

**Center for Scientific Review  
Center for Scientific Review Advisory Council Meeting  
National Institutes of Health  
U.S. Department of Health and Human Services**

**September 28, 2015**

The Center for Scientific Review Advisory Council (CSRAC) convened at 8:30 a.m., Monday, September 28, 2015, at the Pooks Hill Marriott Hotel in Bethesda, MD. The entire meeting was held in open session. Richard Nakamura, Ph.D., presided as chair.

**Members Present**

Roberta Diaz Brinton, Ph.D.  
Susan Essock, Ph.D.  
Pamela Hammond, Ph.D.  
Michael Hollingsworth, Ph.D.

Richard Nakamura, Ph.D.  
Harry Orr, Ph.D.  
Stephan Targan, M.D.

René Etcheberrigaray, M.D., was the executive secretary for the meeting.

**I. Welcome and Approval of Minutes**

Dr. Nakamura, CSR Director, welcomed CSRAC members, CSR staff, and other attendees and asked CSRAC members to introduce themselves. He then asked for a motion to endorse the minutes from its May 18, 2015, meeting. CSRAC approved the minutes.

**II. NCI Awards: R35 and Beyond**

Douglas Lowy, M.D., Acting Director of the National Cancer Institute (NCI), spoke about NCI research grants, with a focus on the new R35 and its relationship with R01 and R21 awards.

**Context: Cancer Mortality and the NCI Budget**

As background, Dr. Lowy discussed the overall decline in cancer mortality rates since 1992: 8 percent from 1992 to 2001 and 13 percent between 2002 and 2011. While some types of cancer remain very high, mortality from the majority of tumor types has decreased, attributable to prevention, screening, and treatment.

The purchasing power of the NCI budget, like the overall NIH budget, has been flat since 1999, with the exception of the spike under the American Recovery and Reinvestment Act (ARRA). NCI maintained or slightly increased the number of competing research program grants (RPGs) over the past several years, in part because of a substantial increase in R21 applications.

**Research Program Grants**

The R35, or the NCI Outstanding Investigator Award, provides long-term support to investigators with outstanding records of cancer research productivity so they can take greater risks, be more adventurous in their lines of inquiry, or take the time to develop new techniques.

Dr. Lowy described the characteristics and review criteria of the award. NCI made 40 awards in fiscal year (FY) 2015, with another 24 planned for the first round of FY16.

NCI awards R21s for research in its priority areas and, through an R21 Omnibus since 2013, in unsolicited areas. Whether to continue the omnibus is under active consideration. The increase in R21s has meant the first-year funding ratio of R01 to R21 awards went from about 5:1 in FY12 to 4:1 in FY14. The total cost of maintaining 60 R01s over a five-year period is equivalent to about 325 R21s.

### **Support for Basic Research**

The NCI leadership is concerned about basic research. Based on attendance trends at the NCI Division of Cancer Biology New Grants Workshop, fewer early stage investigators (ESIs) are engaged in what he termed basic, basic research. NCI does not want ESIs to think the only or best way to receive NCI funding is to do research with translational or clinical implications. He stressed NCI support for high-quality, basic research.

Dr. Lowy highlighted recent modifications to the RPG pool, including decreasing the cuts to modular grants from 17 to 8.5 percent and increasing the average size of Outstanding Research Awards. The implication, given the budget, is the number of R01s will decrease over time.

### **Discussion Highlights**

- ***Infusing an innovation culture in review:*** Roberta Diaz Brinton, Ph.D., asked how innovation, as exemplified by the R35, could be infused in the CSR review process. Dr. Lowy replied the R35 looks at the track record of the investigator, while the R01 has historically focused more on the research. Strong involvement from NIH helps guide a study section. But he recognized that the low percentage of funded grants can lead study sections to focus on minutia to distinguish between applications.
- ***Success of early investigators:*** Harry Orr, Ph.D., asked about the success of ESIs at NCI given the limits in funding. Dr. Lowy said ESIs have a higher success rate than experienced investigators with R01s. When Dr. Orr pointed out the perception at some institutions that ESIs have an easier entry with R21s, Dr. Lowy agreed and said he planned to share the recently compiled information about success rates with the relevant NCI boards.
- ***Comments about R35s:*** Michael Hollingsworth, Ph.D., referred to his participation on the R35 review panel. He noted most of the investigators were well into their careers. Dr. Lowy said in subsequent rounds, NCI will tell reviewers that mid-career applicants should also be strongly considered. Dr. Hollingsworth asked about any interim analysis of the effectiveness of the award. Dr. Lowy said the plan is an evaluation at the five-year point.
- ***Comments about R21s:*** Dr. Hollingsworth suggested one reason for the increase in R21s was a perception that they represent a better chance for funding. He asked about possible plans to end the R21 Omnibus. Dr. Lowy said NCI welcomes researchers taking a chance on a good idea, but wants to diminish the number of R21 applications that originally came in as unsuccessful R01s. He said a balance is needed between encouraging researchers to resubmit grants with good ideas but not those that will never be competitive.
- ***R01s versus R21s:*** Returning to the ratio between R01s and R21s, Dr. Brinton said the R21s can serve as startup funds. Dr. Lowy said most of the R21s at NCI are within the Division of Cancer Treatment and Diagnosis or the Division of Cancer Biology, thus either applied or

basic. Many of the R21s do not have the preliminary data needed for an R01, but the divisions are enthusiastic about them.

- **CSR Review:** Dr. Nakamura offered CSR assistance in NCI's review of R35s and R21s.

### **III. Developing the NIH-Wide Strategic Plan**

Lawrence Tabak, D.D.S., Ph.D., Principal Deputy Director of NIH, spoke about the NIH budget and the strategic plan. He also asked for CSRAC thoughts on several peer review topics.

#### **NIH Budget**

Dr. Tabak presented a graph that showed the NIH program level in nominal and constant dollars, with the buying power indexed to 1998. The FY16 House and Senate budgets are slightly higher than the President's budget, but final appropriation remains uncertain. From the 1970s until the doubling, the budget grew by about 3 percent per year. If that slow growth had continued, NIH would have about \$10 billion more now. He noted most people in the biomedical research field favor sustained, predictable growth, rather than feasts and famines in funding.

#### **NIH Strategic Plan**

NIH must submit a strategic plan to Congress under H.R. 83-346. In addition, the pending 21st Century Cures Act requires a plan that will identify strategic focus areas and two priorities: research into rare and pediatric diseases, and maintenance of the biomedical workforce.

Dr. Tabak reviewed the general goals of the strategic plan, which will serve as a living, trans-NIH document, rather than address priorities of individual Institute, Centers, and Offices or just catalogue all the things NIH will do. He described the process to develop it. NIH Director Francis Collins has carefully monitored progress and will oversee development of the final document. Dr. Tabak then presented the draft framework of the plan, with an overview of the unique moment in biomedical research opportunities and constraints confronting the community; areas of opportunity that apply across biomedicine in fundamental science, treatments and cures, and health promotion and disease prevention; and unifying principles to set priorities and enhance stewardship.

A Request for Information, consultation with NIH advisory councils, and webinar will provide an opportunity for feedback on the plan. Dr. Tabak welcomed comments from CSRAC on all aspects of the plan, but posed three specific questions:

- What are the benefits and drawbacks of the framework structure and content?
- Are there any trans-NIH themes that have not been captured?
- Are there future opportunities or emerging research needs that should be included?

#### *Discussion Highlights on the Plan*

- **Peer review:** Dr. Brinton asked about the emphasis on interdisciplinary, multi-faceted science and what that means for the composition of review panels. Dr. Tabak pointed to the debate about whether true experts or generalists are needed. He suggested generalists might be needed for more interdisciplinary research. Dr. Hollingsworth praised a model at his institution for some seed grants. Everyone who submitted an application was on the review

panel and only left when her or his application was under review. Dr. Nakamura noted the National Science Foundation has experimented with a similar model (see later in the agenda). Dr. Tabak suggested this as something CSR could pilot.

- **Diversity:** Pamela Hammond, Ph.D., asked about NIH efforts related to diversity. Dr. Tabak noted some important experiments (see later in the agenda), as well as intensive analysis on the pattern of applications, fields of science, and network of investigators to seek clues about disparities. He said some of the studies will inform efforts to mentor young people to undertake biomedical research. Dr. Brinton said in her experience in Los Angeles, many smart young people are poorly educated and urged NIH to become a voice on this topic. Dr. Tabak said he agreed with the importance of quality education, but NIH has no authority or leverage to tackle the issue. Dr. Brinton suggested requiring NIH trainees to serve as mentors to underrepresented individuals. He agreed with the value of the idea, but said it falls outside the NIH mission. Susan Essock, Ph.D., noted everyone agrees with the notion of effective mentoring, but asked about a way to quantify its impact. Dr. Tabak said NIH is undertaking experiments with the National Research Mentoring Network.

### **Focus on Peer Review**

Dr. Tabak returned to his presentation and the topic of peer review. He asked about ways to reduce conservatism in peer review raised in developing the strategic plan draft.

Dr. Orr said he is offended by discussion that peer review is broken. While it is important to elucidate a plan and continue to improve peer review, he maintained that an NIH-wide strategic plan should not blame peer review for other problems.

Dr. Brinton suggested an analysis of exactly how many scientists are needed in the U.S. and the relationship between funds invested and outcomes. She noted the continuing discussion about increases in applications compared with limited funds. Dr. Tabak said society needs scientists to fill many roles, including in policy, teaching, and intellectual property. Dr. Brinton pointed out the metric for success of NIH training grants is if a student has gone into academia. Dr. Orr said a broader concept in the review of T32s is critical. It was noted that scientists are going into non-traditional disciplines and organizations like Google and setting up strategies for scientific investigation. Dr. Brinton asked about including investigators with expertise beyond academia on review panels.

## **IV. DPCPSI Update**

James Anderson, M.D., Ph.D., Director of the Division of Program Coordination, Planning, and Strategic Initiatives (DPCPSI) at NIH, spoke about several efforts of the division, which was established by Congress in 2006 to facilitate trans-NIH research.

## **Office of Research Infrastructure Programs (ORIP)**

In 2010, the NIH Director asked the Institute of Medicine (IOM) to review and report on the use of chimpanzees in biomedical research. The major conclusion was that there are very few scientifically necessary reasons, and the IOM offered criteria to use when an application states the necessity. The DPCPSI Council of Councils developed policies based on the IOM report, which included establishment of a Chimpanzee Research Use Panel (CRUP). Dr. Anderson explained how the CRUP operates and how the applications would be reviewed against the IOM criteria.

## **Office of AIDS Research (OAR)**

In August 2015, the NIH Director issued a statement entitled “NIH Efforts to Focus Research to End the AIDS Pandemic.” A notice was issued about HIV/AIDS research priorities and the guidelines NIH will use in funding in the next three to five years. The priorities resulted from input from the OAR Advisory Council, scientific and public communities, and NIH leadership. He also identified low-priority areas and said that a portfolio review is underway. It is possible that some CSR AIDS-related study sections may need to be restructured. In addition, OAR will be involved in reviewing funding opportunity announcements and developing a standard prorating scheme across Institutes going forward.

## **Review Outcomes as a Function of Scientific Clusters**

Dr. Anderson described the third topic in his presentation as an experiment for which he sought CSRAC feedback. The questions that prompted the study were:

- How do areas of science map onto the current configuration of CSR study sections?
- Are there distinct areas of science that fare better or worse in peer review?
- Are the best applications concentrated in a limited number of study sections?

To answer these questions, DPCPSI did a content analysis to determine scientific topic clusters, based on 180,000 R01 applications. Using the IN-SPIRE tool, they defined 200 such clusters, and placed applications within them. They then compared the distribution and funding outcome of the clusters across CSR study sections.

He illustrated the findings with heat maps, focusing on two clusters related to diabetes, obesity, and metabolism and relevant applications spread among 11 study sections. Applications in one of the clusters were much more often discussed and funded across all the study sections, while applications in the other cluster had the opposite outcome. Although both clusters dealt with diabetes, a word cloud showed applications in the more favored cluster used molecular and cellular language, while the less favored cluster used more epidemiological language.

They are still analyzing results, but it seems that topic clusters, and not study sections, are an important unit of decision making in review. Preliminary conclusions include the presence of some group-think. Percentiling does not disadvantage the best applications, but it may hide some topics from the ICs entirely since the applications are not discussed.

## **Discussion Highlights**

- *Membership of study sections:* Dr. Brinton asked whether an analysis of study section membership is anticipated. She suggested at least two explanations for the disparity—

perhaps the panels are all made up of people with comparable expertise, which gives preference of one domain over another, or there may be bias. Dr. Nakamura said SROs choose members with expertise for the applications received.

- **Language use:** Dr. Orr said he was not surprised that “molecular” rose to the top, but noted from the presentation that one cluster on psychosocial risk and disease prevention performed well. Dr. Anderson said he would look into this issue.
- **Renewals versus first-time applications:** Dr. Targan asked about any data related to renewals versus first-time applications. Dr. Anderson said he presented just a small portion of the data. Dr. Nakamura suggested arranging an opportunity for interested members of Council to talk further with the study director.
- **Implications:** Dr. Nakamura said the set of results was a surprise. One implication is that topics that underrepresented scientists tend to study are in applied areas of science that, as the cluster analysis revealed, are less favored. He noted this might shed light on disparity of support awarded to underrepresented scientists.

## **V. National Science Foundation Approaches to Merit Review**

Stephen Meacham, Ph.D., Co-Chair of the National Science Foundation (NSF) Merit Review Working Group, said the NSF Office of Integrated Activities, deals with activities that cut across NSF, including studying NSF’s merit review process. As context, he described the NSF merit review process, which involves ad hoc, panel, and internal reviews. NSF receives about 48,000 competitive proposals per year, with a success rate of about 23 percent, and about 15,000 graduate research fellowship applications. Some 500 program officers manage these programs. NSF has looked at ways to streamline the process and conducted nine pilots in the past three years. Dr. Meacham summarized a few of them.

### **“One-Plus”**

A program with twice-yearly deadlines changed how it handled proposals. In the first round, in addition to the usual review, panel members scored (1) how big an impact the research would have if successful and (2) how likely they thought the research would be successful. The principal investigators (PIs) of the proposals that scored well on the first measure but not on the second had the chance to revise for review in a second round. Such revisions had a success rate that was higher than the overall program success rate. Potential impacts include accelerated support for highly significant, potentially transformative research and an improved workflow for NSF staff.

### **Elimination of Proposal Deadlines**

Over time, programs without deadlines have seen proposal pressure grow more slowly than those with deadlines. Many faculty members are expected to submit a proposal for every deadline, increasing the number and also creating a potential for degradation of proposal quality.

A program with twice-yearly deadlines eliminated its deadlines. The number of proposals fell from about 175 per year to fewer than 100.

## Mechanism Design

Another experiment incorporated an approach from game theory. Applicants were required to review seven other proposals during the same round. If the ranking of the proposals they reviewed mirrored the ranking generated by combining all of the review scores, their own application received bonus points. Outreach about the experiment stressed that it would cover just one round, and no one was compelled to submit. The program running the pilot received a record number of applications, as people wanted to try the new approach. It reduced the workload for program officers, who ordinarily spend a great deal of time recruiting reviewers. In addition, proposals received more reviews than would normally be the case.

## College of Reviewers

A “college of reviewers” was recruited, consisting of experts who agreed in advance to review at least three proposals per year. Review of a cohort of proposals was divided into two phases. In the first phase, a round of ad hoc reviews was obtained. Many of these were solicited from members of the College of Reviewers, speeding the process. In the second phase, panels only discussed the proposals that received positive reviews in the first phase. This allowed for more discussion of the stronger proposals in the second phase and streamlined the process.

Dr. Meacham said he welcomed ideas to improve these and other methods of NSF review.

## Discussion Highlights

- **Deadline:** Dr. Meacham noted the program that eliminated deadlines was not a large one, but had an impact on workload in that the ratio of proposals to program officers was equivalent to larger programs. There are other programs that also accept proposals at any time, rather than using deadlines. For some of these proposals, ad hoc reviews were used, rather than panels. An additional benefit is that, in some programs, program officers had the time to ask PIs for follow-up if the reviews indicated this was needed.
- **Game theory:** Dr. Hollingsworth asked about metrics to judge the quality of the reviews in the mechanism design model. Dr. Meacham said the length of the reviews was one metric used. A group of program officers also looked at the reviews. Results were mixed—some thought the reviews were better, some worse. They are trying to see if text-mining software could distinguish between high-quality and low-quality reviews, starting with readability scores as the first metric. This effort is not far along.
- **Demographics:** In answer to a question from Dr. Nakamura, Dr. Meacham said NSF looks at a standard set of demographic measurements. The number of proposals submitted by women has steadily increased, with slightly more success in funding than the overall success rate. There is a gradual upward trend in the number of proposals submitted by underrepresented racial and ethnic groups, but with slightly less success than the average NSF researcher. The gap had widened in the prior three years. They will analyze FY 2015 data in the next few months. Overall, they see a sharp peak in proposals around tenure time and a gradual upward trend in success rate as careers advance. At this time, underrepresented minorities tend to be more heavily represented in earlier career stages. Dr. Essock asked if that is enough to account for the disparity in success rates. Dr. Meacham said they have not completed the analysis. He noted that the study by Donna Ginter, Ph.D., controlled for years of experience, and that this narrowed but did not eliminate the disparity in success rates. Dr. Nakamura pointed out the Ginter study showed a difference in NIH success rates for African American

and Latino scientists. Dr. Meacham said in the case of NSF, Asians are another ethnic group with success rate below the NSF average.

## **VI. CSR Updates**

Dr. Nakamura first discussed plans for review meetings should the federal government shut down. He then talked about application volume, quality, and fairness in peer review.

### **Application Surge**

A 14 percent surge in applications occurred in 2015, which he attributed to the change in submission policies. SRO workload increased and more temporary reviewers had to be brought in. Because the same percentage was discussed, at the request of the Institute Directors, CSR was \$10 million over budget last year. NIH has provided CSR with additional budget next year in order to pay for a similar number of applications to review, although a reduction in volume of about 3 percent is projected for January 2016.

### **Quality in Peer Review: Outcomes Study**

CSR aims to recruit the highest-stature scientists to conduct reviews. CSR and the Office of Extramural Review have calculated a potential pool of 21,000 such individuals, based on their own funding and publication records. As the number of needed reviewers grows, CSR is looking at alternatives to ensure quality in review, including some of the NSF models discussed earlier. Because of authorization language, all applications submitted to NIH must be given a full review complete with a written report on review outcomes.

Several papers have reported no relationship between the scores provided by peer review and outcomes as measured by citation activity or publications. Yet there is also internal validity to the idea that scientific ideas that are read and cited regularly bear some relationship to their importance. To look further, CSR provided data to two researchers, Danielle Li, Ph.D., and Leila Agha, Ph.D. They examined 130,000 funded R01s, controlled for many factors, and found a clear positive relationship between scores and number of citations, publications, and patents, particularly in applications in the 5 to 10 percentile rating. This shows value-added through peer review. Another study traced the value of patents that cited grants funded by NIH and found the value of the patents was more than twice the overall cost of NIH funding for this time period. In patent value alone, NIH has more than paid for its taxpayer investment.

### **Fairness in Review: Anonymization Experiment**

Dr. Nakamura highlighted an anonymization experiment planned to address concerns about fairness in review. The principal aim is to determine if removing Principal Investigator Identity from grant applications reduces the differences in final scores for black and white applicants. Secondary aims are to see any effect based on male and female, senior and junior, and more research-intensive and less research-intensive universities aspects.

A set of original R01 applications already reviewed will be reviewed again, with full information known by one group and anonymized for the other group. He explained the controls and instructions given to reviewers.

### *Discussion Highlights related to Anonymization and Disparity*

- **Study bias:** Dr. Hollingsworth and Dr. Essock expressed concern that knowledge about the pilot would bias the reviews. Dr. Nakamura said they would explore this concern, but the committee felt it important to do a full review and an anonymized review at the same time.
- **Investigator and environment:** Dr. Targan noted anonymization leaves out the investigator and environment. Dr. Nakamura said the experiment could provide a basis for further study. Lee Mann, Ph.D., who is developing the study, noted the applications of the black and white scientists will be matched based on science. In answer to a question from Dr. Targan about reviewer experience levels, Dr. Nakamura said the same pool of reviewers will be available for both reviews. Dr. Nakamura highlighted possible options if bias is detected.
- **Diversity:** Dr. Hammond stressed the need to remain vigilant about NIH activity to promote diversity and eliminate bias. She expressed support for progress to date but urged CSRAC and NIH as a whole not to allow diversity to become a backburner issue. She emphasized the importance of having more demographic data, particularly on R35 applications and grants. Dr. Nakamura agreed. The anonymization experiment is not the only project related to diversity, but is intended to provide insight so NIH can develop interventions.

### **Half-Point Scoring Pilot**

Dr. Nakamura discussed a pilot to use a half-point scoring scale, rather than the whole numbers 1 to 9. Reviewers are encouraged to use 5 as a median score, but a graph of the distribution of preliminary impact scores shows this is not the case. After discussion and final scoring, many applications receive a 2, which leads to program staff making decisions among tied applications.

In the half-point pilot, reviewers will have the option, in addition to the regular score, to add or subtract a half-point in the final impact score to see the effect on distribution. Results will be compared with an earlier ranking pilot and a possible future binning study. In answer to a question from Dr. Targan about using the half-point option earlier, Dr. Nakamura said the pilot will see the effect of half-point changes after the discussion. Several Integrated Review Group (IRG) Chiefs have volunteered study sections to participate in the pilot. The results will not be used for scoring or award initially.

## **VII. Realignment of Two Study Sections in the Population Sciences and Epidemiology Integrated Review Group**

Karyl Swartz, Ph.D., Director of the Division of AIDS, Behavioral and Population Sciences, ask CSRAC to consider the realignment of two study sections in the Population Sciences and Epidemiology IRG: Cardiovascular & Sleep Epidemiology (CASE) and Epidemiology of Cancer (EPIC). The realignment would create two overlapping panels that would both review Cancer, Heart, and Sleep Epidemiology (CHSA and CHSB).

Dr. Swartz presented the rationale, noting a large number of applications in the current system result in many special emphasis panels (SEPs). Two sister study sections could eliminate many potential conflicts of interest. A pilot took place over four rounds. Reviewers and program staff were positive. A working group and the scientific community also strongly support the change. After a short discussion, a motion to recommend the realignment passed unanimously.

## Discussion Highlights

- **Reaction:** Dr. Targan asked about any negative comments. Dr. Swartz said an initial concern about fair treatment disappeared after discussions and review of the data from the pilot.
- **Application numbers:** In response to a question from Dr. Hollingsworth, Dr. Swartz said about 160 applications go through the study sections in each round.

## VIII. Open Discussion

In opening the discussion session, Dr. Nakamura said themes he has heard during the meeting, all of persistent concern to CSR, include fairness, recognition of innovation, workload, and decision making about what constitutes highest quality and how to measure it.

## Discussion Highlights

- **Quantifying innovation:** Dr. Brinton asked about developing metrics and outcomes related to innovation, in addition to numbers of patents and publications, and which institutions might be comparators to NIH in regard to innovation. Dr. Nakamura said U.S. institutions might be the major comparators in this regard. An international analysis, based on Scopus records, is underway and should be available for the next meeting. Dr. Targan noted the increase in very large consortia may have an impact on the number of publications, although they are impactful, innovative studies. Dr. Brinton suggested another measure of innovation is the number of global consortia led or initiated by NIH-sponsored researchers.
- **Peer review:** Dr. Hollingsworth asked about opportunities missed because of the stochasm present in peer review. One method of measurement is to quantify success stories of research rejected by NIH but funded elsewhere. He also noted given the paylines and no real statistical differences between the top scorers, randomness occurs in terms of where paylines get set and what is or is not funded. He said Congress needs to hear that message. Dr. Nakamura said the Canadian Institute of Health Research shifted to an all-electronic peer review process with five reviewers per application, a number considered more statistically sound.
- **Split votes:** Dr. Nakamura suggested another area to examine is the meaning of split votes to detect possibly highly innovative or transformative applications, which are sometimes scored poorly as too risky. Dr. Brinton said text-mining might provide some clues. Dr. Orr said some of the analysis used in clusters may also be useful.
- **Application numbers:** Dr. Essock asked what could be done to discourage applications that are likely to be noncompetitive and wondered about a reasonable way to identify high-volume submitter institutions. She said the NSF model in which reviewers had to review a certain number of other applications is intriguing. Absent a change in the payline, the number of applications is something to address related to the low success rate. Dr. Nakamura agreed the volume affects success rate and SRO workload. Dr. Hollingsworth suggested tying an institution's indirect cost rate to its success rate, although he acknowledged the idea could not be implemented. Dr. Essock suggested looking at what might discourage non-competitive applications and how NIH could help someone develop a competitive application.
- **Continuing submission:** René Etcheberrigaray, M.D., asked for CSRAC feedback on continuous submissions, noting the NSF study showed a drop in volume when the deadline was removed. Dr. Essock said it might be worth piloting as NSF has done. Dr. Hollingsworth noted many people are deadline-driven and was not sure it would help.

- **Reviewer fatigue:** Dr. Hammond asked for SRO input on reviewer fatigue. Dr. Nakamura said CSR does not have data on reviewer recruitment but informally, SROs say they are finding it more difficult. From the audience, an SRO said he has found it helpful to offer more flexible terms of service. He said reviewer fatigue is real.
- **Repeated submissions:** Dr. Targan asked about scores of resubmitted applications. Dr. Nakamura said a tension between applications that are improved upon resubmission and the low payline. Dr. Hollingsworth pointed out a conundrum in which reviewers are not supposed to compare applications but must spread their scores. Some applications will never receive a better score, no matter how many times they are resubmitted.
- **National investment:** Dr. Brinton said another solution to the increasing demand for support is to decrease the number of scientists. Dr. Nakamura said that it was important for the U.S. to stay competitive with other countries that are expanding their research base, and our country has to decide if it will make the necessary investments. He noted Dr. Collins has heard from members of Congress about the need to provide more support for science.
- **Triage:** Dr. Orr asked about tweaking the triage system to reduce pressure and frustration, such as through a two-tier review. Dr. Nakamura said the methods explored would save some, but not much, time, since at least three reviewers would need to be involved in the first stage. Institute directors have not been interested in review panels discussing fewer applications. He said he is open to suggestions. One possibility might be to assure applicants that their applications would be discussed, but, in return, they would agree not to submit another application for a year.
- **Use of data:** Dr. Brinton said analyses conducted with data have yielded interesting outcomes and insights. She praised efforts to delve into and learn from big data.

We do hereby certify that, to the best of our knowledge, the foregoing minutes of the September 28, 2015, meeting of CSRAC are accurate and complete. The minutes will be considered at the next meeting of the Advisory Council, and any corrections or comments will be made at that time.

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Rene Etcheberrigaray, M.D.  
 Executive Secretary  
 Center for Scientific Review Advisory Council

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Richard Nakamura, Ph.D.  
 Chair  
 Center for Scientific Review Advisory Council