

Developing and Executing New Neuroscience Training Programs

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

October 28 - 29, 2014
Institute of Medicine

Why are we asking this question?

- There must be a perception that there is a need for something “new”.
- Who feels this need?
 - Leadership in the field?
 - Leaders of training programs?
 - Trainees (the ones who matter)?
 - Funding agencies (Top-down, mission-driven)?
 - Consumers (academia, industry)?
 - And which of these do we care about? There is room for differences of opinion here. BUT training requires funding, so there are 600lb gorillas in the decision matrix.
- Who CAN make use of the ideas/conclusions?

Or is it just that we like/need change?

Hawthorne effect (AKA “Westinghouse effect”): Named for the *Hawthorne Works*, a factory built by Western Electric.

In the 1920’s, efficiency engineers were assessing whether improved working conditions would increase performance at the production line.

Experiment: Changing to improved working conditions increased efficiency.

Control: But, when the production line was returned to its original condition, efficiency increased again.

The engineers concluded that it was the observation of the workers, not the change in conditions that led to increased efficiency.

But the alternative interpretation is that the increase in efficiency occurred when the conditions were changed, regardless of what the change was.

Opinion: *Changes in the medical curriculum are perceived as improvements largely because of the Hawthorne effect.*

Motivation/basic philosophy?

- Is the motivation for new training programs investigator-initiated (bottom-up)?
- Or based on perceived need/central planning (top-down)?
 - Training programs depend on funding: currently there are two paradigms for funding trainees.
 - Program-based (funded by training grants, fellowships).
 - Specific Aim-specific (funded by research grants).

Fundamental questions

- Is neuroscience a discipline?

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- Is neuroscience interdisciplinary?

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- Is neuroscience a discipline?
- Is neuroscience interdisciplinary?
- Is neuroscience RESEARCH interdisciplinary?

Choose the best answer:

- If a *computer scientist* is putting together an inter-disciplinary team of mathematicians, computer scientists and neuroscientists, they want:
 - A specialist? (meaning someone who is a card-carrying *Neuroscientist*).
 - A generalist? (meaning someone can talk the language of computer science, but may not have deep knowledge about the brain).
 - Opinion: An interdisciplinary team requiring a neuroscientist needs a card-carrying *Neuroscientist*.
 - Similarly, if a neuroscientist was putting together a team requiring a mathematician, they would want a *Mathematician* (not a neuroscientist with some knowledge of math).
 - So there is still a need for specialists (meaning experts in the discipline of neuroscience).

The history of Neuroscience as a Discipline

- In August 1968, Ralph Gerard (then at UCI) *appointed* Ed Perl as Chair of a 20 member Executive Group for the Organization of Brain Sciences, to organize an "extensive network of local organizations" to build a national consensus for the creation of an **interdisciplinary** society.
- Over the winter of 1969, Perl drafted a constitution and bylaws for this new organization and enlisted Louise Marshall to request institutional assistance and operating funds from NAS.
- The Executive Group shared drafts of the Constitution and bylaws, which put no limits on members from any **sub-discipline**, with 200 colleagues they had identified as potential members.
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- On June 16, 1969, the Committee on Brain Sciences held the crucial meeting that would bring the ***Society for Neuroscience*** into being. Psychologist Neal Miller of Rockefeller University, as the chair, reviewed the survey findings and the proposed Constitution and bylaws submitted by Perl and his Executive Group. "Miller waved his long yellow pencil" and "all 20 of those at the conference table... **being qualified neuroscientists**, became founding members."

Signatories of the Neuroscience Declaration of Independence

Edgar A. Bering, NINDS

A.T. Bever, NSF

John M. Brookhart, NSF

James H. Brown, NSF

Robert W. Doty, University of Rochester

Fred Elmadjian, NIMH

Daniel X. Freedman, Pritzker School of
Medicine

Ralph Gerard, UC Irvine

Lore Heinlein, Elsevier

Richard T. Louttit, NIMH

Charles U. Lowe, NICHD

Louise H. Marshall, NAS-NRC

Neal Miller, Rockefeller, University

Edward R. Perl, University of Utah

Alfred Pope, McLean Hospital

Vernon Rowland, Case Western Reserve
University

James M. Sprague, University of
Pennsylvania

Eliot Stellar, University of Pennsylvania

Robert L. Thompson, Hunter College

John E. Wilson, University of North
Carolina

There has always been a creative tension about the definition, which we are revisiting today.

- Should it be the Society for Neuroscience or the Society for Neurosciences.
- The conclusion of the founding fathers and mother (AFTER MUCH DEBATE) was the former, which implies that there is a discipline of Neuroscience.
- And so it is the *Society for Neuroscience*.

Pre-meeting conversations

- *Neuroscience* IS a discipline.
- There is need for training programs in the discipline of Neuroscience. Discussion: May be a need to sharpen Neuroscience as a frame of reference.
- Probably a substantial majority of people doing neuroscience research are not Neuroscientists.

What constitutes the core knowledge for a Neuroscientist?

- I sent out a draft list of about 20 topics for a rough opinion poll.
- No-one cut any of the topics; everyone who commented added topics.
- With more courses in the dinner, the portions have to be smaller.

Implications for neuroscience training programs

- When we talk about neuroscience training programs, are we talking about
- Training OF neuroscientists (meaning training in the core knowledge of a discipline that qualifies one to be called a *Neuroscientist*)?
- Training IN neuroscience (meaning training for individuals in OTHER disciplines that would allow them to be partners in the greater enterprise of neuroscience research)?
- Can a single program fit both needs?
 - Opinion: probably not. So, we need to be intentional about what we are trying to do.

Vignette

- Brian Litt's talk—a trainee in the neuroscience program at Penn could get their Ph.D. in:
 - XXX
 - YYY
 - *Or Neuroscience (Caps and Ital mine).*
 - What does this mean? I think it means that there is an implied intention to provide an option of training OF neuroscience *OR* IN neuroscience.
 - Opinion: These are different paths. It's important to be intentional in designing these different paths and define them clearly for trainees, training faculty, and funding agencies.

Asked another way:

- There could be training programs of Neuroscientists.
- Or training programs in neuroscience research, which is interdisciplinary.
 - Opinion: There is a place for both, but it's important to be clear about the goals.

For whom are we training?

- Should we be training people to be Renaissance scientists, who seek to discover, to feel the freedom to explore, “...to boldly go where no *man* (meaning person) has gone before”?
- Or, should we be training people to be goal directed, focused on solving problems, to “land a “*man*” on the moon by the end of the decade”, to find cures for the disorders that are the scourge of humanity?
- Can the same goals be met without clearly identifying the paths?
 - Opinion: *Probably not; distinct tracks are probably desirable.*

Opinion

- There is room (and a need) for different types of training programs that specialize.
 - Renaissance science (to boldly go..., to discover how things work)
 - Goal-directed science (also to discover how things work, but in the context of a defined goal).
 - Define the “connectome”
 - Identify the diversity of neuron types
 - Develop new technologies
 - Translational science (a sub-type of goal-directed that seeks to make things work in the way you want).
 - Develop new therapies for neurological and neuropsychiatric disorders.

Think locally, act globally?

- What key training elements could/should be accomplished through on-line training modules or at specialized training centers?
 - Professional skills training
 - Scientific rigor
 - Neurobiology of disease
 - Animal models of disorders
 - Centers for technology training

Who will define conditions?

- What constitutes a training program in Neuroscience?
- What are the metrics for admission?
 - Best predictors?
 - Academic performance?
 - Scores on standardized tests?
 - Other definable metrics?
 - Have you participated in team sports?
 - What are your volunteer activities?
 - Gut impressions (The Teddy bear test)

Disconnects

- *Stakeholder* decisions regarding best selection criteria may not (probably won't) match up with the metrics for evaluation used by funding agencies to evaluate training program quality.
- And only the defined metrics will matter in terms of funding.
- So, in a practical sense, our decisions on *what matters for success* are IRRELEVANT unless we (stakeholders) can influence the *metrics for evaluation* used by funding agencies.
- But is there consensus on metrics?
 - Opinion: probably not. So, we will be left with traditional evaluative metrics.

Dimensions of programmatic diversity

- The longest discussions are probably on topics (disciplinary)
 - Neuroanatomy, Neurophysiology, Cellular, Molecular, Developmental, Computation
 - Experimental, Theoretical, Computation
- Guiding philosophy (what are you trying to teach?)
 - Freedom to explore
 - Tension between individual freedom/independence vs. team membership?
 - Focus on a goal
 - Focus on translation
- Purpose (career paths)
 - Academia, Industry, Publication, Education, Administration

But people change their minds

Opinion: Many programs are trying to do everything without being explicit about the philosophy and purpose, which is probably not the optimal strategy.

Opinion: To Develop and Execute New Neuroscience Training Programs there will need to be differentiation

- Execution:
 - Define the purpose of the program.
 - Based on the purpose, define the philosophy.
 - Based on the purpose and philosophy, define the topics.

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- Execution:
 - Define the purpose of the program.
 - Based on the purpose, define the philosophy.
 - Based on the purpose and philosophy, define the topics.
- But in the end, how we develop and execute training programs will depend to a large extent on what the funding agencies will support.