by utilizing transgenic Cre lines to drive fluorescent calcium sensors (GCaMP6f). This dataset provides a resource of sensory stimuli through the cortical visual pathway at both the single cell and population levels.

Cre driver x GCaMP6 reporter → Surgery → Intrinsic Imaging (1) → Habituation → *In vivo* Two-photon imaging

Show all files

Documentation



community.brain-map.org

Latest FAQ topics - Allen Brain X Saskia

Secure | https://community.brain-map.org/c/faq

BRAIN OBSERVATORY
COMMUNITY

FAQ ▶ Latest New Unread Top

Edit + New Topic

Topic	Users	Replies	Views	Activity
Are there any publications using the Brain Observatory?		0	43	11h
Is there an extracellular recording database available for the Brain Observatory?		0	38	23d
How do I access 2-photon calcium movies?		1	70	23d
How can I generate visual stimuli like those used in the Brain Observatory?		0	37	23d
How can I access the natural images used in the Brain Observatory?		0	32	23d
Do you have any combined data with functional recordings and cell type information?		0	33	23d
When is the next data release?		0	45	Jun 4
⌚ How can I get eye tracking and body movies?		1	24	May 21



Timeline

2P data collection launched

2P data collection completed

Neuropixel data collection

2016	2017	2018	2019	2020
------	------	------	------	------

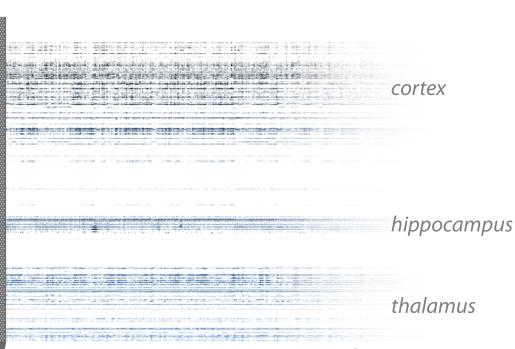
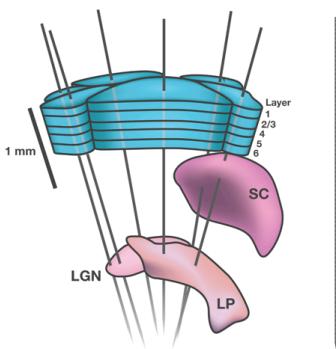
July:
First data release

June:
Data release

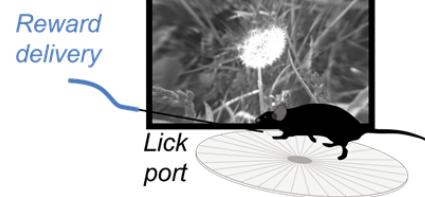
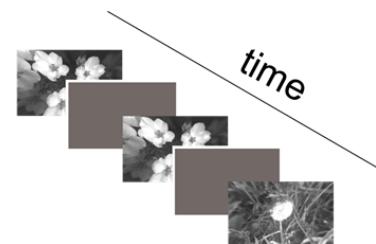
October:
Data release

October:
Neuropixels Data release

Visual Behavior Data release



Josh Siegle
Xiaoxuan Jia
Shawn Olsen



Marina Garrett
Peter Groblewski



TUTORIAL

Accessing data using the AllenSDK



<http://dev.dynbrain.org/>

token = CSHL19

Please shut down AWS when you are done working.
This token will remain valid for one week.



Ways of using Allen Brain Observatory

- **Analyze it.**
 - Standard analyses across entire dataset
 - Specific aspects of the data (eg. running)
- **Bench mark analysis methods**
 - Processing (segmentation, neuropil subtraction, demixng, etc)
 - Analysis (eg. “responsive”)
- **Identify new questions -> drive new experiments**
 - Find rare types of neurons/responses
 - Subtle differences in responses
- **Use to compare with complementary datasets**



External Publications using Allen Brain Observatory

- **Network reconstruction from high dimensional ordinary differential equations.** Chen et al. <https://arxiv.org/abs/1610.03177>
- **Tracking the same neurons across multiple days in Ca²⁺ imaging data.** Sheintuch et al. <https://www.sciencedirect.com/science/article/pii/S2211124717314304>
- **SCALPEL: Extracting neurons from calcium imaging data.** Petersen et al. <https://arxiv.org/abs/1703.06946>
- **Untuned but not irrelevant: the role of untuned neurons in sensory information coding.** Zylberberg. <https://www.biorxiv.org/content/early/2017/09/21/134379>
- **Running reduces firing but improves coding in rodent higher-order visual cortex.** Christensen & Pillow. <https://www.biorxiv.org/content/early/2017/11/04/214007>
- **Identification and targeting of cortical ensembles.** Carrillo-Reid et al. <https://www.biorxiv.org/content/early/2017/11/29/226514>
- **Organization of neural population code in mouse visual system.** Esfahany et al. <http://www.eneuro.org/content/5/4/ENEURO.0414-17.2018>
- **Population coupling predicts the plasticity of stimulus responses in cortical circuits.** Sweeney & Clopath. <https://www.biorxiv.org/content/early/2018/02/14/265041>
- **Neuronal activities in the mouse visual cortex predict patterns of sensory stimuli.** Cai et al. <https://link.springer.com/article/10.1007%2Fs12021-018-9357-1>
- **High-accuracy decoding of complex visual scenes from neuronal calcium responses.** Ellis & Michaelides. <https://www.biorxiv.org/content/early/2018/03/26/271296>
- **Weighted network density predicts range of latent variable model accuracy.** Palmerston et al. <https://www.biorxiv.org/content/early/2018/06/11/343285>

