Defining the Expertise Needed for the 21st Century Neuroscience Workforce: A Workshop

October 28 - 29, 2014

Institute of Medicine
500 Fifth Street NW, Room 100
Washington, DC

Background:
From its very beginnings, neuroscience has been fundamentally interdisciplinary. As a result of rapid technological advance and the advent of large collaborative projects, however, neuroscience is expanding well beyond traditional sub-disciplines and intellectual boundaries to include expertise from many other fields, such as engineering, computer science, and applied mathematics. Revolutionary tools are quickly becoming incorporated into the work of many labs. However, the importance and rapid proliferation of mission-critical technologies raises important questions as to how to train the next generation of neuroscientists, not only to use particular tools, but to be prepared for a changing technological landscape. In addition, the advent of new types of data and the growing important of large data sets raises additional questions about how to train the next generation in approaches to data sharing and proper analysis. These concerns dovetail with the need to teach improved scientific practices ranging from experimental design (powering of studies, appropriate blinding) to greater sophistication in statistics. As important, is the increasing need for investigators who are able to bridge the translational gap between basic and clinical neuroscience. Given the changing landscape resulting from technological advance and the growing importance of interdisciplinary and collaborative science, the goal of this workshop is to explore future diverse workforce needs and consider the changing needs of training programs.

Meeting objectives:
- Explore future workforce needs in light of new and emerging tools, technologies, and techniques
    - Consider what new sub-disciplines and/or collaborations with other fields might be needed moving forward
    - Describe opportunities and challenges for cross-training of neuroscience research programs with other areas (e.g., engineering, computer science, mathematics, physical sciences) and across research environments (e.g., academia, industry)
- Identify current components of graduate training programs that could be leveraged and new components that could be developed that might lead to:
    - Greater interdisciplinary and collaborative approaches
    - Enhanced data handling and analysis capabilities
    - Increased scientific accuracy and reproducibility
    - Improved understanding of translational research
    - Enhanced awareness of ethical research practices

- Examine roles of training program funders (e.g., government, fellowships), administrators, mentors and mentees in developing and executing revised training programs to meet the needs outlined above.
- Consider mechanisms for updating researcher competencies at multiple levels (e.g., post-doctoral, independent investigators) to meet the needs outlined above.

DAY ONE: Lunch on your own

12:30 p.m. Opening Remarks

HUDA AKIL, *Co-chair*
Professor of Neurosciences
Department of Psychiatry
University of Michigan

STEVIN ZORN, *Co-chair*
Executive Vice President
Neuroscience Research
Lundbeck Research USA

12:35 p.m. Challenges for the Next Generation of Scientists

STORY LANDIS
Director
National Institute of Neurological Disorders and Stroke

12:55 p.m. The Changing Neuroscience Research Landscape: Opportunities and Challenges

EVE MARDER
Professor of Biology
Brandeis University

1:15 p.m. Imagining the Future Neuroscience Workforce

CAROL MASON
Professor
Department of Pathology and Cell Biology
Columbia University

1:35 p.m. Discussion with Speakers and Participants

- What key workforce characteristics would best position the field to address emerging opportunities and challenges in neuroscience research?

SESSION I: BASIC SCIENTIFIC PRINCIPLES AND FUNDAMENTAL KNOWLEDGE

Session Objectives: Identify current gaps in expertise necessary to advance fundamental knowledge and basic neuroscience research. Explore the impact of integrating additional disciplines into the basic neuroscience research enterprise. Examine innovative programs addressing these gaps. Consider potential strategies for creating and/or updating training of both current and future researchers.

Session Moderator: KATJA BROSE
Editor
Neuron

1:55 p.m. Defining the Gap in Neuroscience Expertise around Basic Scientific Principles and Fundamental Knowledge

JOAN FERRINI-MUNDY
Assistant Director
Directorate for Education & Human Resources
National Science Foundation

2:15 p.m. Addressing the gaps through cross-training and collaboration

- How could disciplines outside the neurosciences help address this gap? Which disciplines would provide the greatest value-add?

TERRY SEJNOWSKI
Professor
Computational Neurobiology Laboratory
Salk Institute for Biological Studies

2:35 p.m. Program Example

- What gaps in knowledge has the program focused on? How were these gaps determined?
- What challenges and opportunities have emerged during development and execution of the program?

DARCY KELLEY
Professor
Biological Sciences
Columbia University

2:55 p.m. Discussion with Speakers, Panelists and Participants

- How could programs be designed to enhance the abilities of current and future researcher to meet the challenges and develop an inter- and multi-disciplinary research enterprise?
  - What are priority components of such programs?

- How could enhanced awareness of ethical research practices be incorporated into current programs?

3:20 p.m. BREAK

SESSION II: DATA HANDLING AND ANALYSIS

Session Objectives: Identify current gaps in expertise necessary to advance the ability to handle and analyze data. Explore the impact of integrating additional disciplines into the basic neuroscience research enterprise. Examine innovative programs addressing these gaps. Consider potential strategies for creating and/or updating training of both current and future researchers.

Session Moderator: RICHARD MOHS
Vice President
Neuroscience Clinical Development
Eli Lilly and Company

3:30 p.m. Defining the Gap in Neuroscience Expertise around Data Handling and Analysis Knowledge

MARYANN MARTONE
Co-Director
National Center for microscopy and Imaging Research
University of California, San Diego

3:50 p.m. Addressing the gaps through cross-training and collaboration

- How could disciplines outside the neurosciences help address this gap? Which disciplines would provide the greatest value-add?

BRIAN LITT
Director
Penn Center for Neuroengineering and Therapeutics
University of Pennsylvania

4:10 p.m. Program Example

- What gaps in knowledge has the program focused on? How were these gaps determined?
- What challenges and opportunities have emerged during development and execution of the program?

MICHAEL SPRINGER
Assistant Professor of Systems Biology
Department of Systems Biology
Harvard Medical School

4:30 p.m. Discussion with Speakers, Panelists and Participants

- How could enhanced teaching of statistical methods bolster research?

- How could programs be designed to enhance the abilities of current and future researcher to meet the challenges and develop an inter- and multi-disciplinary research enterprise?
    - What are priority components of such programs?

SESSION III: TRANSLATIONAL SCIENCE

Session Objectives: Identify current gaps in neuroscience expertise around translational science. Explore the impact of greater understanding and knowledge in furthering innovative therapeutic development. Examine current programs focused on improving translational neuroscience research. Consider potential strategies for creating and/or updating training of both current and future researchers.

Session Moderator: ATUL PANDE
President
Verity BioConsulting

4:55 p.m. Defining the Gap in Expertise around Translational Science Knowledge

FRANK YOCCA
Vice President
Neuroscience iMed
AstraZeneca Neuroscience

5:15 p.m. Addressing the gaps through cross-training and collaboration

- How could disciplines outside the neurosciences help address this gap? Which disciplines would provide the greatest value-add?

HOWARD FEDEROFF
Executive Dean
School of Medicine
Georgetown University

5:35 p.m. Program Example

- What challenges and opportunities have emerged during development and execution of the program?

ANTHONY RICCI
Edward C. and Amy H. Sewall Professor
Stanford School of Medicine

5:55 p.m. Discussion with Speakers, Panelists and Participants

- What fields outside the sciences (e.g., regulatory) might also be included in programs designed around developing translational neuroscientists?
- How could programs be designed to enhance the abilities of current and future researcher to meet the challenges and develop an inter- and multi-disciplinary research enterprise?

- What are priority components of such programs?

6:15 p.m. Day One Wrap-Up & ADJOURN

HUDA AKIL, *Co-chair*
STEVIN ZORN, *Co-chair*

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BREAKFAST ON YOUR OWN

8:30 a.m. Day Two Opening

HUDA AKIL, *Co-chair*
STEVIN ZORN, *Co-chair*

SESSION IV: EXPERIMENTAL RIGOR AND QUANTITATIVE SKILLS

Session Objectives: Identify current gaps in neuroscience expertise to improve experimental rigor and quantitative skills. Explore the impact of greater expertise in this area on the neuroscience research enterprise. Examine innovative programs addressing these gaps. Consider potential strategies for creating and/or updating training both current and future researchers.

Session Moderator: RICHARD BORN
Professor
Department of Neurobiology
Harvard Medical School

8:40 a.m. Defining the Gap in Expertise around Experimental Rigor and Quantitative Skills

- Are there challenges in these areas specifically related to neuroscience research?

EMERY BROWN
Professor of Computational Neuroscience
Department of Brain and Cognitive Sciences
Massachusetts Institute of Technology

8:55 a.m. Addressing the gaps through cross-training and collaboration

- How could disciplines outside the neurosciences help address this gap?
- Which disciplines would provide the greatest value-add?

MARK COHEN
Professor
Department of Bioengineering
University of California, Los Angeles

9:15 a.m. Program Example

- What challenges and opportunities have emerged during development and execution of the program?

JAMES BARRETT
Professor and Chair
Department of Pharmacology and Physiology
College of Medicine, Drexel University

9:35 a.m. Discussion with Speakers and Participants

- Which quantitative tools might provide the most benefit?
- How could greater skills in these areas improve the reproducibility of scientific results?
- How could programs be designed to enhance the abilities of current and future researcher to meet the challenges and develop an inter- and multi-disciplinary research enterprise?
  - What are priority components of such programs?

10:00 a.m. BREAK

SESSION V: EMERGING TOOLS, TECHNOLOGIES, AND TECHNIQUES

Session Objectives: Explore challenges and opportunities for integrating emerging tools, technologies, and techniques into current neuroscience research practice. Examine innovative programs training neuroscience researchers to utilize and incorporate new and emerging tools, technologies, and techniques into current research programs. Consider potential strategies for developing a neuroscience research enterprise that seamlessly disseminates and incorporates new and innovative tools, technologies, and techniques.

Session Moderator: JOHN MORRISON
Professor
Department of Neuroscience
Icahn School of Medicine at Mount Sinai

10:15 a.m. Challenges and Opportunities in Neuroscience Research for Real-Time Integration of Emerging Tools, Technologies, and Techniques

DOUGLAS WEBER
Program Manager
Biological Technologies Office
Defense Advanced Research Projects Agency

10:35 a.m. Mechanisms for Integrating Emerging Tools, Technologies, and Techniques

- How are emerging and new tools, technologies, and techniques being integrating in real-time into research programs?

MARIE-FRANCOISE CHESSELET
Charles H. Markham Professor of Neurology
Reed Neurological Research Center
University of California, Los Angeles

10:55 a.m. Discussion with Speakers, Panelists and Participants

- What skills might provide the greatest benefit to researchers when preparing to integrate new tools, technologies, and techniques into research programs?
- Is there an opportunity related to the BRAIN initiative?
- How could programs be designed for both current and future researchers to meet the challenges and develop an inter- and multi-disciplinary research enterprise?

SESSION VI: DEVELOPING A DIVERSE NEUROSCIENCE RESEARCH ENTERPRISE THROUGH COLLABORATION

Session Objectives: Explore challenges and opportunities associated with developing a diverse neuroscience research enterprise with greater incorporation of collaborative science approaches. Consider the role of cross-disciplinary training of future scientists in increasing collaborative and innovative science.

Session Moderator: WALTER KOROSHETZ
Deputy Director
National Institute of Neurological Disorders and Stroke

11:30 a.m. Challenges and Opportunities in Neuroscience Research for Collaborative and Diverse Science

DENNIS CHOI
Director
Neurosciences Institute
Stony Brook University

11:50 a.m. What role can the Big Data Projects (BRAIN, HBP, Allen Institute) play in developing new opportunities to enhance cross-disciplinary training, and boost the likelihood and ease of future novel collaborations in neuroscience?

JANE ROSKAMS
Executive Director, Strategy and Alliances
Allen Institute for Brain Science

12:10 p.m. LUNCH

1:10 p.m. Increasing Innovative Neuroscience Research through Collaboration

- How has the collaboration(s) advanced innovative science?
- What challenges and opportunities have emerged during development of the collaboration?

DAVID LOPES CARDOZO
Associate Dean for Graduate Studies
Director Division of Medical Sciences
Harvard Medical School

1:30 p.m. Discussion with Speakers, Panelists and Participants

- What are potential mechanisms for training?
  - Can *collaboration* be taught?
- What impact would concerns around career development have on encouraging collaborative research?
- How could programs be designed to enhance the abilities of current and future researcher to meet the challenges and develop an inter- and multi-disciplinary research enterprise?

1:55 p.m. BREAK

SESSION VII: DEVELOPING AND EXECUTING REVISED TRAINING PROGRAMS

Session Objectives: Examine the roles of neuroscience training program funders, administrators, mentors, and mentees in developing and executing revised training programs focused on diverse expertise in the areas identified in previous sessions. Consider specific challenges and opportunities related to the potential training program components outlined.

Session Moderator: NANCY DESMOND
Associate Director
Division of Neuroscience and Basic Behavioral Science
National Institute of Mental Health

2:10 p.m. Developing and Executing New Neuroscience Training Programs

OSWALD STEWARD
Director, Reeve-Irvine Research Center
Senior Associate Dean for Research
University of California Irvine School of Medicine

2:30 p.m. Perspectives and Panel Discussion: Integrating New Training Components

- Given the potential new expertise identified, describe current and potential mechanisms for integration. Consider potential challenges for integration.
- Consider how training programs could be different for future researchers vs. current investigators (e.g., postdoctoral fellows, principle investigators)

- Explore new and/or alternative training mechanisms that might facilitate training (e.g., online courses)
- Discuss additional skills that might be critical for researchers to possess (e.g., critical thinking, management, administrative, communication)

Training Program Funder

TOM INSEL
Director
National Institute of Mental Health

Department Administrator

RICHARD TSIEN
Druckenmiller Professor of Neuroscience
Director Neuroscience Institute
Chair Department of Physiology and Neuroscience
NYU Langone Medical Center

Mentor

INDIRA RAMAN
Professor
Department of Neurobiology and Physiology
Northwestern University

3:15 p.m. Mentor and Mentee Response Panel

- What potential challenges and opportunities for integration of new topics into current and future training programs?

DIANE LIPSCOMBE
Professor of Neuroscience
Center for Neurobiology of Cells and Circuits
Brown University

KATHERINE PRATER
Graduate Student
University of Michigan

SOFIA JURGENSEN
Postdoctoral researcher
Laboratory of Pablo E. Castillo
Dominick P. Purpura Department of Neuroscience
Albert Einstein College of Medicine

MARGUERITE MATTHEWS
Postdoctoral Fellow
Department of Behavioral Neuroscience
Oregon Health and Science University

4:00 p.m. Discussion with Speakers, Panelists and Participants

SESSION VIII: NEXT STEPS FOR NEUROSCIENCE RESARCH

Session Objectives: Explore priority areas for updating the knowledge and expertise of current and future scientists in an effort to address future neuroscience workforce needs. Identify tangible next steps for developing and integrating new concepts and expertise into current and future training programs. Discuss the role of funders, administrators, mentors, and mentees in this process.

4:50 p.m. Panel Discussion

Session Moderators

5:30 p.m. Final comments

HUDA AKIL, *Co-chair*
STEVIN ZORN, *Co-chair*

5:45 p.m. ADJOURN