The Allen Brain Observatory

CSHL Neural Data Analysis

JULY 23, 2019

Saskia de Vries
Assistant Investigator

ALLEN INSTITUTE *for*
BRAIN SCIENCE

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.

ALLEN INSTITUTE for BRAIN SCIENCE

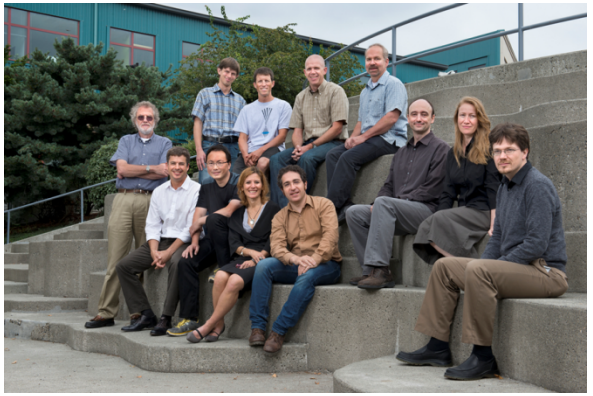
Mission:

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.

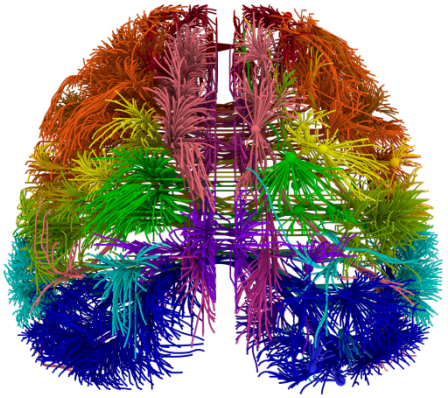
Allen Institute Guiding Principles

Team Science: Multi-disciplinary teams working towards common goal

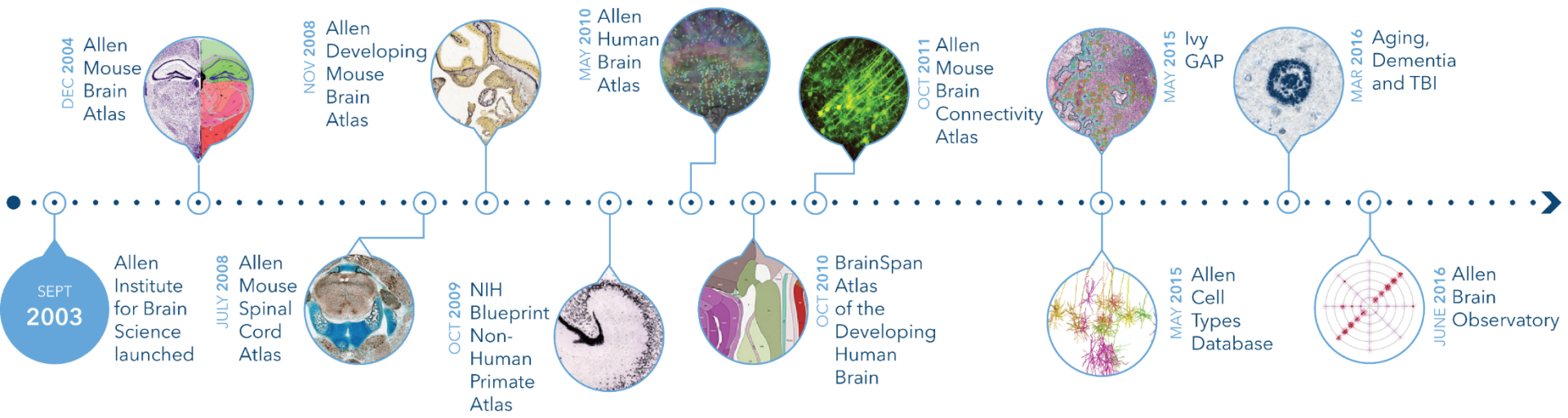


Big Science: Clear goals or milestones for large-scale projects

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

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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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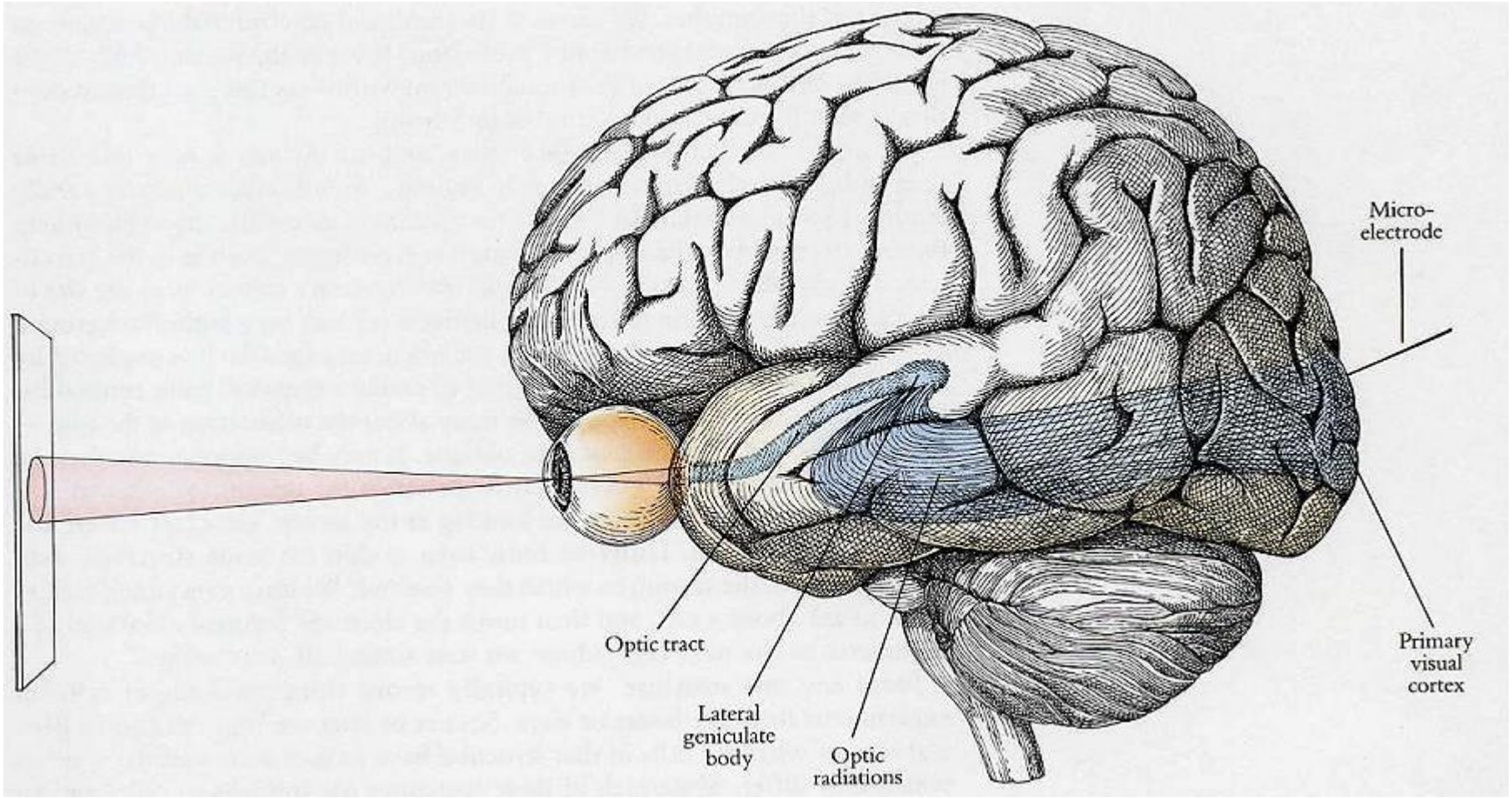
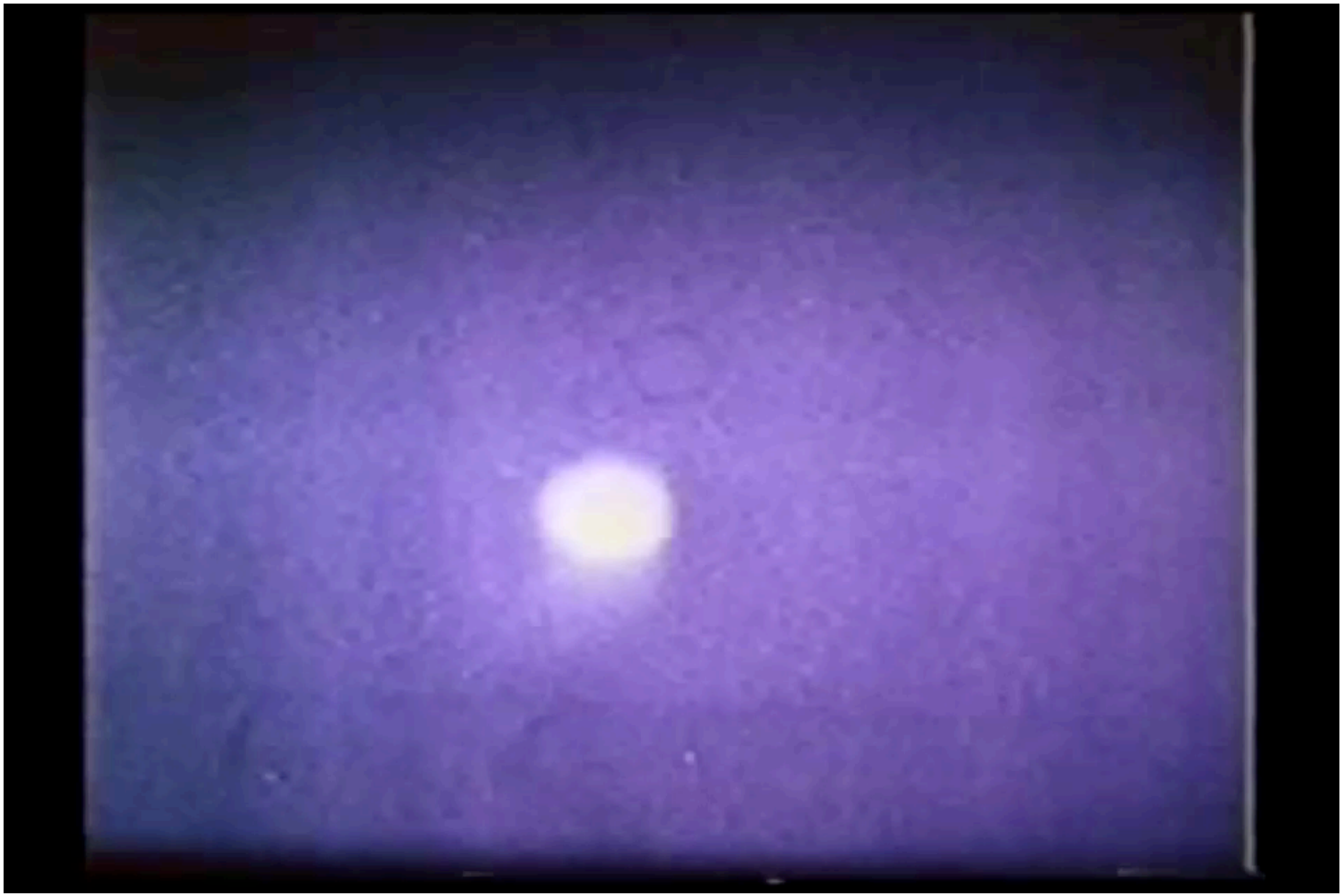

Micro-
electrode
Optic tract
Lateral
geniculate
body
Optic
radiations
Primary
visual
cortex

Hubel (1988)



Hubel & Wiesel (1961)

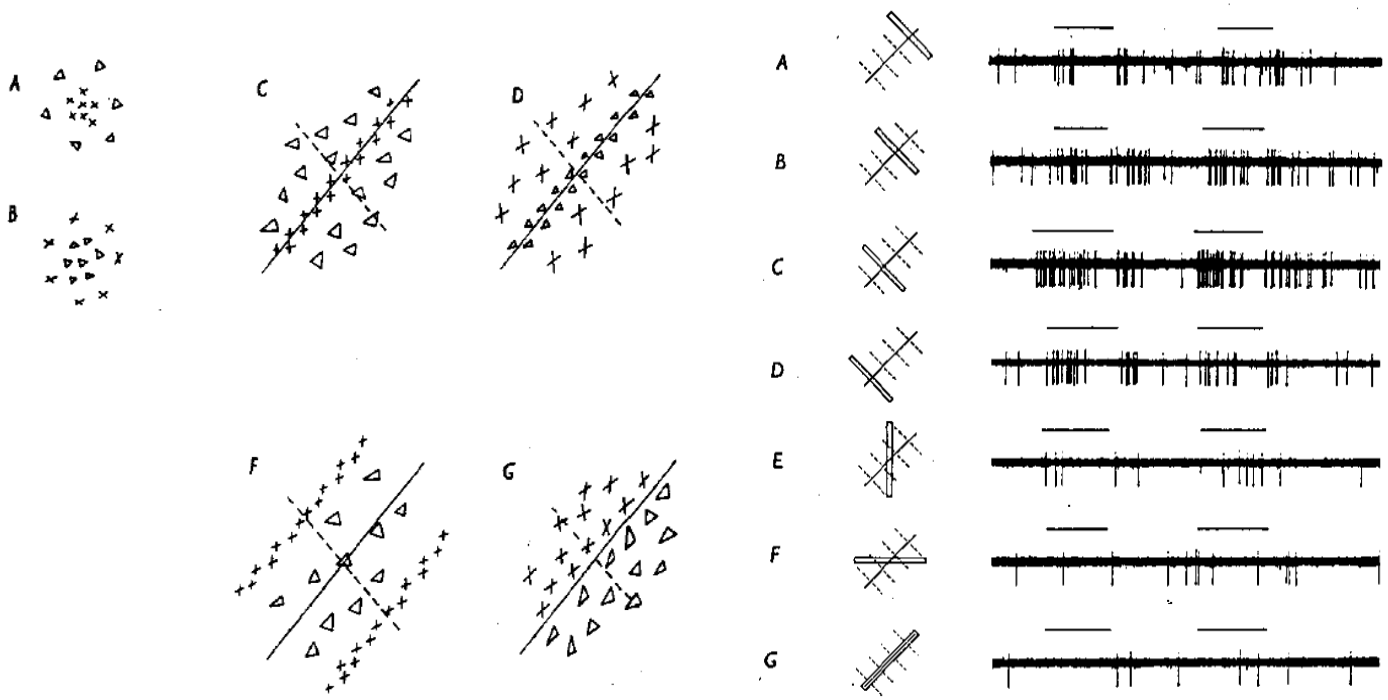
Hubel & Wiesel (1959,1962)

LGN

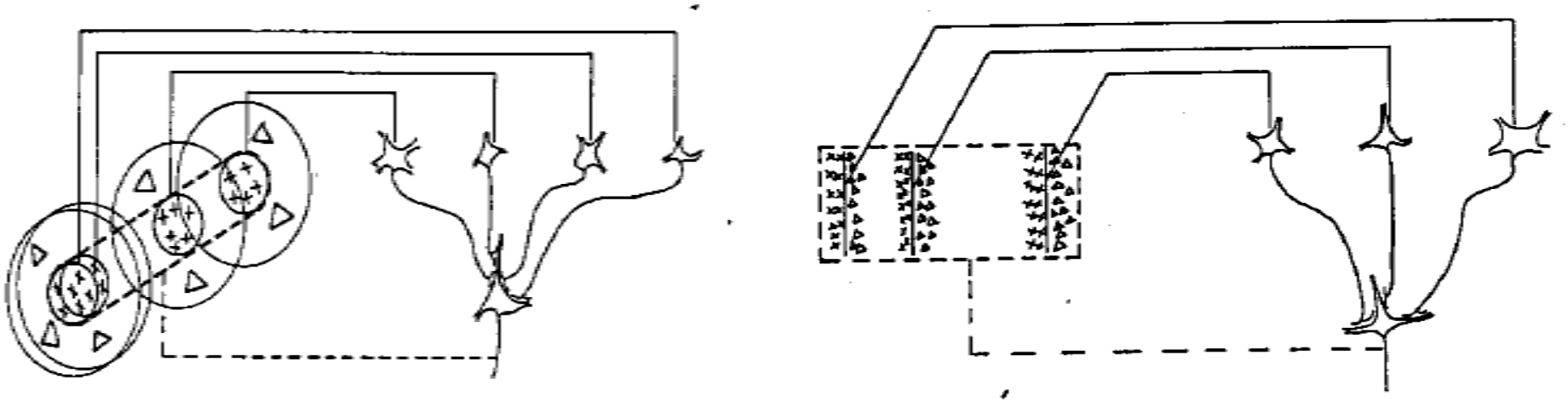
cortex

simple

complex

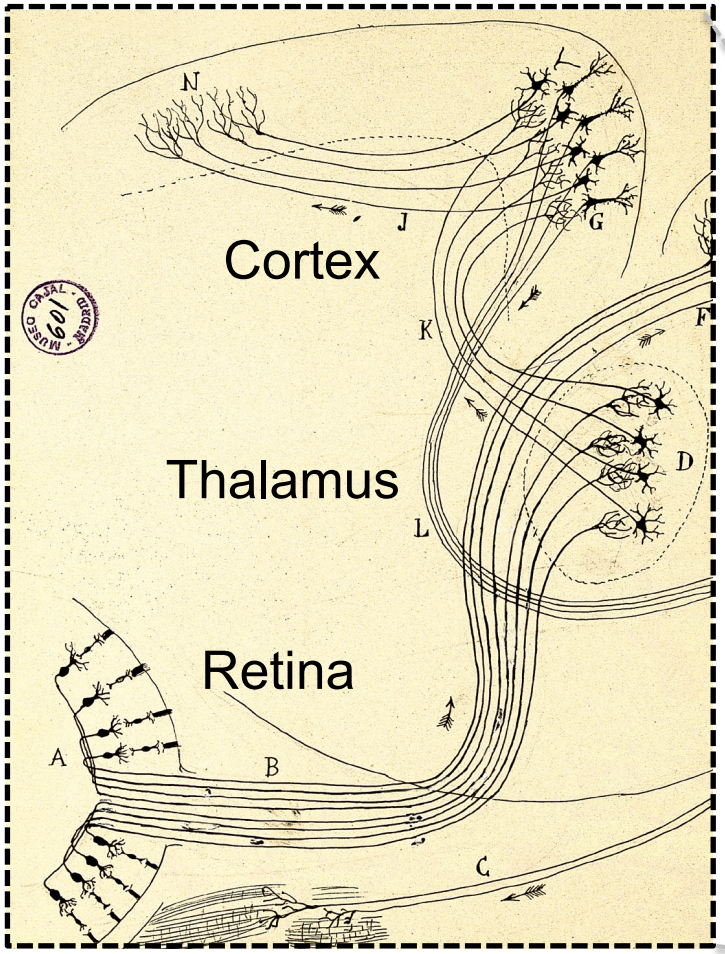


Hierarchical feedforward model

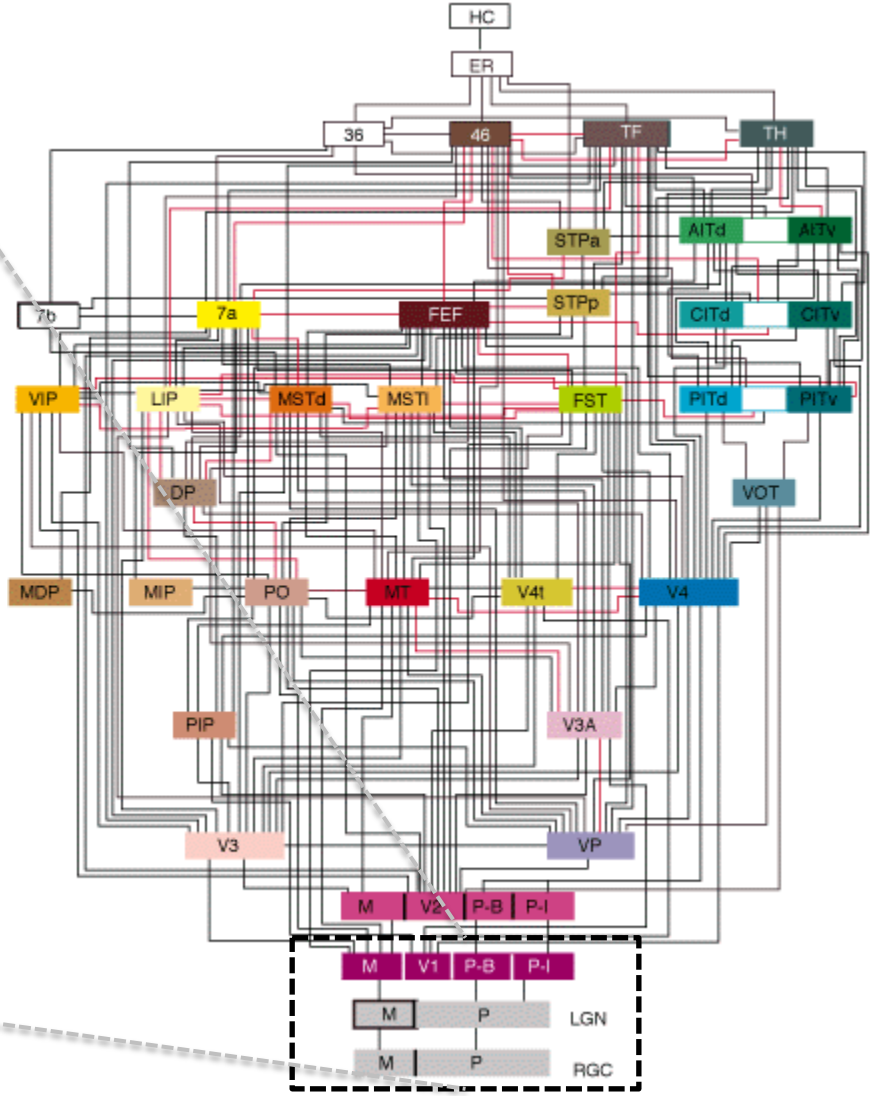


Hubel & Wiesel, 1962

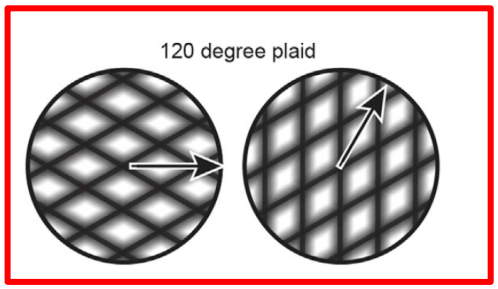
Visual Circuit

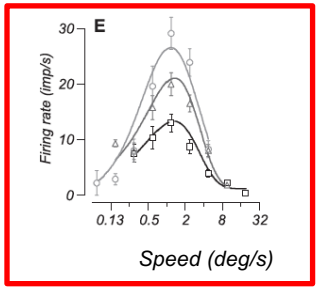


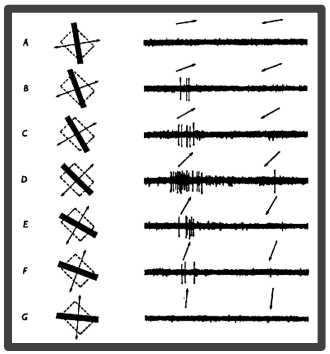
Ramon y Cajal, (1902)

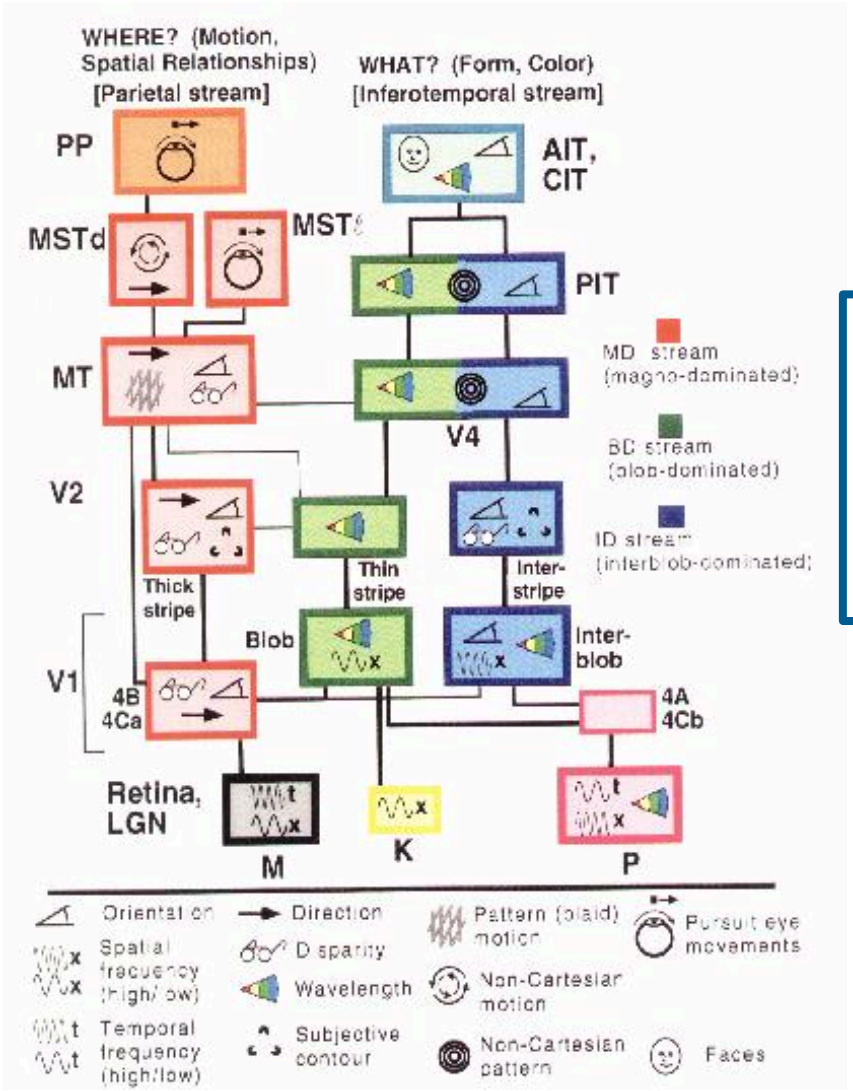


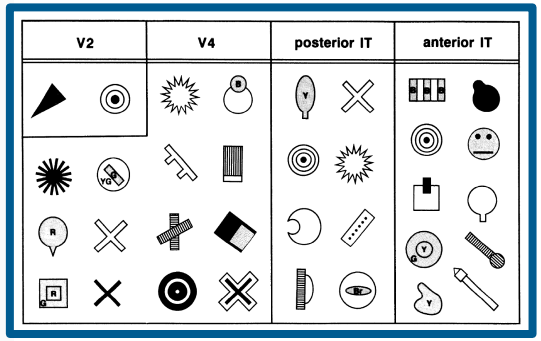
Van Essen et al. (1992)









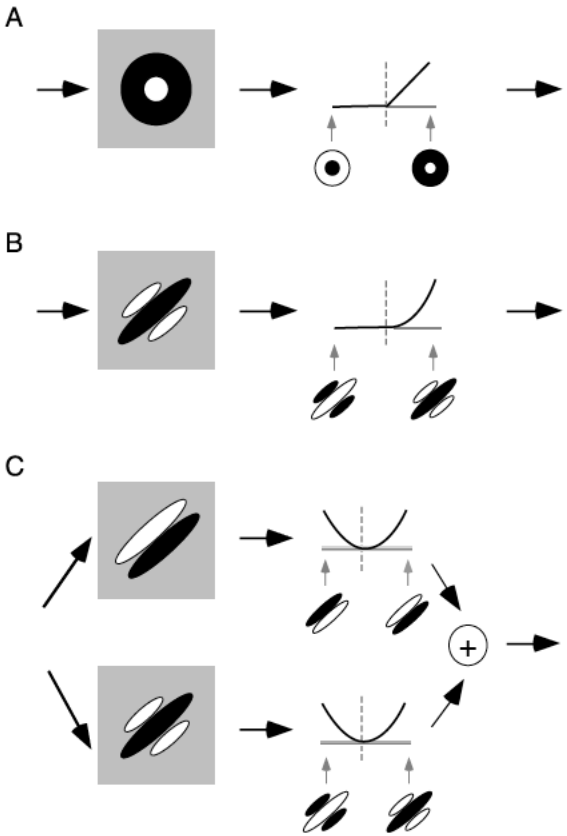


Van Essen & Gallant, 1994

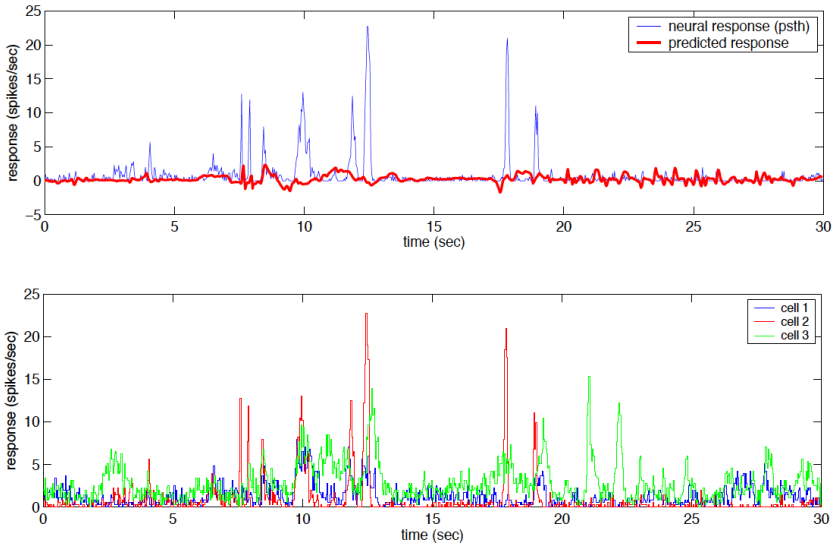
Questions

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

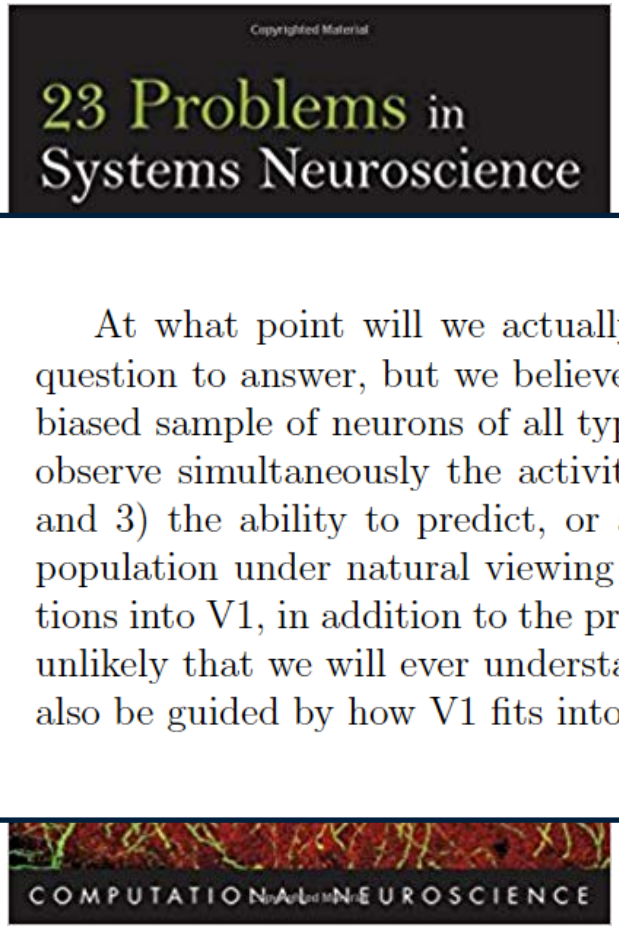
Questions

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?



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.

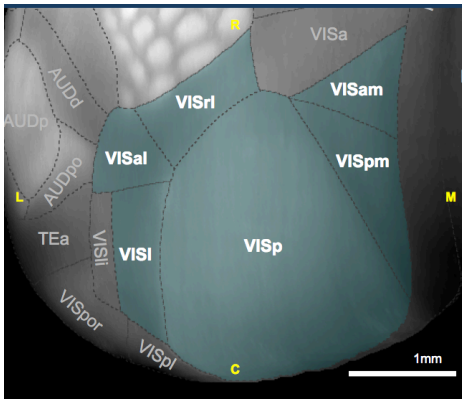
THE ALLEN BRAIN OBSERVATORY

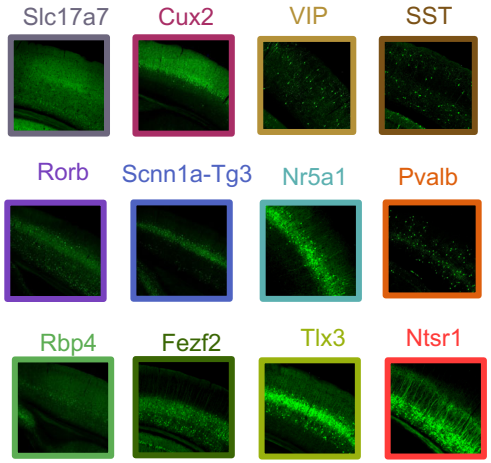
Allen Brain Observatory: Visual Coding
A physiological survey of visual representation in the mouse cortex

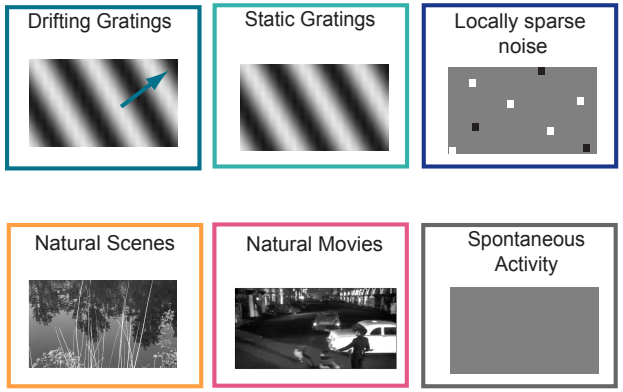
Are there functional streams in the mouse visual cortex?

Are there functional differences between transgenically defined Cre lines?

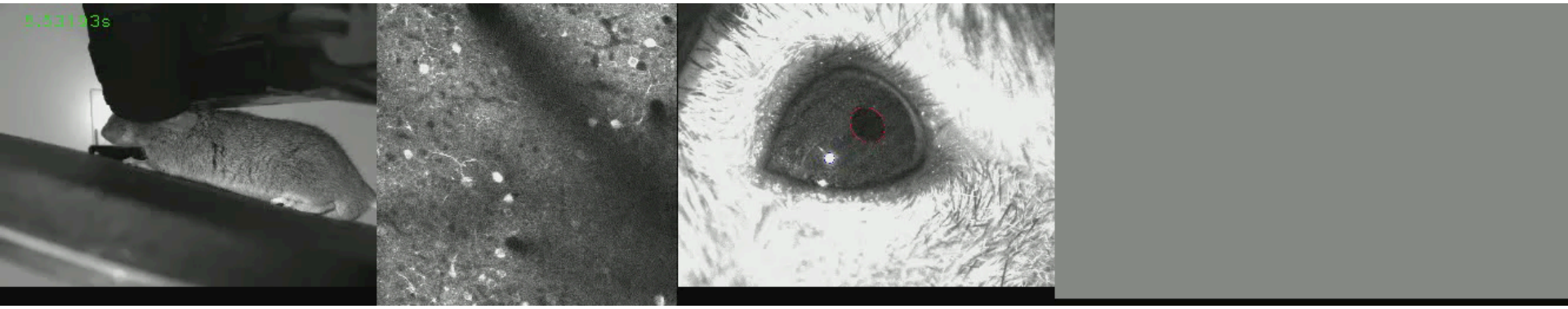
Can we build predictive models to capture the visually evoked activity?

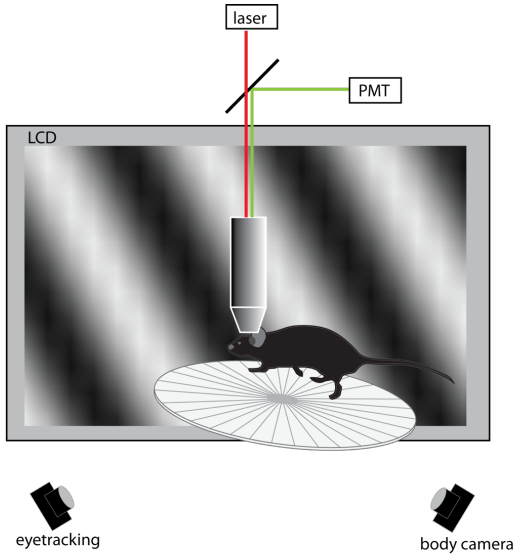




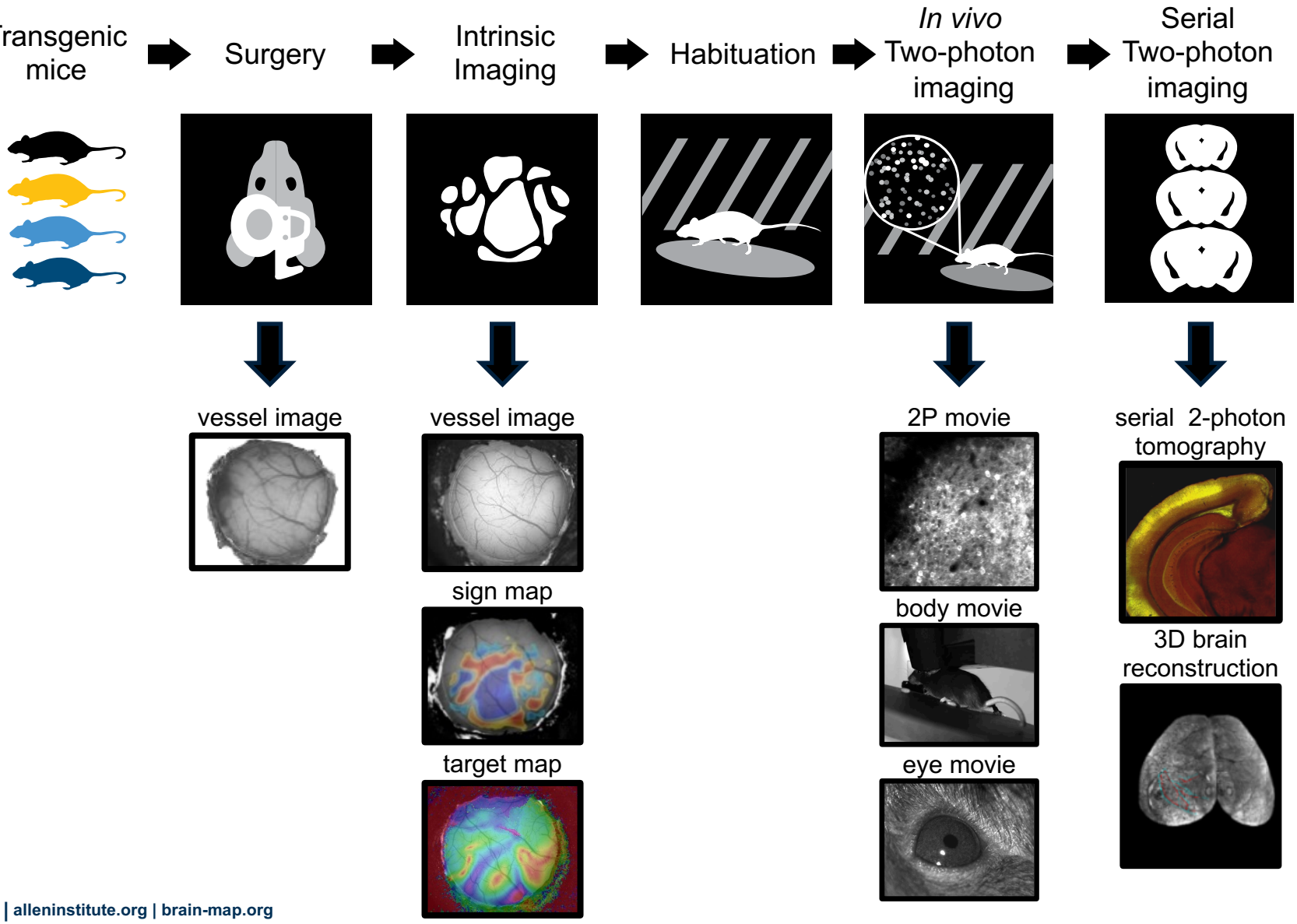


2-photon calcium imaging in an awake mouse

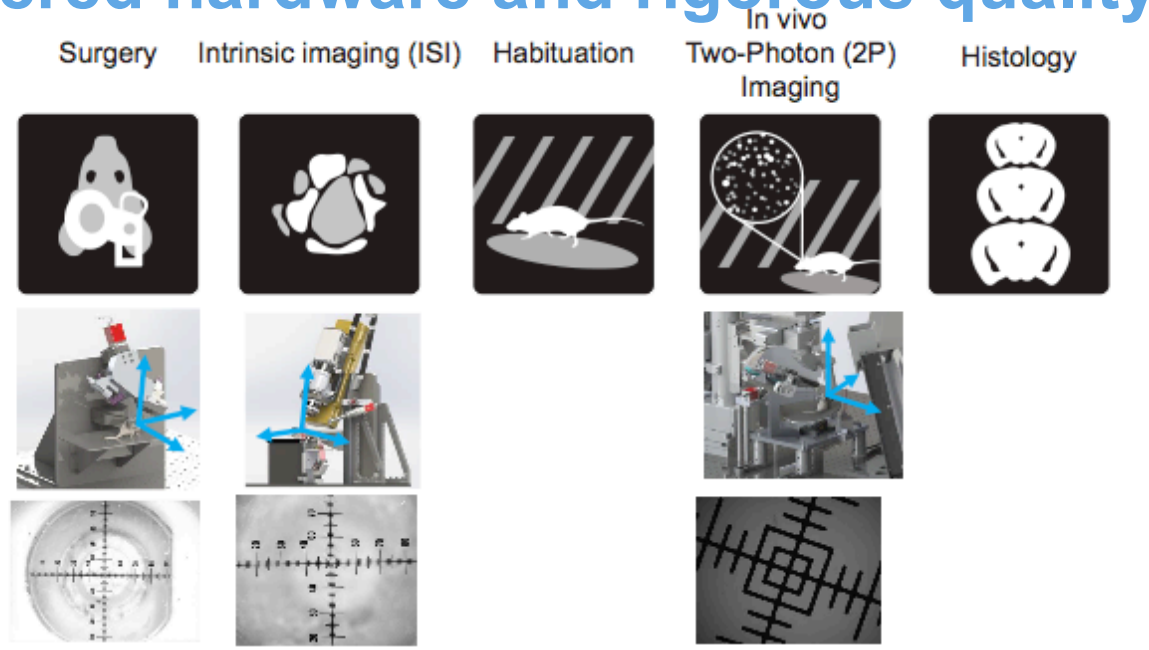


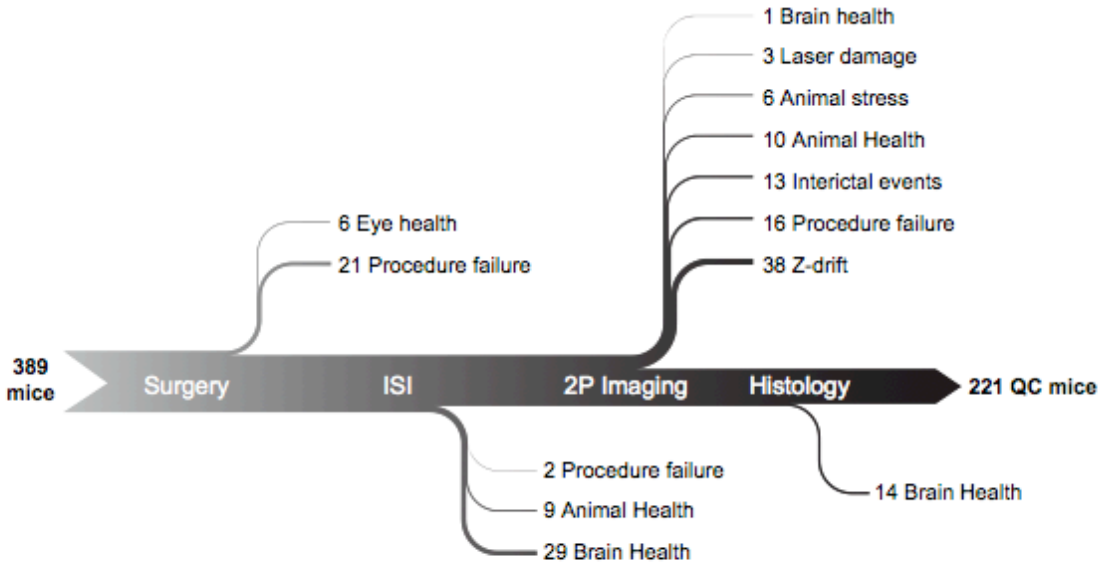


High-throughput pipeline data collection

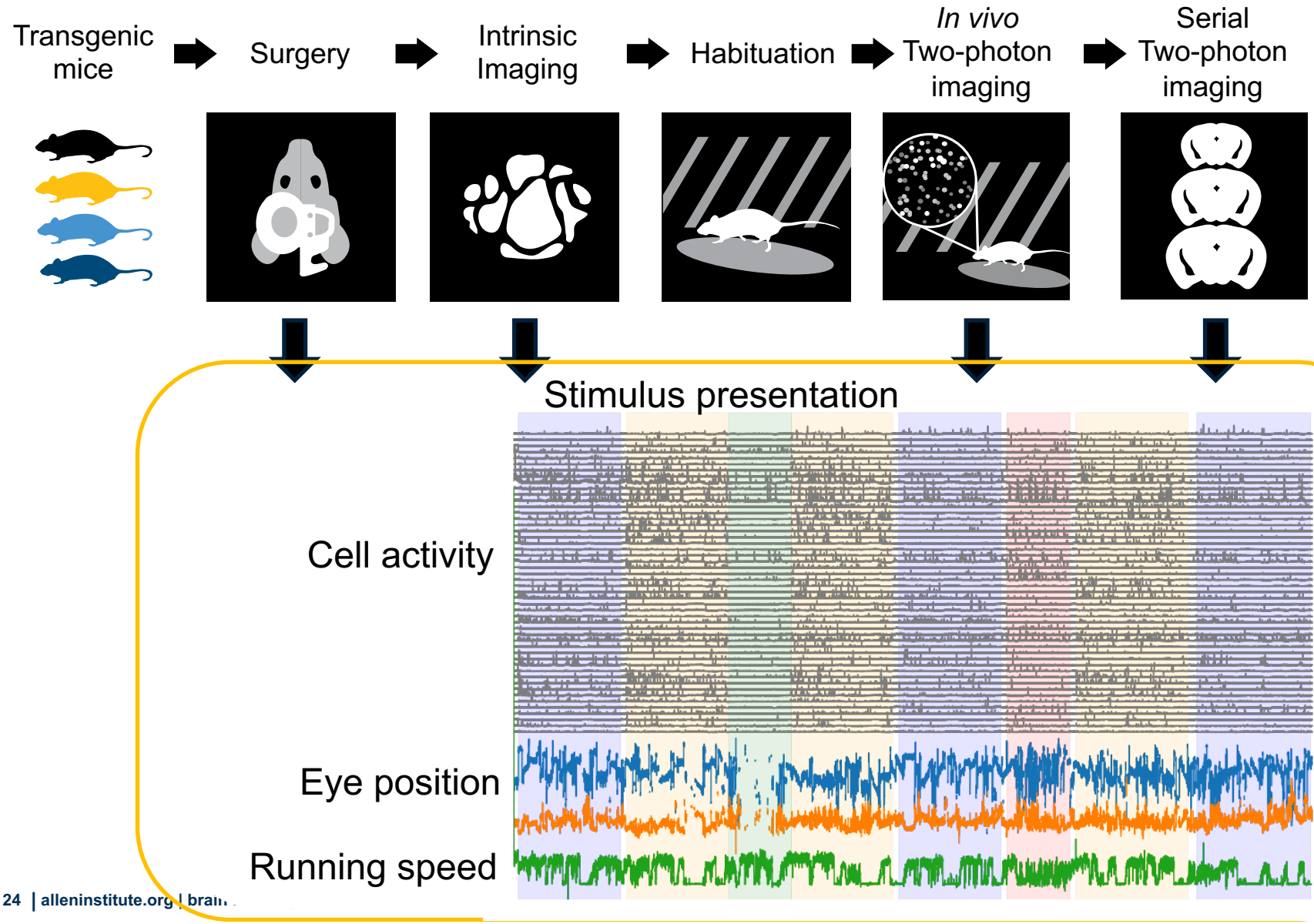


Standardized data collection depends on registered hardware and rigorous quality control

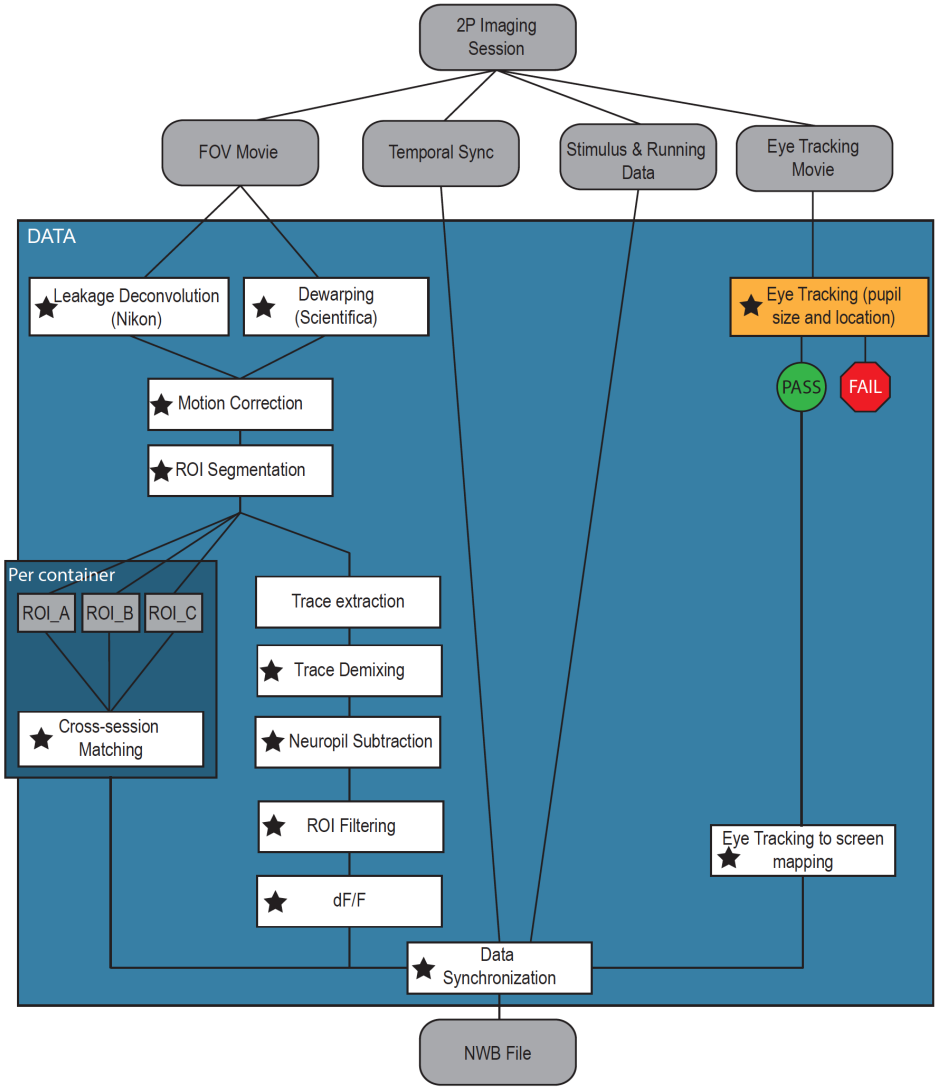




High-throughput pipeline data processing



Pipeline image processing

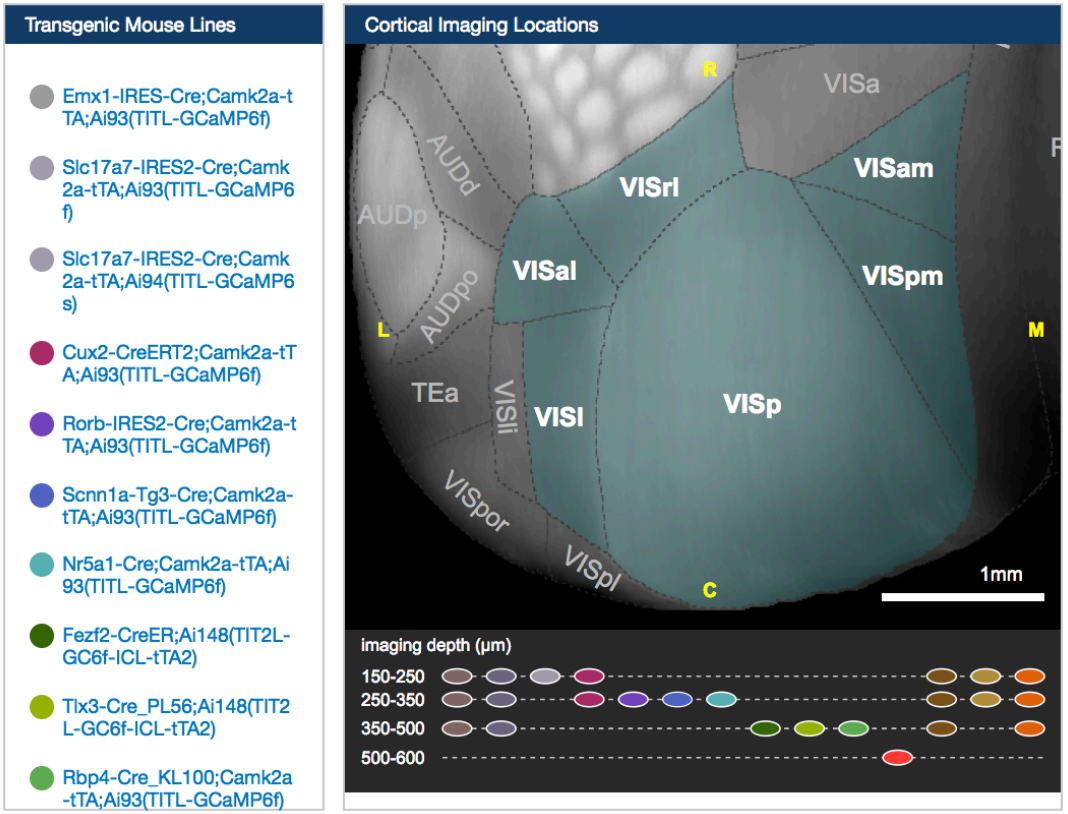


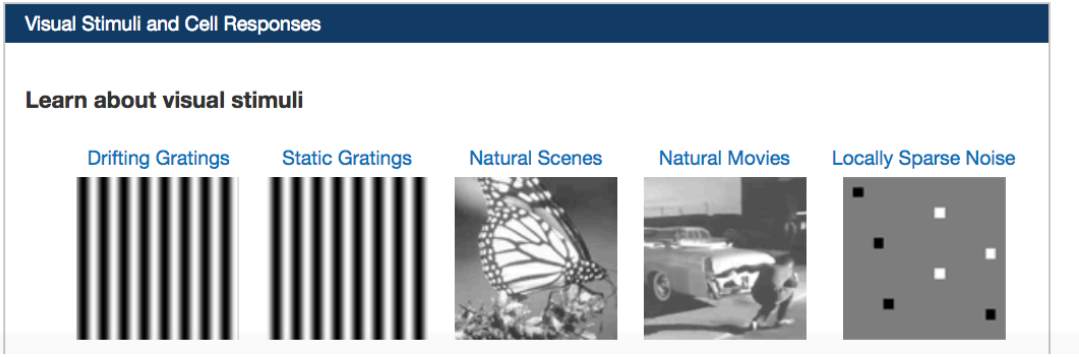
Data from each experiment is contained in an NWB file

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 ΔF/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	VISl	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	VISl	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)
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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	VISl	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)
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Tlx3-Cre_PL56;Ai148	5	E	F	1181 (6)	946 (3)					2127 (9)
Ntsr1-Cre_GN220;Ai148	6	E	F	573 (7)	719 (7)		581 (4)			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

Excitatory and Inhibitory Neurons

Allen Brain Observatory Visual Coding Dataset

Cre line	Layers	E/I	F/S	VISp	VISl	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)	1319 (7)		581 (4)			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

4 Cortical layers: layers 2/3 through 6

Excitatory and inhibitory Neurons

Allen Brain Observatory Visual Coding Dataset

Cre line	Layers	E/I	F/S	VISp	VISl	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)	384 (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)	419 (7)		581 (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)		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

4 Cortical layers: layers 2/3 through 6

14 Transgenic mouse lines

Excitatory and inhibitory Neurons

Allen Brain Observatory Visual Coding Dataset

Cre line	Layers	E/I	F/S	VISp	VISl	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)	384 (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)	419 (7)	581 (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)	237 (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

4 Cortical layers: layers 2/3 through 6

14 Transgenic mouse lines

Excitatory and inhibitory Neurons

Fast and slow GCaMP6 reporters

Allen Brain Observatory Visual Coding Dataset

Cre line	Layers	E/I	F/S	VISp	VISl	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)	384 (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)	419 (7)		581 (4)			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

4 Cortical layers: layers 2/3 through 6

14 Transgenic mouse lines

Excitatory and inhibitory Neurons

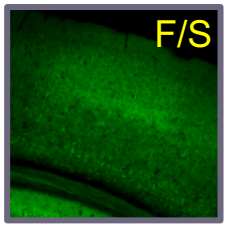
Fast and slow GCaMP6 reporters

Excitatory Cells

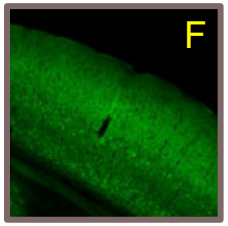
Inhibitory Cells

Pan excitatory

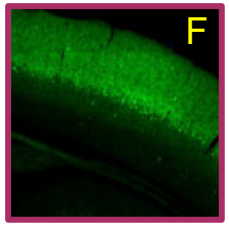
Slc17a7



Emx1



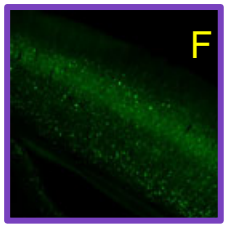
Cux2



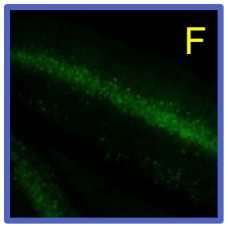
Layers 2/3 & 4

Layer 4

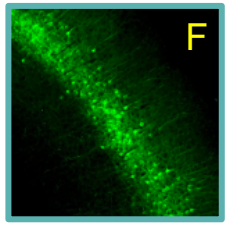
Rorb



Scnn1a-Tg3

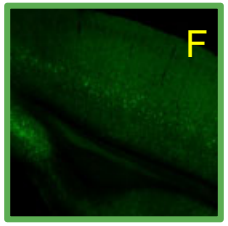


Nr5a1

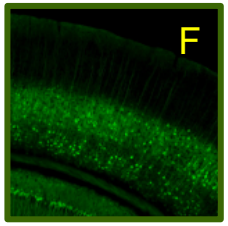


Layer 5

Rbp4

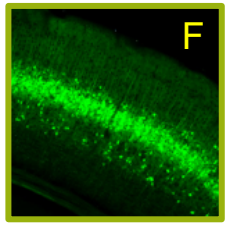


Fezf2



Cortico-thalamic

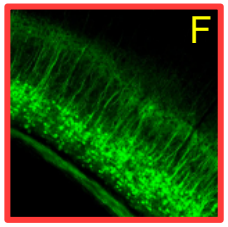
Tlx3



Cortico-cortico

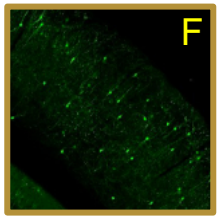
Layer 6

Ntsr1



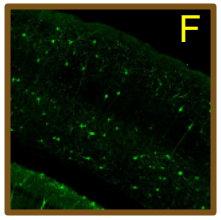
Cortico-thalamic

VIP



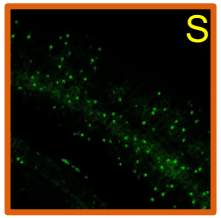
Layers 2/3 & 4

SST



Layers 4 & 5

Pvalb

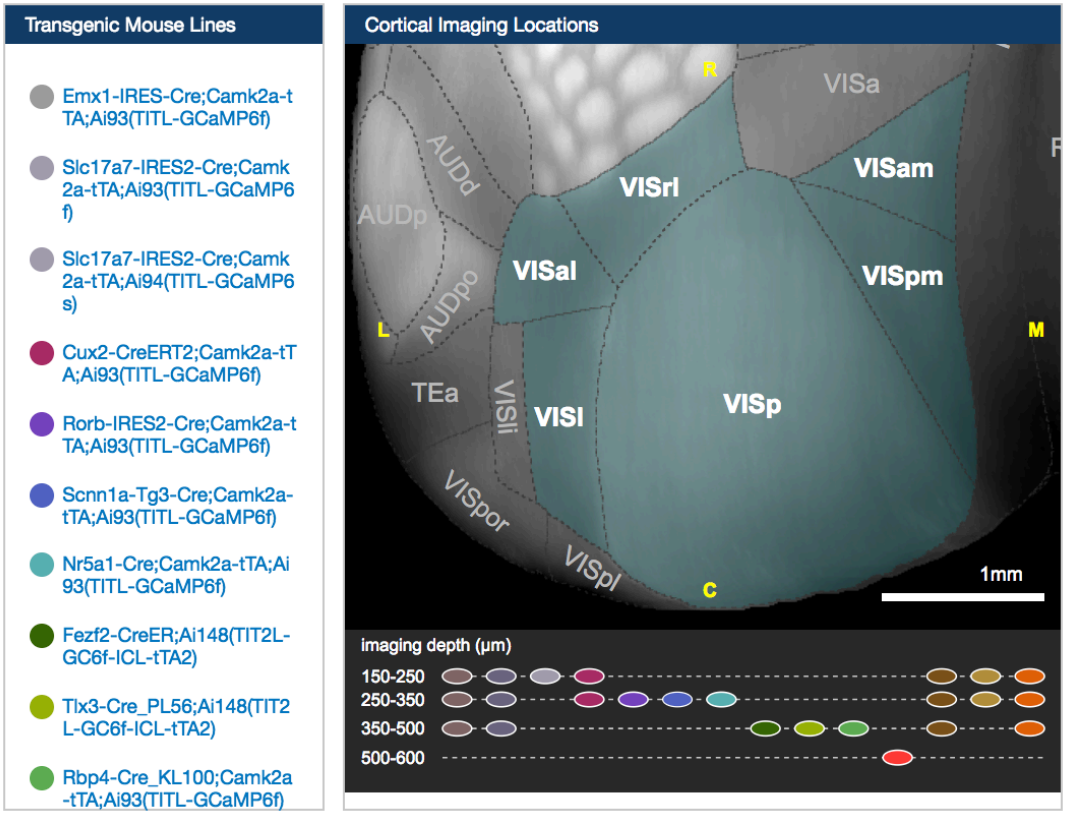


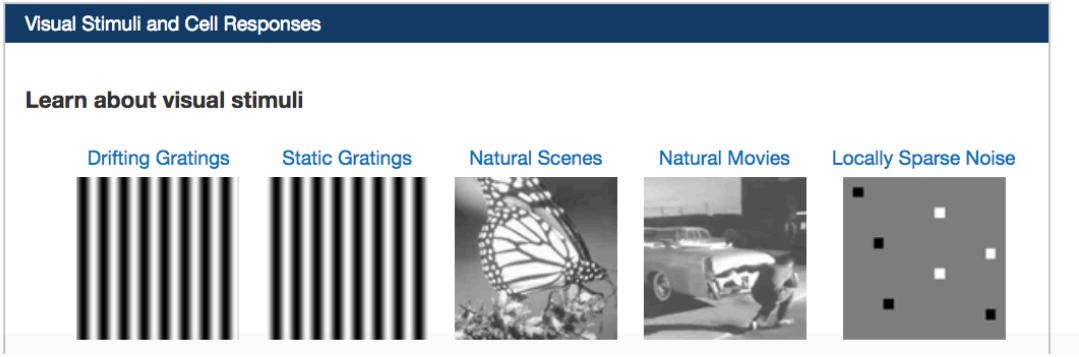
Layers 4 & 5

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

Documentation: Transgenic Line Catalog

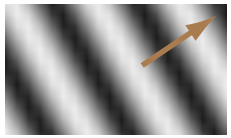
http://observatory.brain-map.org





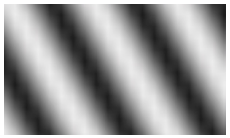
Visual Stimuli

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

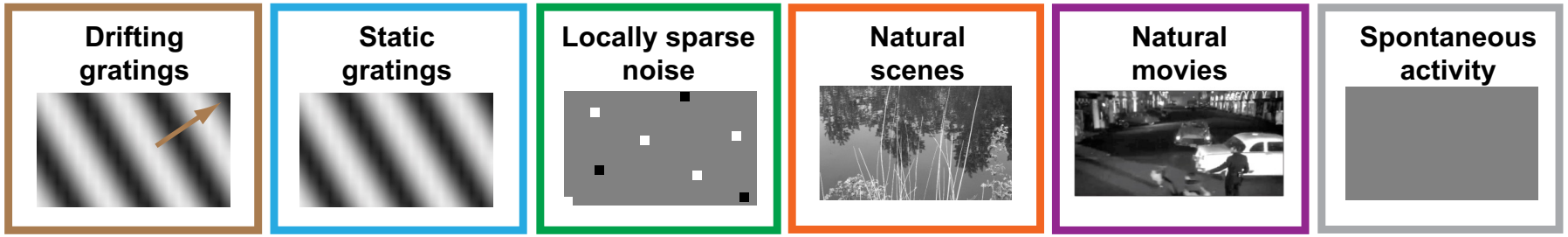
Natural movies

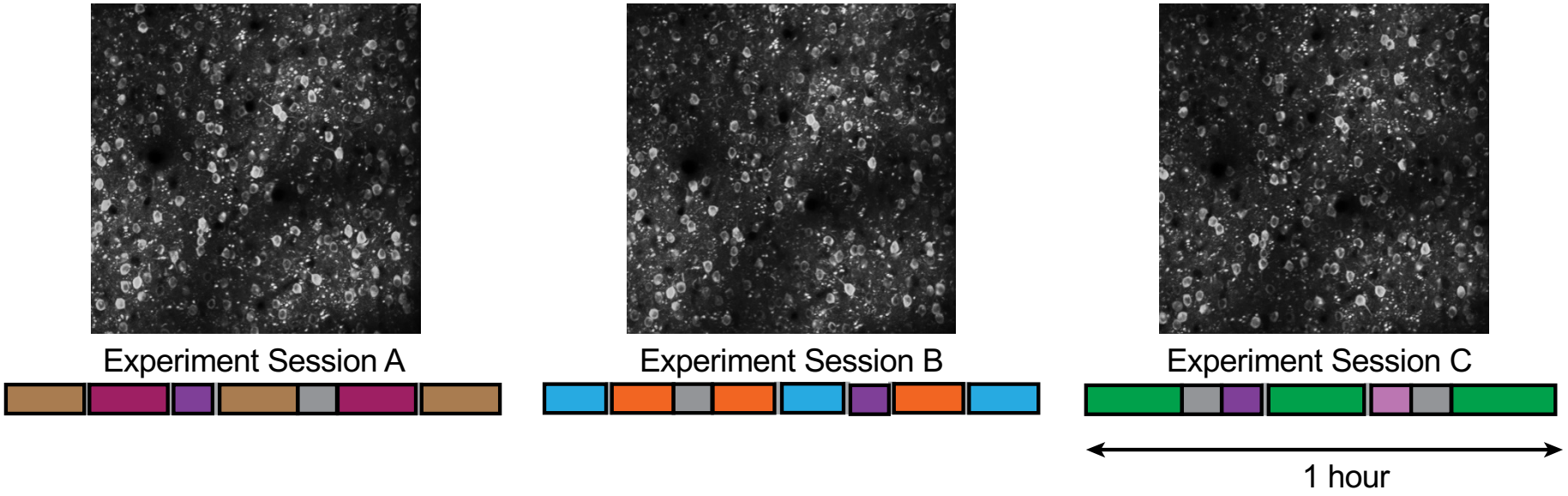
Two 30s clips
One 120s clip
10 trials

Spontaneous activity

50 cd/m^2
5 minutes

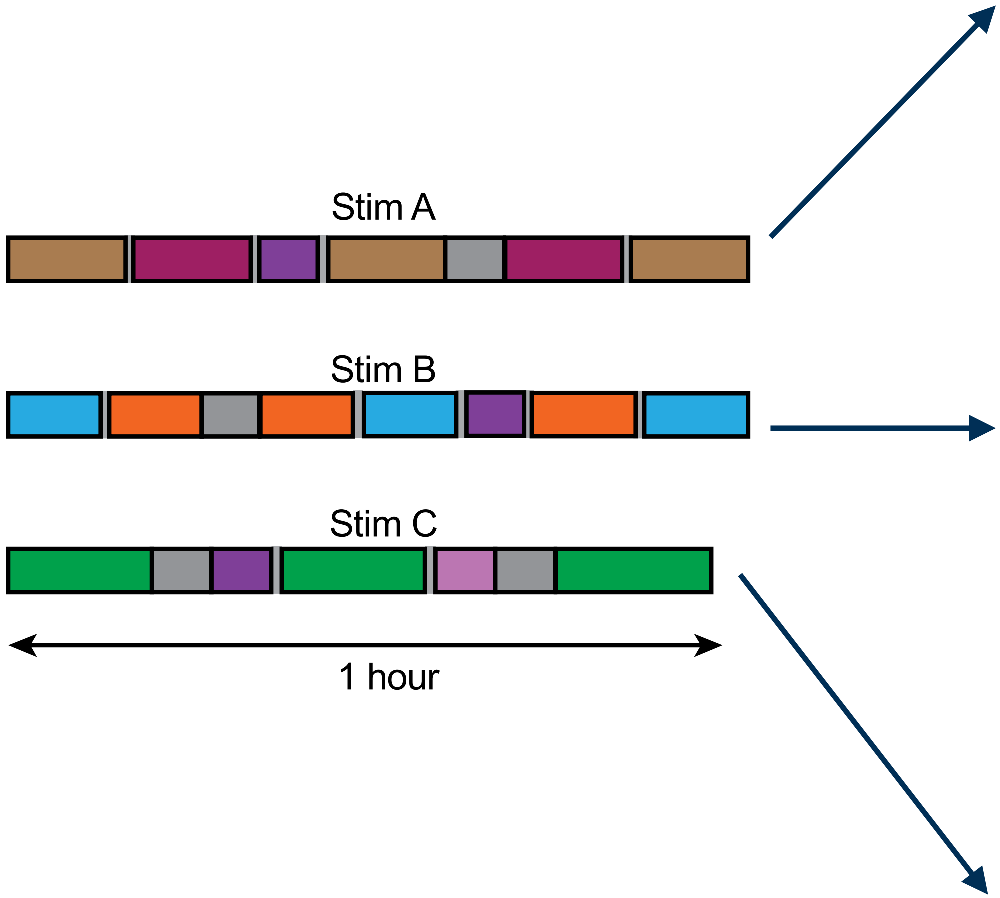
Stimuli are shown over 3 experimental sessions





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



- Max projection image
- ROI masks
- Raw fluorescence for each ROI
- Surrounding neuropil trace and r value for each ROI
- ∆F/F for each ROI
- Stimulus table
- Stimulus template (natural scenes, natural movies, noise movie)
- Mouse's running speed
- Motion correction (x & y pixels)
- Meta data (cre line, visual area, imaging depth, experiment container, mouse ID, age, sex, etc)

- Max projection image
- ROI masks
- Raw fluorescence for each ROI
- Surrounding neuropil trace and r value for each ROI
- ∆F/F for each ROI
- Stimulus table
- Stimulus template (natural scenes, natural movies, noise movie)
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- Motion correction (x & y pixels)
- Meta data (cre line, visual area, imaging depth, experiment container, mouse ID, age, sex, etc)

- Max projection image
- ROI masks
- Raw fluorescence for each ROI
- Surrounding neuropil trace and r value for each ROI
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- Stimulus table
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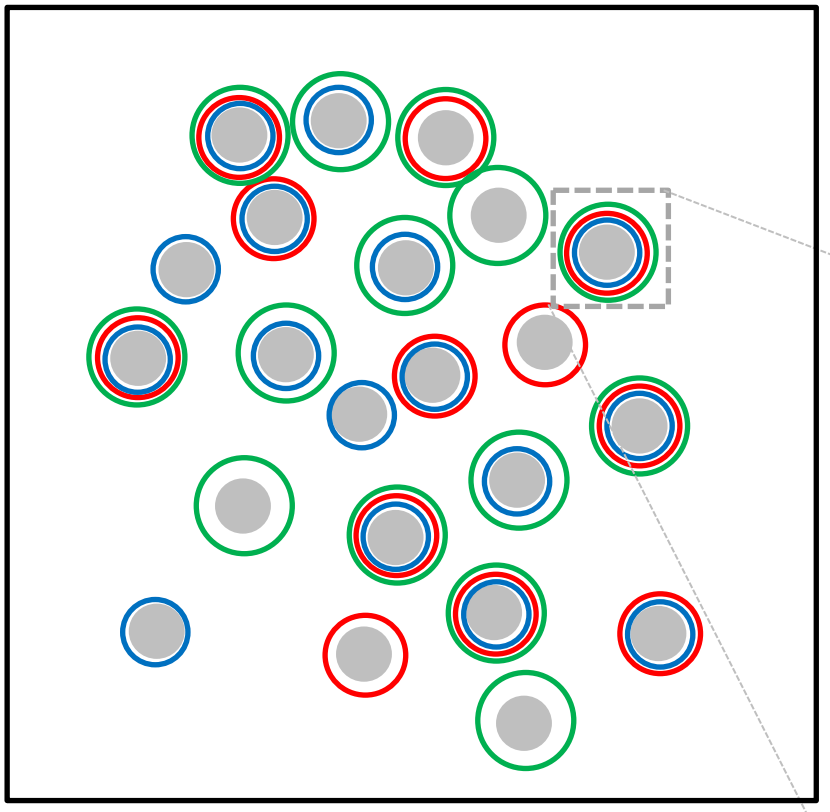
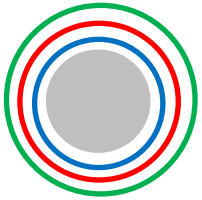
- Mouse's running speed
- Motion correction (x & y pixels)
- Meta data (cre line, visual area, imaging depth, experiment container, mouse ID, age, sex, etc)

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



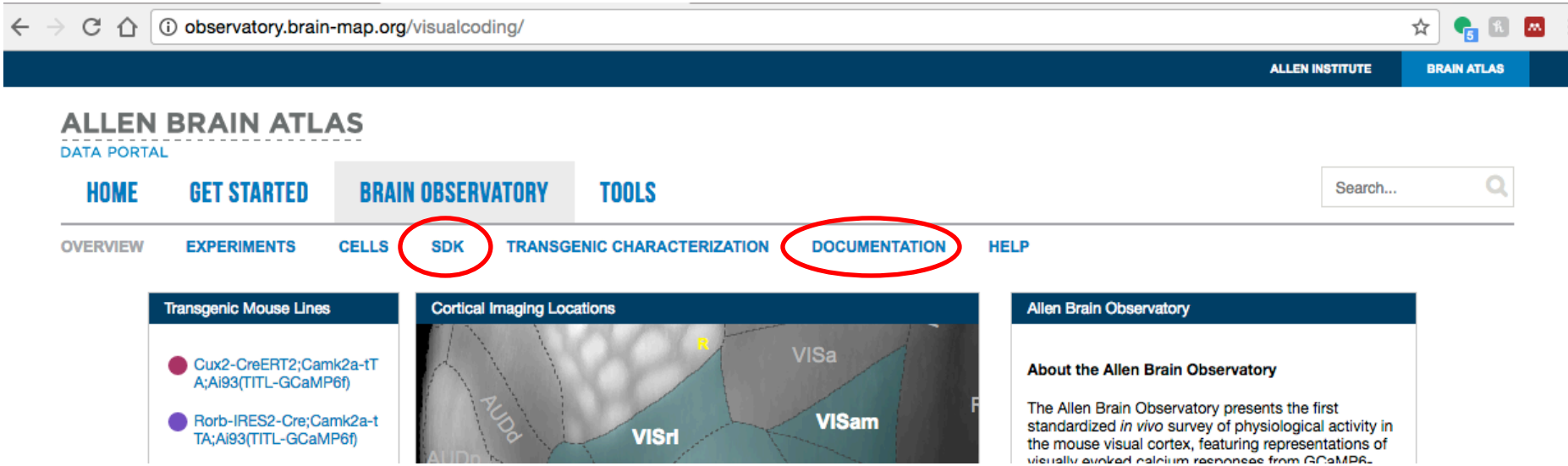
Experiment Container
Experiment Session A
Experiment Session B
Experiment Session C



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



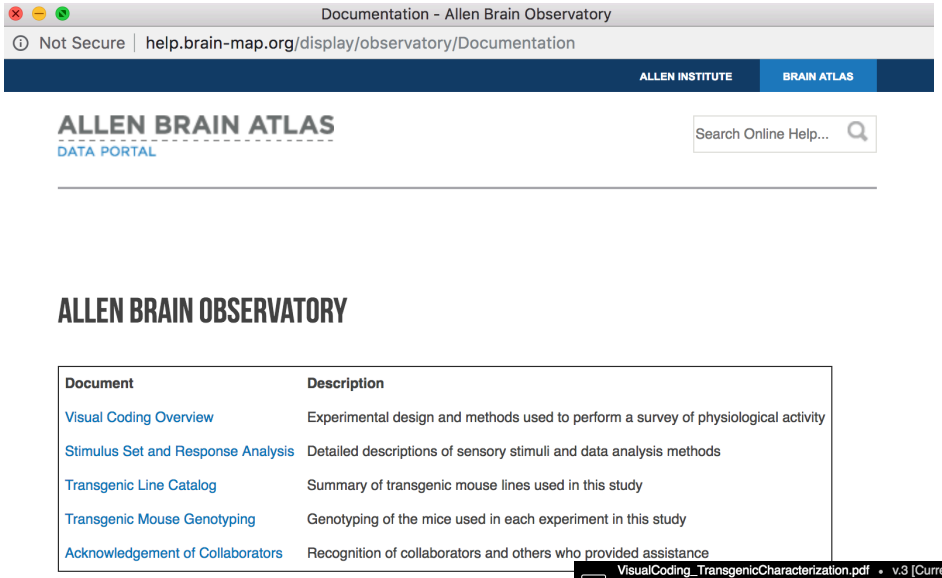
Allen SDK Installation
http://alleninstitute.github.io/AllenSDK/install.html

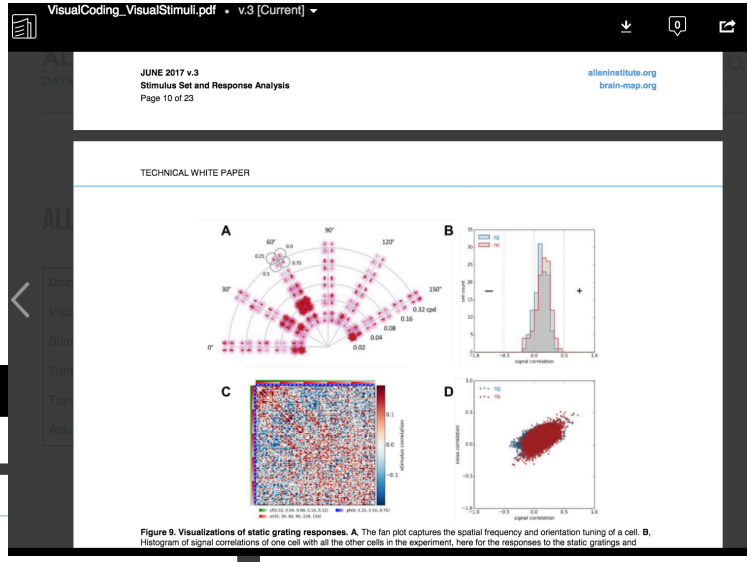
Allen SDK information and tutorials:
http://observatory.brain-map.org/visualcoding/sdk/index

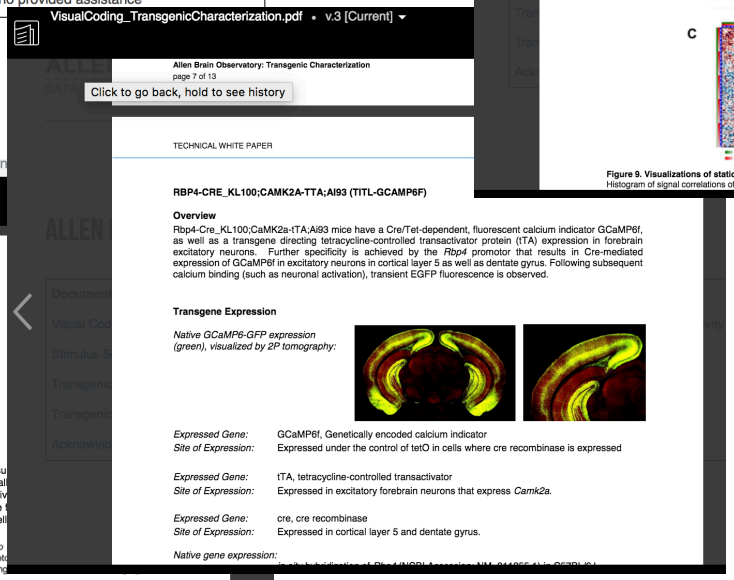
Observatory documentation:
http://help.brain-map.org/display/observatory/Documentation

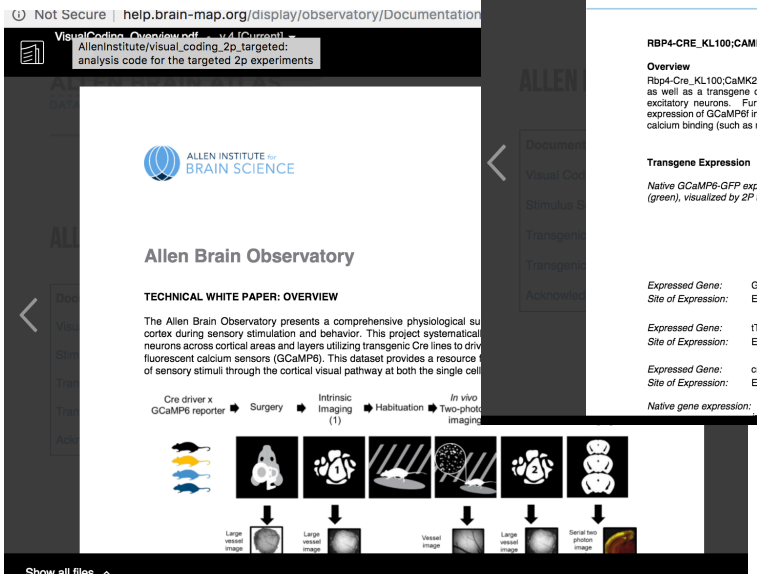
Questions and discussion:
http://community.brain-map.org

Documentation

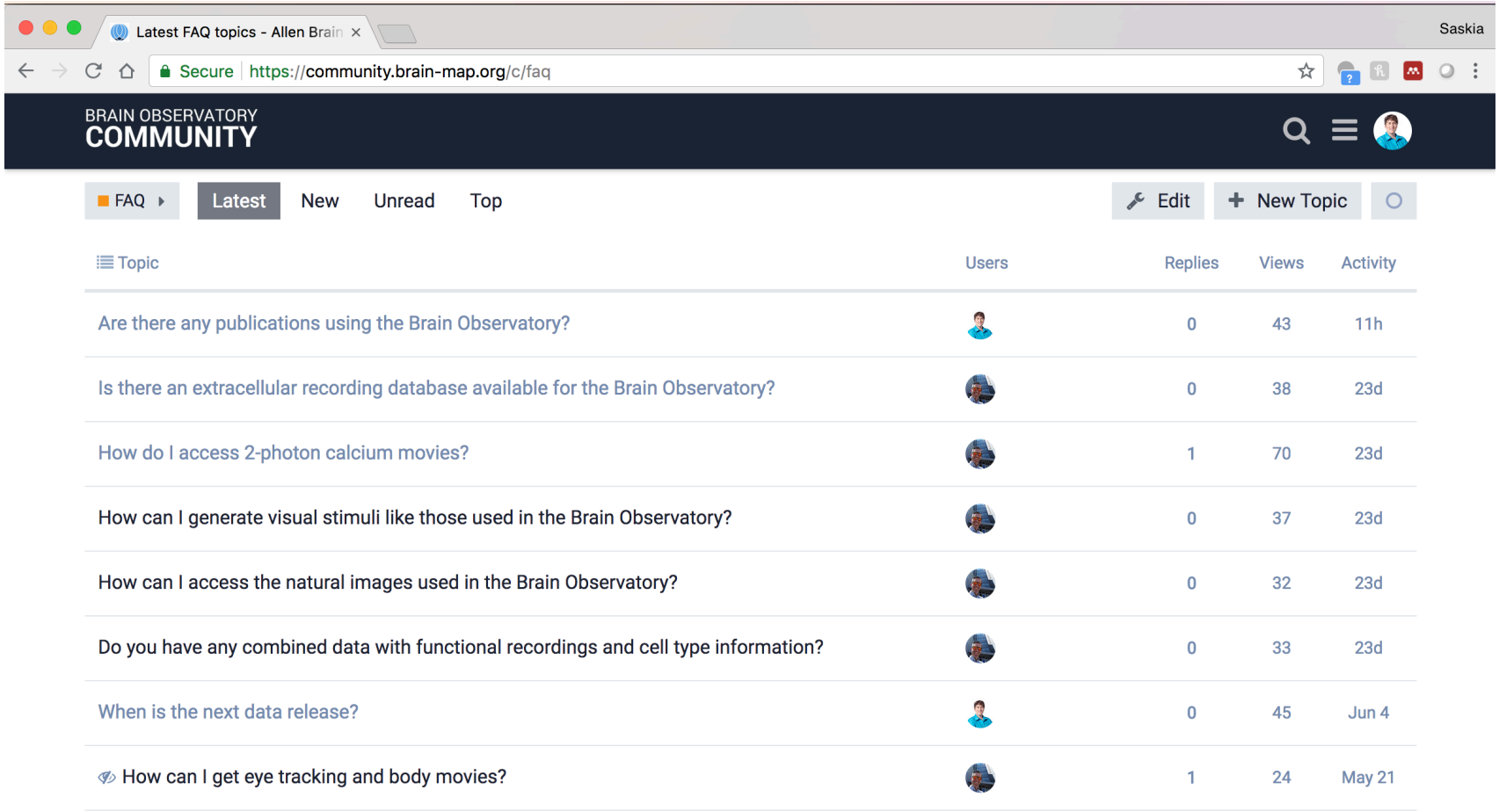








community.brain-map.org



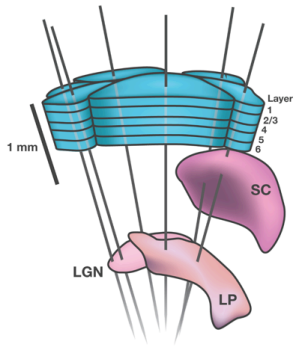
Timeline

2P data collection launched

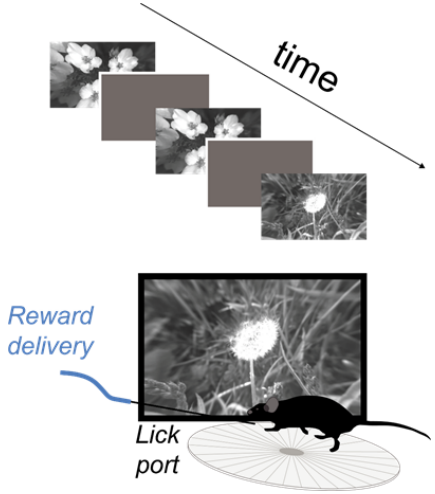
2P data collection completed

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 Ca^{2+} imaging data.** Sheintuch *et al.* https://www.sciencedirect.com/science/article/pii/S2211124717314304
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