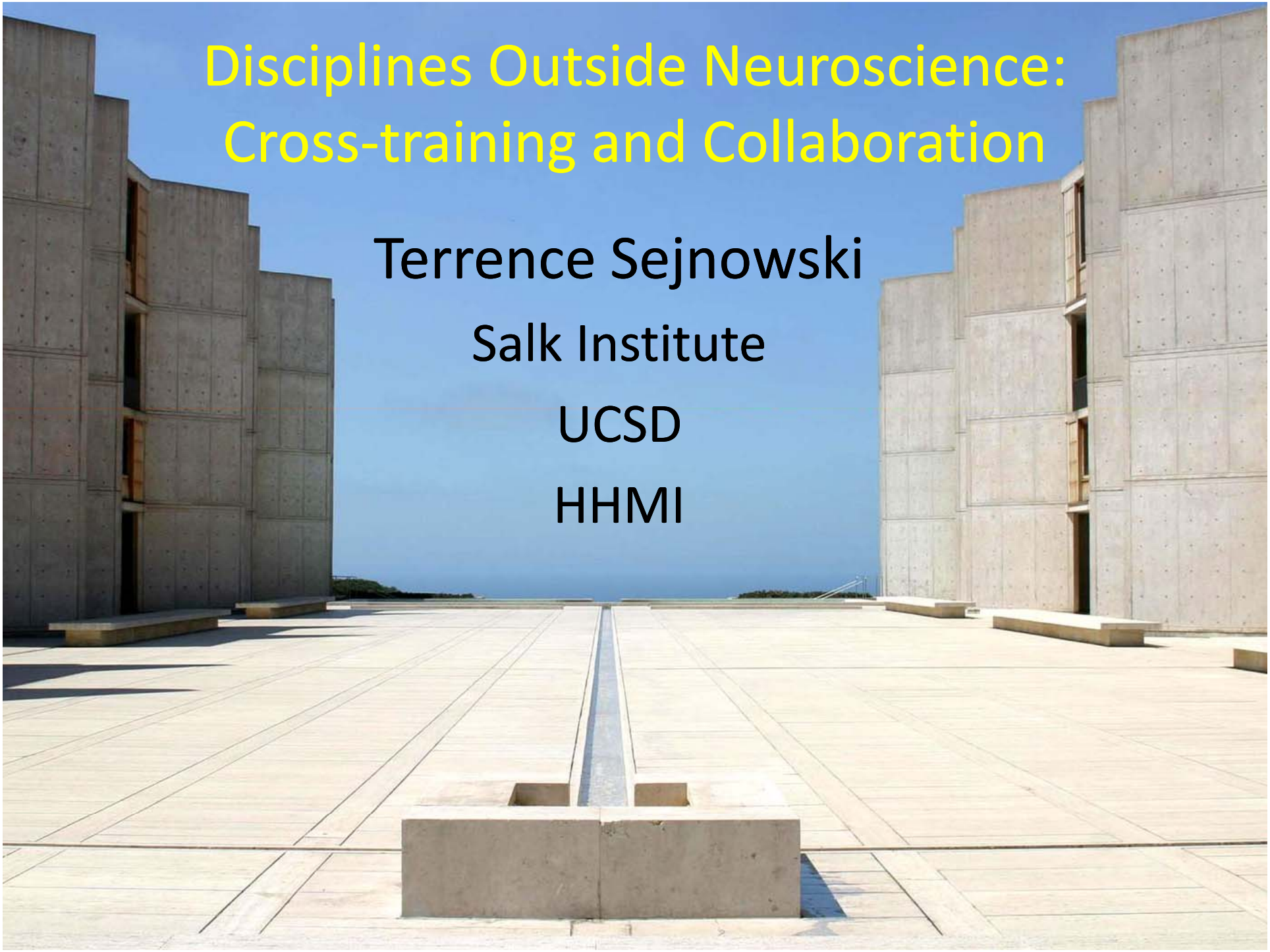

Disciplines Outside Neuroscience:
Cross-training and Collaboration
Terrence Sejnowski
Salk Institute
UCSD
HHMI

Advisory Committee to the NIH Director

BRAIN 2025

Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Working Group

JUNE 05, 2014

NIH National Institutes of Health
Turning Discovery Into Health


NIPS
LAKE TAHOE NEVADA
DECEMBER 5 - 10, 2013
http://nips.cc/
NEURAL INFORMATION PROCESSING SYSTEMS

THE NATIONAL ACADEMIES

KECK FUTURES INITIATIVE

Reflecting on the Past, Planning for the Future

TERRENCE J SEJNOWSKI

HOWARD HUGHES MEDICAL INSTITUTE; SALK INSTITUTE

CHAIR, NAKFI TEN YEAR EVALUATION & PLANNING PANEL

BRAIN Initiative

WORKING GROUP IDENTIFIED

15 members + 3 ex officio members;
Selected for visionary leadership, broad expertise

FOUR WORKSHOPS

Human Neuroscience
Minneapolis, MN
August 29-30

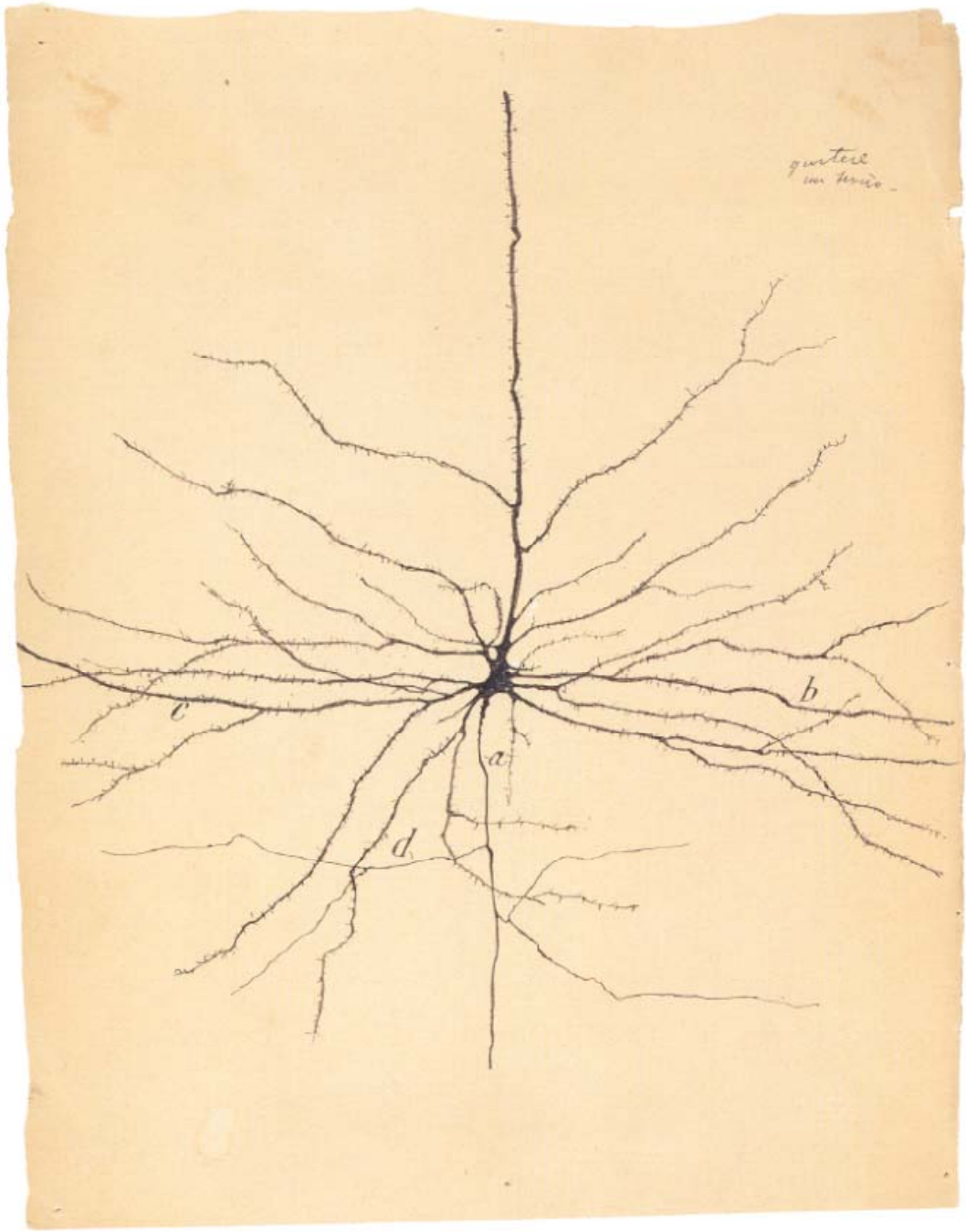
Molecular approaches
San Francisco, CA
May 29-30

Theory, computation and big data
Boston, MA
July 29-30

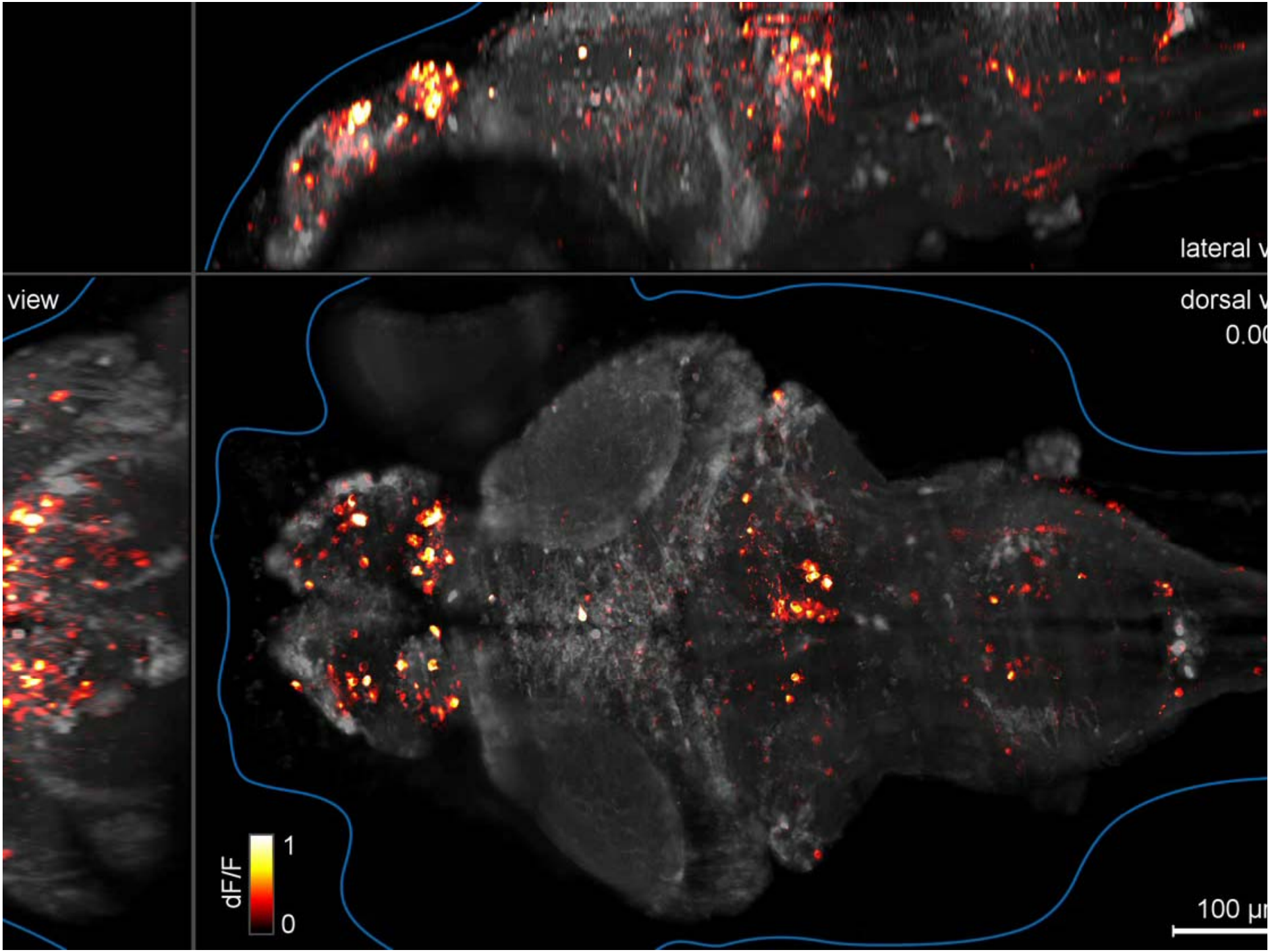
Large-scale recording and structural neurobiology
New York, NY
June 26-27

THREE ADDITIONAL MEETINGS

April 16, May 5, September 8



Cajal, 1899


lateral v
view
dorsal v
0.00
dF/F
1
0
100 µ

BRAIN 2025: Scaling Up Neuroscience

- Genetics: Cell Types
- Physiology: Large Scale Recordings
- Anatomy: Connectomics
- Behavior: Less Constrained
- TMCS: Theory/Modeling/Computation/Statistics

BRAIN 2025: TMCS

Theory, Modeling, Computation and Statistics

Goal:

Conceptual foundations for understanding the biological basis of mental processes through development of new theoretical and data analysis tools

Objectives:

- **Predictions:** Distinguish between competing ideas to help direct further experiments.

- **Integration:** Across experimental data obtained from different experimental techniques, scales and systems.

- **Multiscale Models:** New analytic and computational methods are required to understand how behavior emerges from signaling events at the molecular, cellular and circuit levels.

BRAIN 2025: TMCS

Infrastructure for Preserving and Sharing Data

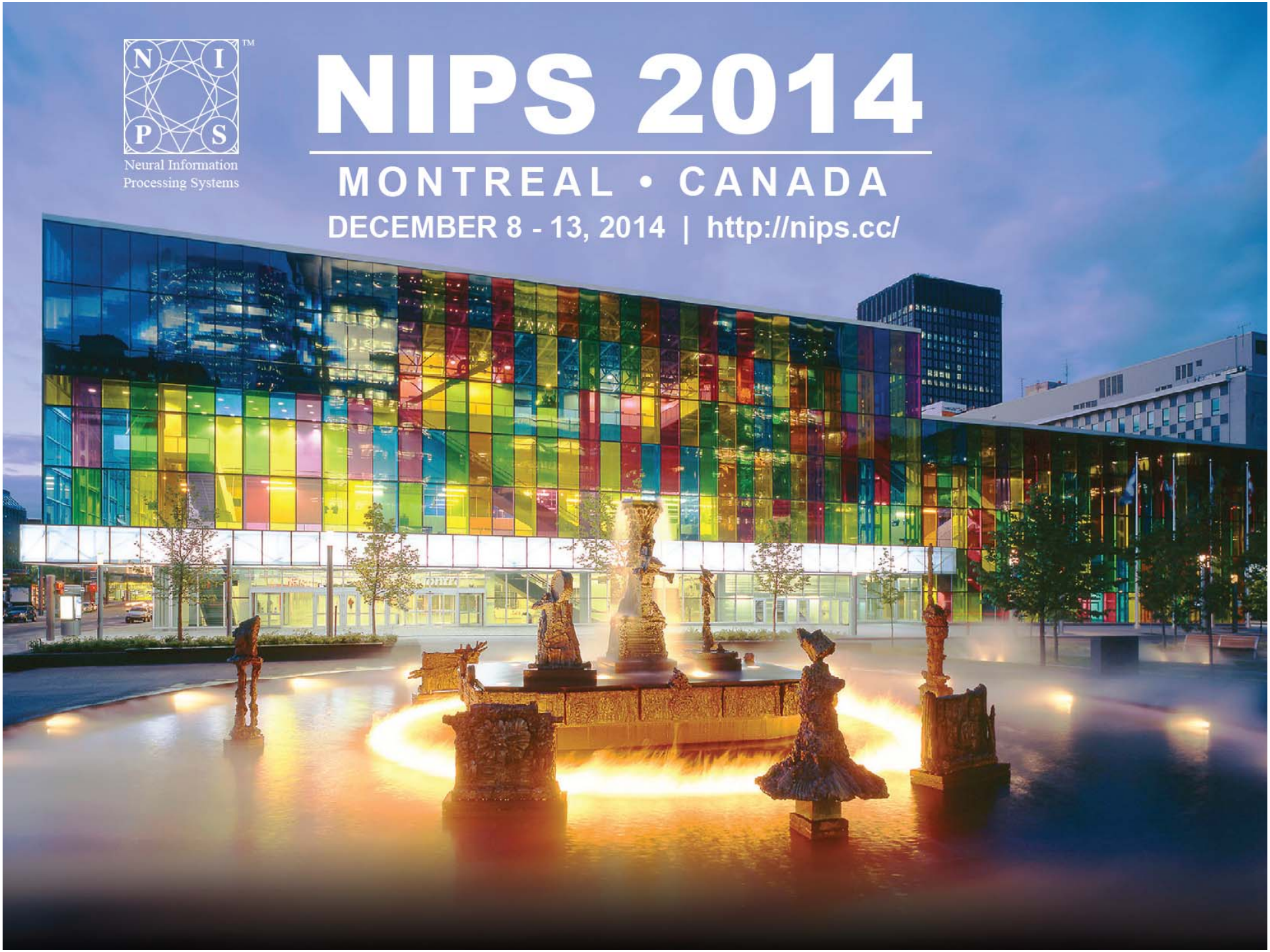
Objective:

Accelerate scientific progress by establishing platforms for sharing data and data analysis tools.

Deliverables:

- Integrated repositories for datasets and data analysis tools, with an emphasis on user accessibility and expert curation.

- An infrastructure for open sharing of archival data and tools for data analysis that improve reproducibility of published results, makes new analyses possible, and facilitates comparisons to data from future experiments.


Neural Information
Processing Systems
NIPS 2014
MONTREAL • CANADA
DECEMBER 8 - 13, 2014 | http://nips.cc/

BRAIN 2025: TMCS

Overall Objective: The BRAIN Initiative should sponsor the development of quantitative expertise at all levels — faculty, postdoctoral and graduate student.

NIH: Change the composition and culture of NIH study sections to recognize that theory is critical for the neuroscience of the future.

Faculty: Provide incentives to biology and neuroscience departments so that theorists and statisticians are seen as important and integral faculty hires.

Training:

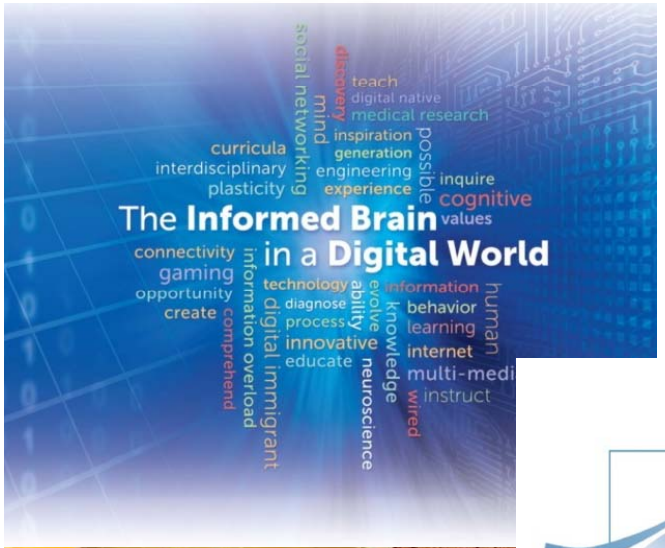
1) Ensure that all neuroscience postdocs and graduate students become proficient with basic statistical reasoning and methods, and

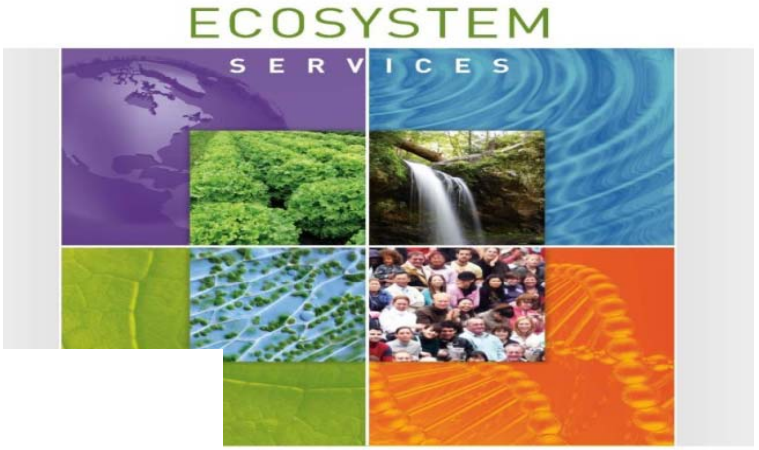
2) are able to analyze data at an appropriate level of sophistication, for example by writing code.

3) Encourage trainees to construct models as a way to generate ideas and hypotheses or to explore the logic of their thinking.

COLLECTIVE BEHAVIOR
From Cells to Societies

Nov 13 –15, 2014 • Irvine, CA • National Academies Keck *Futures Initiative*

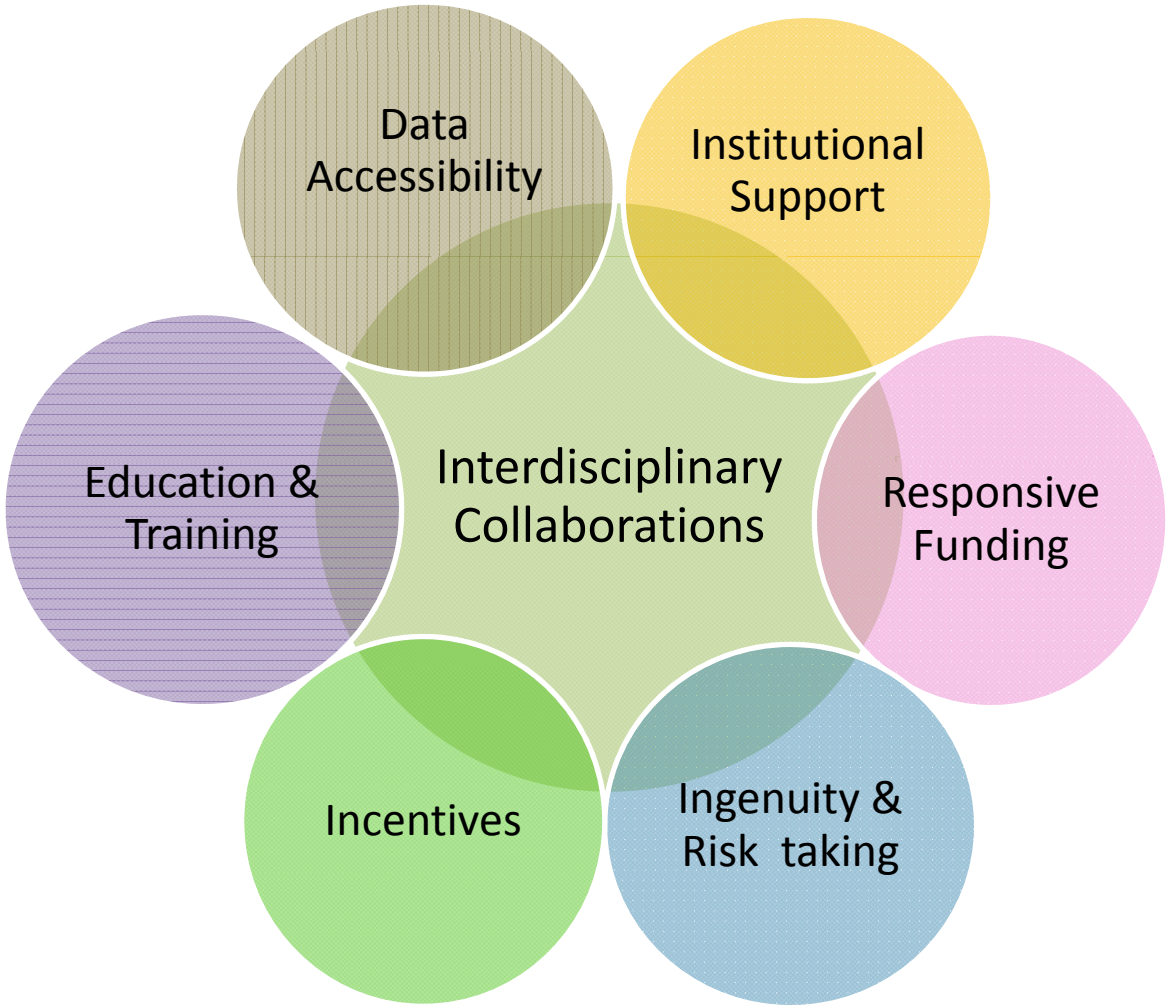




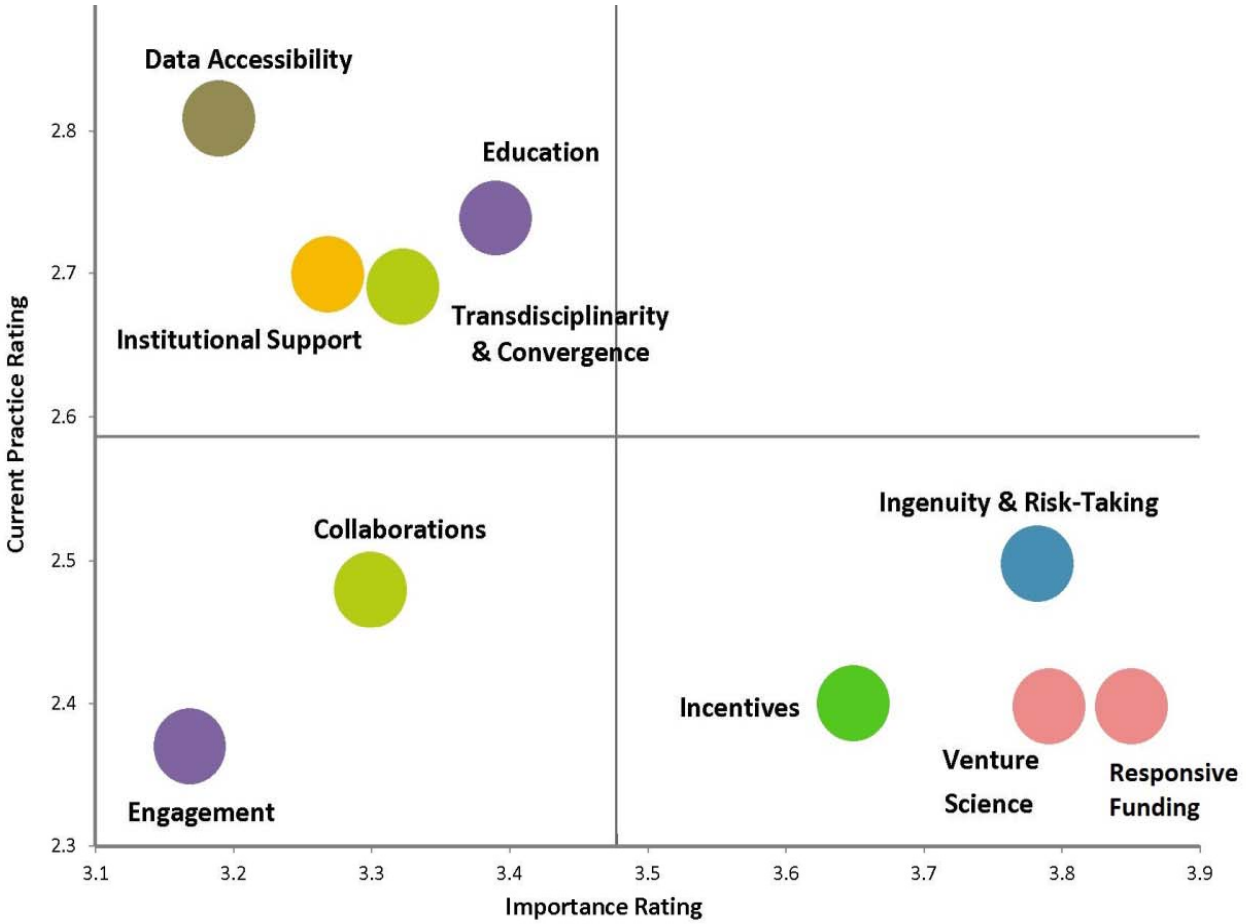
ting a Path to Sustainability

THE NATIONAL ACADEMIES
KECK FUTURES INITIATIVE

Conceptual Model for More Innovative Research



Research would be more innovative if...



Science and Technology

1900-1950 – Fundamental Physics

1950-2000 – Molecular Biology

2000-2050 – Information

Computer Science

Neuroscience

Nanoscience

President John F. Kennedy
The Decision to Go to the Moon
May 25, 1961, Joint Session of Congress