Institute of Medicine
Neuroscience Training Workshop

October 29, 2014

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How can the Allen Institute Help to Prepare the Next Generation?
The mission of the Allen Institute for Brain Science is to accelerate the understanding of how the human brain works in health and disease. Using a team science approach, we generate useful public resources, drive technological and analytical advances, and discover fundamental brain properties through integration of experiments, modeling, and theory.
Big Science - Open Data for the Biggest Impact

• Founded by **Paul G. Allen** in 2003
• Independent, **non-profit** research organization working to support **basic research** in the brain sciences
• Dedicated to making **tools and data and knowledge** readily and freely available to the scientific community
• Project-focused, industrial scale, **milestone driven**

**Multi-disciplinary teams** working towards a common goal

• **Launched 10-year Plan in 2012**
First 10 Years & 30 on-time public data releases: ALLEN BRAIN ATLAS Online Public Resources

- 50,000 visitors/month
- Users from around the globe
- >3 Petabytes data generated
- > 5000 engineered mice
- > 1 million microscope slides

All data are:
- publicly accessible as soon as they pass QC
- freely available
- accessible 1-2 years prior to any publications

www.brain-map.org
• Identify gene marker(s) associated with diseases, pathways,
• Refine neuroanatomy
• Identify cell type markers
• Compare similarities/differences between human & mouse
2012-2022: Long-range path to understanding the brain

Our Plan: Understanding **Vision in Human and Mouse**
The Big Challenge: Where we are going...

- Cortex is a planar 2+e-D computational tissue
- Varies $10^5$ in areas across mammals
- Relatively uniform across area

What is the canonical, columnar operation performed by cortex that makes natural intelligence so robust and flexible?

Beyond Vision: Collaborating to drive questions elsewhere

Components
- synapses
- cell types
- circuits

Computation
- emergent system properties
- top-down signals
- sensory representation

Cognition
- memory
- decision
- attention
- object recognition

Models and Approaches: Mouse Cortex, Human Cortex, single Cell type-functional, morphological and gene expression analysis, human array tomography and functional analysis, iPS-derived cells, computational modeling, expression-anatomical-functional correlates, engineer/program new high-throughput tools to analyze form and function, etc.
Where is the workforce to tackle this?

It takes a Village: Team Science

Multi-disciplinary Collaborative Research In Action
Phase II: Fostering Collaborative Culture Change

“TO TACKLE MANY OF THE LARGE QUESTIONS IN NEUROSCIENCE, WE NEED INTERDISCIPLINARY COLLABORATIONS.” -Jack Waters, Associate Investigator
Team Science: Multi-disciplinary teams working towards a common goal, flexible career development.

ENGINEERING

MODELING, ANALYSIS & THEORY

NEURAL CODING

NEURO CELL BIOLOGY

Mouse TRANSGENESIS

“STRUCTURED SCIENCE”
Team Science: Multi-disciplinary teams working towards a common goal

Structured Science

Information Technology

Human Brain Research

Research & Development

Expanding the Team: Internships, Visiting Scientist Program, Academic Partnerships for graduate training
Brain Explorer, AGEA, Molecular Neuroanatomical Maps

Allen Institute: Developing the Data and Tools, - and Teaching How to Use them

Injection:
Primary motor area

Caudoputamen

Thalamus, sensory-motor cortex related
Superior colliculus, motor related

Pons, motor related

Inferior olivary complex
Topography of Cortico-subcortical Projections

Ipsilateral

Bregma: 0.25mm - 0.25mm - 0.75mm - 1.25mm - 1.75mm - 2.25mm - 2.75mm - 3.25mm

CP CP CP CP CP TH TH TH TH MB MB MB

Isocortex

Caudoputamen

Thalamus

Lydia Ng

ALLEN INSTITUTE for BRAIN SCIENCE
Fueling Discovery
Looking Slightly Differently: Connectivity Matrix for the Entire Mouse Brain

“Think of what you could do if you could really mine all that data”
Brian Litt, IOM workshop, 2014
Brain-map.org Visitor Traffic

Visitor traffic


- alleninstitute.org
- API
- Mouse Diversity Study
- Sleep Study
- Ivy GAP
- NIH Blueprint NHP Atlas
- BrainSpan Atlas of the Developing Human Brain
- Allen Mouse Brain Connectivity Atlas
- Allen Spinal Cord Atlas
- Allen Developing Mouse Brain Atlas
- Allen Mouse Brain
- Allen Human Brain Atlas
- Data Portal
Interrogating Big Data: Helping to Train the Next Generation

- **Online Webinars**
  - ~60 attendees each session

- **On-site training**
  - ~800 attendees at 31 institutions in 2013
  - >600 attendees at 19 institutions in 2014 (to Sept)

- **Courses and Hackathons**
  - Molecular Neuroanatomy at OIST
  - Allen Brain Atlas API Hackathon
  - Allen Human Brain Atlas **Hackathon**
  - Summer Workshop on the Dynamic Brain
  - Neuro-ethics, Scientific Ethics
  - Showcase
Allen Brain Training Sessions, US/Canada 2013-14

Terri Gilbert on Tour
Allen Brain Atlas Training Sessions in Europe

- now collaborating with IBRO and HBP on informatics workshop development
Workshops and Symposia

Course in Molecular Neuroanatomy at Okinawa (OIST)

- Two-week course in Japan
- 2011-2013

ALLEN INSTITUTE for BRAIN SCIENCE
Fueling Discovery
Allen Brain Institute “Hackathon”

• Held at the Allen Institute: 2012 Hackathon

• Bring in the Programmers: Give them a different kind of challenge
In 2015:
Workshop Development with IBRO, HBP

- Partnership with Allen Institute and University of Washington
- Two-week intensive course at Friday Harbor, Washington
Showcase Symposium: Next Generation Leaders

- Two-day symposium, focusing on fostering team science
- Included presentations, team talks, lightning talks and poster sessions, rapid fire “sales pitches” of posters
- Inauguration of Next Generation Leader Council
Training for the future: Re-tooling across the Lifespan
Coming Fall 2015: New home for Allen Institute for Brain Science Headquarters
Dedicated Training Center at new Allen Institute headquarters

Dedicated training room on 6th floor of the new building

= training hub for interdisciplinary Neuroscience
Committed to Developing and Partnering on Priority Training Initiatives, Educational Development, and open to ideas! *Rainer Prep
Acknowledging the growing team that makes this happen!

We wish to thank the Allen Institute founders, Paul G. Allen and Jody Allen, for their vision, encouragement, and support.
alleninstitute.org
brain-map.org
Our Distinct Brand: Open Science - Big Science.

Unique Combination of Corporate and Academic Environments
- Scientific Oversight
  - Scientific Advisory Board and Project Advisory Councils
  - Corporate Oversight- Corporate Board

- Budgetary Control
  - 10-year budgetary plan
  - External funding match (20%)

- Team work
  - Focused on common goal
  - Team success=Institute success

Team Structure
- new integrated framework of positions and career plan