National Institutes of Health
Center for Scientific Review
Open House Workshop: Neuroscience
March 2, 2007
Natcher Conference Center, Bethesda, MD

Meeting Summary

Welcome and Introduction

Dr. Elias Zerhouni (Director, National Institutes of Health [NIH]) welcomed the participants and expressed his gratitude for the services that scientific reviewers render to NIH, whose success results in no small part from their contributions. Over 31,000 scientists participate in NIH peer reviews, probably the largest scientific consulting group in the world. Their work has increased in recent years as rising budgets have led to an increase in the number of grant applications, a broadening of the fields of science under review, and an acceleration in the cycle of science. Because peer review is so vital to the integrity and excellence of science, it behooves NIH to periodically review the peer review process, ensuring that it has kept pace with its field. The present workshop and others that will follow are designed to determine whether the NIH peer review process has kept pace with an evolving field, and to suggest minor adjustments (not radical changes) that might improve its performance.

Dr. Toni Scarpa (Director, Center for Scientific Review [CSR]) noted that there were 200 scientists in the audience, about evenly divided between NIH and the extramural scientific community, and that 24 of the 29 study section chairs in neuroscience were in attendance. He explained that this would be the first of six workshops to be held every 2 months over the next year. In each case, the goal is to get the community's responses and input on two central questions:

1. Is the science of your discipline, in its present state, appropriately evaluated within the current study section alignment?
2. What will be the most important questions and/or enabling technologies you see forthcoming within the science of your discipline in the next 10 years?

For this reason, the breakout sessions will be vital, and participants are asked to focus on the science. Questions about process should be held for the afternoon, when time would be set aside to address them. Finally, he recognized the contributions of intern Shannon Connolly, whose efforts had made this workshop possible.

Overview of the Current Organization of the Neuroscience Study Sections

Dr. Anita Sostek Miller, (Division Director for Clinical and Population-based Studies, CSR), reported that the current structure of peer review in the neurosciences had its beginnings in 1992, when the research components of the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA) were returned to NIH, and the Division of Research Grants, the precursor to CSR, was given 5 years to design an integrated review process. In 1998 the first applications were reviewed under this design, which included 21 study sections organized under 3 integrated

review groups (IRGs). One of the principles of this organization was that applications should be assigned to study sections based on scientific focus rather than professional affiliation, in order to reduce "IC captivity." Between 2001–2002 and again in 2005–2006, CSR conducted internal reviews of this integrated structure, resulting in additional study sections and some resorting among IRGs, resulting in the current structure of 29 study groups under three IRGs:

1. Molecular, Cellular, and Developmental Neuroscience (MCDN);
2. Integrative, Functional, and Cognitive Neuroscience (IFCN); and
3. Brain Disorders and Clinical Neuroscience (BDCN).

A retrospective evaluation of the neuroscience IRGs, conducted in 2003, rested on three components: reports from CSR working groups, surveys of applicants and program staff, and internal data. This report pointed out the importance of "senior," experienced reviewers and the need for special training of both reviewers and study section chairs. It also revealed that most applicants were satisfied with the timeliness and usefulness of the review process, although (perhaps understandably) those who received funding were more satisfied than those who did not. Internal data analysis indicated that this structure has markedly reduced "IC captivity," and there have been modest fluctuations in how well applications previously assigned to different ICs fared in the reorganized neuroscience study sections. Several concerns were identified that went beyond the neurosciences study sections, notably the special needs of new principal investigators (PIs). In addition, review of fellowships was moved from regular (R01) study sections to dedicated review committees that could focus more narrowly on training criteria. It remains possible to modify the study sections based on changes in the underlying science, with broad input from the scientific community.

Past Study Section Evaluations, Working Group Reports, and Realignments

As an example of how study sections have evolved, Dr. Don Schneider, (Division Director for Molecular and Cellular Mechanisms, CSR), explained that the MCDN IRG was originally formed with seven study sections, but as the field has grown and evolved, some of the study sections have split (one more than once), others have been restructured, and a few have moved to different IRGs. MCDN has also formed a number of special emphasis panels (SEPs) on subjects such as small business, fellowships, neurogenetics, neuroinformatics, and neuroimaging. In the most recent restructuring (2006), a Working Group, which ensured stakeholder participation, recommended further evolution, including a division of the study section on Neural Degenerative Disorders and Glial Biology, where the workload had risen above the recommended 50–80 applications a cycle, and the consolidation of SEPs from different IRGs, with shared interests and low workloads. At the end of this process, the MDCN IRG had grown from seven to nine study sections. Further restructuring can be expected in the future.

Dr. Christine Melchior (Chief, IFCN IRG, CSR) reported on similar changes in her IRG. IFCN was originally established with nine study sections, and a tenth was added in 1999. In the most recent cycle of review, whose report will go to the Peer Review Advisory Committee, a working group addressed not only study section organization but also a wide range of procedural issues, including selection of reviewers, reviewer workload, SRA management of meetings, and better

ways of scoring applications. It also recommended increased training for new reviewers (possibly by pairing with experienced reviewers), ad hoc reviewers when special expertise is required, and a limit of 35 reviewers at a single meeting. It also criticizes telephone reviewers as a "necessary evil" that may disrupt the flow of the meeting but works best when the remote participant is an experienced reviewer well known to the group. Mail reviews, on the other hand, seem to have a limited impact, and Internet-assisted reviews hold considerable promise for the future. In general, study sections are open to new ideas and approaches to peer review.

Discussion

Dr. Schneider and Dr. Melchior were joined for a discussion session by Dr. Carole Jelsema (Chief, MCDN IRG, CSR), Rene Etcheberrigaray (Chief, BDCN IRG, CSR), Dr. Anita Miller Sostek, and Dr. Cheryl Kitt (Deputy Director, CSR).

The first point discussed was the CSR scoring system, which assigns a numerical (percentile) score rather than a rank order. A rank-order scoring system is being considered as an option for scoring in a pilot study section.

There was some discussion related to identifying innovation in applications. There was concern that applications show little innovation and that no credit is given without preliminary data. Another comment was that reviewers may not have the expertise to recognize innovation. Considering these points, CSR staff reiterated that scores should reflect all five criteria, and that innovation is best evaluated under the heading of "significance." Regarding a question relating to the review of translational research, panelists said that some study sections address translation directly, while others use *ad hoc* members.

Another question was whether the growing number of applications in some study sections indicates an emerging area of science, or "hot spot", whose importance deserves increased funding, while other declining areas should receive less funding. CSR staff agreed with the need to anticipate emerging areas of science, but emphasized that CSR does not address the question of funding. Rather, CSR's job is to evaluate the quality and significance of grant applications, and to recommend those that represent the best science to the ICs which determine funding.

Explanation of Breakout Groups and Charge to Breakout Groups

The assignments and logistics for the six breakout groups in which participants would discuss the two central questions were reviewed:

1. Neural Excitability, Synapses, and Glia: Cellular/Molecular
2. Developmental Neuroscience
3. Behavioral and Sensory Neuroscience
4. Disorders of the Nervous System
5. Neuroendocrinology, Neuroimmunology, and Neurogenetics

6. Neurotechnology, Neuroimaging, and Neuroinformatics

The meeting then recessed for lunch and reformed in breakout groups for 90 minutes of discussion.

Report Out from Breakout Groups

Each of the breakout groups reported back with its answers and suggestions to the two questions they had addressed. The following summary is organized according to those questions, rather than by breakout group.

Question 1. Is the science of your discipline, in its present state, appropriately evaluated within the current study section alignment? Suggestions?

In general, the breakout groups reported that participants were satisfied with the evaluation of their disciplines under the current structure and organization of CSR study sections. Opinion polls of society memberships and previous applicants consistently show that a clear majority are satisfied with the review process, although this obviously means that some people are not satisfied. Most groups agreed that the recent growth in the number and expertise of study sections is moving in the right direction.

However, specific suggestions revealed that some areas of sciences are not adequately covered. For example, newly developed topics and emerging fields are not always well represented or well received. In addition, basic science is reviewed more adequately than clinical science, and there is a continuing problem with "complex"research (e.g., translational, multidisciplinary, discovery-based):

- Neural Excitability, Synapses, and Glia: Cellular/Molecular Group suggested that MNPS (molecular neuropharmacology and signaling) needs more chemists; BDPE (biology and diseases of posterior eye) needs more modeling and computer expertise; AED (anterior eye disease) might be moved from neuroscience to a cell science study section; and CMBG (cell and molecular biology of glia) should consider more cell types.
- Developmental Neuroscience Group urged CSR to avoid a bias against non-genetic models and to foster basic clinical interactions, for example in studying the impacts of different diseases on different stages of development.
- Behavioral and Sensory Neuroscience Group asked for recruitment of more senior scientists and greater continuity in SEPs, especially those that address translational research. Professional societies should urge their members to participate in the peer review process.
- Disorders of the Nervous System Group suggested that multi- and cross-disciplinary topics such as sleep and emergency medicine do not have a proper home at CSR. In addition, CSR should develop its own expertise in evaluating translational research that does not depend on IC review.

- Neuroendocrinology, Neuroimmunology, and Neurogenetics Group thought that professional societies should recommend lists of reviewers for CSR to consider, and that SRAs should consult their chairs in assigning applications to particular reviewers.
- Neurotechnology, Neuroimaging, and Neuroinformatics Group called for a greater focus on neuroscience and the application of new technology for the sake of neuroscience, not for the sake of the technology.

Question 2. What will be the most important questions and/or enabling technologies you see forthcoming within the science of your discipline in the next 10 years? Suggestions?

There was relatively little agreement among the breakout groups in terms of what questions will dominate the field of neuroscience in the next 10 years. This is perhaps to be expected, given the diversity of approaches and emphasis they represent. Nevertheless, two issues did appear on the lists from two or more groups:

1. Integrative science, in particular the integration of physiology and behavior, or the integration of molecular, cellular, and systems processes; and
2. The roles and interactions of genetics, environment, and behavior in both development and disease.

Other issues more closely reflected the topics and participants of specific breakout groups:

- Developmental neurobiology from prenatal to aging;
- Epigenetics in the context of natural environments;
- Prevention and early detection and diagnosis of neurological diseases;
- Common disease mechanisms, such as protein misfolding, chemokines, and angiogenesis;
- Better understanding of normal and disease biology of animal models and humans.

There was somewhat greater agreement on the enabling technologies that will be important to the field in the next 10 years, with four specific examples emerging from three or more of the breakout groups:

1. Bioinformatics broadly, and in particular better techniques for compiling, standardizing, validating, archiving, describing, sharing, and exploiting the large data sets that have accumulated in the post-biotechnology, post-genomic era.
2. Biotechnology broadly, and more specifically at the machine-brain interface, including:
    a. Techniques such as remote sensing, in vivo imaging and implants for gathering data about neurological structures and function; and (eventually)
    b. Instruments or techniques that can influence neural function and even turn signals on and off at specific times, places, and pathways.
3. Computational neuroscience, including computer simulation and modeling at all levels from the molecular to the system.
4. Applications to neuroscience from large-scale science fields such as genomics, proteomics, and catalomics.

Discussion

In the discussion that followed, several participants pointed out that NIH already supports seven centers of excellence in bioinformatics, but apparently participants feel the need for a new focus on neuroscience. A collaborative effort to develop such a center is already under way, and there may be a similar need in dealing with the large collections of data that have emerged on cellular signaling. One participant suggested that the field needed an anthropological dimension to account for demographic and social factors, particularly in other cultures, but Dr. Kitt announced that the next CSR open house, on April 25, would be on the subject of behavioral research.

Other participants suggested that these results point to a "paradigm shift" toward multiple investigator, collaborative, and interdisciplinary research and toward greater emphasis on inductive, descriptive, data-mining, and hypothesis-driven research. Dr. Kitt replied that these are tools that will be applied to neuroscience research in the future, and CSR will need to develop the necessary expertise and to recruit reviewers who have experience in these approaches but will remain open to other approaches.

Questions of Process

Toni Scarpa reported that he has repeatedly asked society presidents to nominate potential reviewers, and CSR has established a special committee to identify and track potential reviewers. It has become clear that this will require commensurate rewards, not only the intellectual reward of participating but also better compensation, supporting grants, and changes in the review process itself. In the past, the major complaints have been that there are too few senior reviewers, the process is too slow, it favors the predictable, and it puts an undue burden on reviewers.

CSR agrees that 10 applications per reviewer, or 50 reviewers around a table, is not conducive to a thoughtful review. As a result, CSR has been trying to improve the process in terms of its transparency, the uniformity of its scoring, and its efficiency. E-filing has been a huge improvement from the point of view of efficiency, and the switch from open to restricted airline tickets will save CSR more than $7 million per year. CSR has also taken steps to shorten the review cycle, improve the alignment of study sections, and recruit and retain senior reviewers. New technologies including telephone-enhanced, video-enhanced, and asynchronous electronic reviews are currently under review, with a goal of 10 percent electronic reviews by end-2007.

In the end, however, the peer review process can be no better than the peers who can be recruited to be reviewers. Dr. Scarpa is encouraged by the support of PRAC, professional societies and individual scientists, who have supported these changes by a margin of three to one. He also expressed his gratitude to those who attended today's open house, and who would attend the five upcoming open houses, to share their ideas and suggestions with CSR for additional improvements in the review process.

In response to specific questions from the audience, Scarpa added that electronic reviews would supplement, not replace, face-to-face meetings. CSR is willing to experiment with other changes, such as shorter application forms, or separate study sections for new investigators, or a database of past reviews for a "virtual study section." Other problems, such as the tight clustering of scores, are more intractable. NIH is willing to consider new ideas—such as reporting both percentile and rank-order scores, or awarding extra points for potential impact—these ideas are still under discussion.

Dr. Scarpa promised that the next open house will give more attention to these and other questions of process. However, the face-to-face study section will be here for many years to come, and the only way to avoid 50 reviewers in one room is to further increase the number of study sections, and with them the total number of reviewers, but it is not realistic to think in terms of 50,000 peer reviewers. He thanked participants for their suggestions about how to improve the process, as well as the science, of the peer review process.

The open house adjourned at 4:00 p.m.

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