NATIONAL POSTDOCTORAL ASSOCIATION
www.nationalpostdoc.org

RESPONSE to NOT-OD-11-106-3 by the NATIONAL POSTDOCTORAL ASSOCIATION

Comment Box 1: For any of the areas described in the Request for Information and any other specific areas you believe are worthy of consideration by the working group, please identify the critical issues(s) and impact(s) on institutions, scientists, or both.

The National Postdoctoral Association recognizes that this request for information will generate a wide range of responses from postdoctoral stakeholders, including suggestions that the NIH needs to engage in a complete restructuring of its research/funding/training models. The NPA has also received extensive input in this regard on more than one occasion. To date, however, no one has developed a truly comprehensive alternative research model or a plan for gradual and incremental change towards this model. The NPA understands that, in essence, the charge of the working group is to identify areas where change is necessary and to gauge the extent of this change. The NPA Board of Directors has attempted to provide both incremental, practical suggestions for change as well as food for thought in regard to possible "game-changing" initiatives.

The National Postdoctoral Association Executive Committee and the Board of Directors sought feedback from its membership and Advisory Council in preparing this response, which focuses primarily on the postdoc experience. This response is based on the best available data from the National Institutes of Health (NIH) Data Book and from survey reports provided by the National Science Foundation National Center for Science and Engineering Statistics (NCSES) [formerly the Division of Science Resources Statistics (SRS)]. As explained in the National Science Board's *2010 Science and Engineering Indicators* (p. 3-44), it should be noted that the NSF surveys capture little information on the "international" postdoctoral scholars who earned their degrees at foreign institutions and subsequently conduct research in the United States on temporary visas.

Supply (Number of Domestic and Foreign-Trained PhDs and Postdocs) and Demand (I.e., Post-training Career Opportunities)

Given that the percentage of new Ph.D. recipients receiving T/TT academic appointments in the life sciences has not changed greatly since 1993 and considering the documented increase in postdocs, the competition for T/TT and other positions and funding for independent research has increased. The low unemployment statistics suggest that postdocs do find employment, but it is important to note that a postdoc position is counted as "employment." The real situation, then, may be clouded by the low unemployment statistics. The *2010 Science and Engineering Indicators* stated:

> However, 9% of Survey of Doctorate Recipients respondents in a postdoc position in April 2006 reported that they took their current postdoc position because "other employment not available." This reason was given by 5% of postdocs in the life sciences, 8% in computer and mathematical sciences, 10% in the physical sciences, 14% in the social sciences, and 16% in engineering (p. 3-47).

What happens when new Ph.D. recipients cannot find satisfactory full-time, permanent employment in their fields? Based on anecdotal reports of postdocs and postdoc administrators to the NPA, the number of new Ph.D. recipients/postdocs who are making the decision to leave research careers and seek other science-related careers, or even careers outside of science, is increasing, especially among women postdocs. These issues seem to impact both U.S.-citizen/permanent-resident postdocs and international postdocs.

There are critical issues presented by the current state of the biomedical workforce that will impact the future balance of the biomedical workforce if left unaddressed. (Please see Appendix A for supporting data.) These include but are not limited to:

Data Collection and Analysis

- The need not only to gather more complete data on postdocs but also to develop data analysis plans that provide the information that is needed for workforce decisions;

Career Education and Development/Mentoring

- The need for a change in culture, so that postdocs do not feel like a "failure" if they do not acquire a T/TT academic appointment;
- The need to educate graduate students and postdocs regarding all of their career options;
- The need for effective mentoring and professional development that recognize and support diverse career options;
- The lack of sufficient role models or the lack of identification of same in relation to the increased number of postdocs.

Pipeline Issues

- The need to stop the "vicious circle" of using the postdoc as a holding place if the postdoc cannot find a permanent position, most likely due to a more competitive field, which often leads to too many years spent in postdoc positions, which in turn makes it even more difficult to find permanent positions.
- Retaining women and underrepresented groups in the research pipeline (a more competitive field will most likely make retention more difficult).
- A perceived loss in the return on investment in training graduate students due to the unavailability of permanent research positions and lack of sufficient funding for those positions, when the rule of thumb for success remains an academic T/TT position.
- A potential for the continued decrease in the number of international postdocs in the United States, which could impact the country's future competitiveness in the global market.

Characteristics of Ph.D. Training in Biomedical/Behavioral Research (Length, Curriculum, Multiple Career Paths)

There is evidence to suggest that the postdoc training experience has been improving over the past decade. Many research institutions are leading the way in recognizing and supporting the postdocs on their campus, as evidenced by the increase in postdoc offices. On the "best" campuses, postdocs receive paid maternity leave (usually through short-term disability insurance) and vouchers for child care expenses. And, there are many faculty who have taken it upon themselves to be their institution's postdoc "champion."

Perhaps one of the most important steps in improving the postdoc experience to date was the adoption of a definition of "postdoc" by the NIH and NSF in 2007:

> *…an individual who has received a doctoral degree (or equivalent) and is engaged in a temporary and defined period of mentored advanced training to enhance the professional skills and research*

independence needed to pursue his or her chosen career path. (http://grants.nih.gov/training/Reed_Letter.pdf)

This definition clarified that the postdoc was to be provided mentored advanced training—and should not be treated as a "cheap" extra hand in the lab or field. It set new standards for the relationship between PI and postdoc.

Supporting the Definition

The NIH has taken steps to support this definition in its own policies:

- It has reinforced the "temporary and defined period" of the definition, such as establishing 3-year limits on its NRSA fellowships and 5-year term limits for its intramural postdocs.
- It established the K99/R00 transition awards to provide a time of funded mentoring geared toward acquiring a faculty appointment.
- In regard to "mentored advanced training," the NIH has required and provided general directions for responsible conduct of research training for those "receiving support through its training, career development award (individual or institutional), research education grant, and dissertation research grant." The NRSA announcement for institutional training grants (PA-11-184) also states: "Programs should provide all NRSA trainees with additional professional development skills and career guidance including instruction and training in grant writing in order to apply successfully for future career development and independent research support. All postdoctoral NRSA trainees should also be provided with instruction in laboratory and project management."[1]
- Given the language of its NRSA payback requirements, it would seem that "chosen career path" could be interpreted as "one of many" rather than only the academia career path.

While the definition has been supported in NIH policies in regard to its training grants, the definition has yet to significantly impact its non-training research grants.

The Principal Investigator and the Postdoc

The PI holds a tremendous amount of power over a postdoctoral researcher. His/her supervision and mentoring (or lack of same) can make the difference between success and failure for the vulnerable postdoc. The NPA's interactions with postdocs suggest that the majority of new biomedical scientists begin their postdocs with high hopes that their PIs' connections and expertise will help them to acquire that elusive tenure-track position. To compound this situation, PIs more often than not perpetuate the cultural norm that the ultimate goal for an independent researcher is academic tenure. There are several possible reasons for this break with reality on the part of both postdocs and PIs, but the most likely reason, aside from traditional expectations for a successful scientific career, is that neither party truly understands that there are no longer enough T/TT academic positions to go around, given the increase in the number of postdocs.

In today's environment, it would be preferable for PIs to encourage postdocs to consider all of their career options. Yet, in reality, most PIs only understand the academic career track. Even so, at the minimum, PIs should provide networking contacts and encourage postdocs to (1) consider all of their career options; (2) find other mentors as needed who can guide them in those options; and (3) pursue professional development opportunities. PIs should support and consider postdoc offices as a resource, rather than as another layer of bureaucracy.

[1] http://grants1.nih.gov/grants/guide/pa-files/PA-11-184.html

Length of Post-doctoral Training

Based on the 2000 report, *Enhancing the Postdoctoral Experience for Scientists and Engineers*[2], the NPA has recommended: "As the postdoctoral appointment is temporary by nature, the aggregate amount of time spent as a postdoc is recommended to not exceed five years." In 2010, in part due to its work for the NPA ADVANCE project, the NPA recognized the need to add the following exception: "not including family medical leave or maternity/paternity leave." In effect, the 5-year recommendation was inadvertently negatively impacting the retention of postdoc women who wanted to start families.

The time limits imposed by the NIH and many research institutions and recommended by the NPA and other groups have had some other unexpected consequences:

- Many of these limits do not refer to "aggregate" amount of time but rather only to the time spent at one institution. Thus, many new scientists who cannot find a permanent position use the postdoc as a "holding" position and move on to second and even third postdocs.
- These time limits have created other classes of mostly under-paid scientists, such as "research assistants," which is where some institutions move postdocs when the time limit is reached. (Although usually not ideal for the postdoc in terms of compensation, such a move can provide them with employee status and improved benefits.)
- Postdocs who receive fellowships in the second or third year of their first postdoc must seek waivers from institutions in order to accept the fellowships that could conceivably propel them on to a successful career.
- For biomedical postdocs who must spend 100% time and effort on their PIs' research, five years may not be enough time for them to fully develop their own research, write grants, and conduct a job search.

On a positive note, the time limits may have contributed to the recognition of many research institutions that postdocs need professional development in order to move forward successfully in five years. Perhaps more likely, the term limits may have encouraged postdocs to be more thoughtful about their career path and the role of the postdoc in moving forward on that path.

The Ratio of Postdoctoral Fellows on Training Grants to Those Supported by Research Grants

There is NIH data showing that NRSA fellows fare better in terms of applying for and receiving NIH research awards within ten years of completing their fellowships than other postdocs. Such data could suggest that it would be better to fund postdocs on training grants. There are many factors to consider, however, before reaching a conclusion. For example, in what way, if any, does the competitive nature of the current NRSA program and the caliber of postdocs supported by this funding impact the outcomes? Would this program work as well if it were expanded?

Besides the immediate impact on postdocs, there are issues regarding the ratio that would impact extramural research. If the number of postdoctoral fellows was substantially increased thereby reducing the supply of postdocs for research grants, one outcome might be the increased hiring of higher-paid staff scientists (who would be classified as employees). Such a shift could result, in the long-term, in having better-trained postdocs and more staff scientist positions (and so providing additional positions for those postdocs who do not want to be PIs but want to stay in research). On the other hand, if research grant funding policies did not allow for the increased costs of hiring staff scientists, this shift could result in yet

[2] Committee on Science, Engineering, and Public Policy (COSEPUP). (2000). *Enhancing the postdoctoral experience for scientists and engineers: A guide for postdoctoral scholars, advisers, institutions, funding organizations, and disciplinary societies.* Washington, DC: National Academy Press, p. 99.

another class of "cheap" labor (such as when postdocs hit an institutional time limit and are moved to "research assistant" positions).

Possibilities for Professional/Staff Scientist Positions and the Level of Training Required for Such Positions (e.g. Ph.D. or M.Sc. Degrees)

The NPA supports the creation of additional professional/staff scientist positions, in order to provide an alternate career path for postdocs who do not want to pursue the PI/faculty career path but remain in academic research. The NPA recognizes the challenges faced by such an effort:

- With the increase in the number of postdocs and the availability of "cheap" labor, the challenge will be convincing the PIs and universities that hiring staff scientists will be worth the extra investment. This will require a culture shift, where over time PIs begin to appreciate the value of one permanent skilled worker versus two postdocs (e.g. long-term return on investment, retained knowledge of lab culture and procedures).
- Another concern is that PIs might not want to hire those whose career goal might eventually veer off to industry after acquiring the needed experience.
- Additionally, in the NPA's discussion with others about creating more staff scientist positions, some expressed concerns that it would also be difficult to convince the grant reviewers that you need the more expensive staff scientist instead of a postdoc.

For staff scientist positions that would only require an M.Sc. degree, the conversation might be less difficult, considering that these positions could be compensated less than those requiring a Ph.D. While these positions would not benefit postdocs, an increase in their number might allow some students to pursue this track and have satisfactory careers in science.

Issues Related to the Attractiveness of Biomedical Research Careers (E.g., Salary, Working Conditions, and Availability of Research Funding)

Compensation of Postdocs

The NIH leadership has been aware that the NRSA training stipends are too low since 2001, after the publication of the results of the National Academy of Sciences (NAS) study, *Addressing the Nation's Changing Needs for Biomedical and Behavioral Scientists*. In response, the NIH pledged (1) to increase entry-level stipends to $45,000 by raising the stipends at least 10 percent each year and (2) to provide automatic cost-of-living increases each year thereafter to keep pace with inflation. Most recently, the 2011 NAS study, Research Training in the Biomedical, Behavioral, and Clinical Research Sciences, called for, among other recommendations, increased funding to support more NRSA positions and to fulfill the NIH's 2001 commitment to increase pre-doctoral and postdoctoral stipends.

The impact of the low stipends extends beyond the NRSA-supported postdocs. The NPA's research has shown that the NIH training stipends are used as a benchmark by research institutions across the country for establishing compensation for postdoctoral scholars. Thus, an unintended consequence is that institutions under-compensate all of their postdocs, who must then struggle to make ends meet, which in turn affects their productivity and undermines their efforts to solve the world's most critical problems.

Benefits for Postdocs

The issue of benefits for postdoctoral scholars is fraught with complications, with indications that many postdocs receive less than adequate benefits. Funding agencies often have strict guidelines regarding benefits, and U. S. tax code classifications regarding employee status further complicate the awarding of benefits. The tax code makes it challenging for institutions to provide equitable benefits for all of the

postdocs, and many institutions are not able to provide postdoctoral scholars the same benefits that they provide to other professionals.

The way that an institution classifies a postdoc directly impacts whether that postdoc has access to benefits such as health and disability insurance and the way that FICA/Medicare is handled. Most often, this classification depends upon the funding source and how the grant funds are disbursed by the funding agency. For example, the University of California has three categories for postdocs: Postdoctoral Scholars Employees; Postdoctoral Fellows; Postdoctoral Paid Directs. (Please see Appendix B for more examples.)

University policy also determines the quality of the benefits that a postdoc receives. Some universities hold PIs responsible for 100% of the cost of benefits for the postdoctoral employee and have established a required list of benefits that the PIs must provide. Others have no such policies and leave it up to the individual PI to decide which if any benefits will be provided and how much of the premiums will be paid by the PI and by the postdoc.

When postdocs do have access to benefits, the plans are often comparable to student plans rather than faculty plans. And, for the postdoc to have his/her family covered, they must pay high premiums not easily afforded on the average postdoc salary/stipend.

The use of the word trainee in the NIH/NSF definition of postdoc has had some unintended consequences. For NRSA fellows, benefits have become an issue of real concern and thus have made the NRSA fellowships less attractive to many postdocs. Since fellows cannot be classified as employees, any benefits paid by institutions on their behalf are often reported as taxable income, which increases the amount of income tax that fellows must pay and so reduces their net income and their standard of living. Since they are not "employees" they cannot make contributions to pension plans. Additionally, some institutions, by choice or by law, may not offer benefits to postdocs receiving stipends. In the NPA's interactions with postdocs, more than a few NRSA fellows have stated that they are now earning less and have fewer benefits—and of lower quality—than when they were a graduate student. They regret accepting the fellowship.

Due to the aforementioned employment classifications, some postdocs (e.g. new fathers) may not even be eligible for leave provided under the Family and Medical Leave Act. Title IX provides for unpaid, job-protected maternity leave for postdocs, but the current research culture discourages them from taking this leave, even if they are aware of their rights to take this leave. Any paid leave is usually provided through using personal time-off or vacation days (if the postdoc has that benefit) or through short-term disability insurance.

In addition to having to count benefits as taxable income, postdoctoral fellows must pay Social Security/Medicare taxes as if they are self-employed, which also cuts into their net income. Additionally, postdocs who are not classified as employees cannot take advantage of the Child and Dependent Care tax credit.

Working Conditions

The working conditions for the average biomedical/behavioral postdoc are far from ideal, and women, underrepresented groups, and international postdocs may find the situation especially intimidating and challenging. Based on the NPA's interactions with postdocs and postdoc administrators, some of these challenges include:

Disenfranchisement

- The NPA's interactions with postdocs suggest that a sense of disenfranchisement/ isolation, rather than the low compensation or other factors, is the single largest complaint that postdocs have and may have the greatest impact on their future success. Interestingly, NPA's recent work

with social, behavioral and economic (SBE) postdocs[3] suggested that, because the concept of "postdoc" is relatively new to these disciplines and because many SBE postdocs work alone rather than as a member of a lab "team," this sense of isolation may be even greater for these postdocs than for biomedical postdocs.

- In spite of progress at many research institutions in identifying and tracking postdocs, there are still many research institutions who do not track postdocs and have no idea how many they have or in what departments they are working.

Less than Optimal Supervision/Mentoring/Communication

- As previously noted, the PI holds a tremendous amount of power over a postdoctoral researcher and the tone and quality of his/her supervision can make the difference between success and failure for the vulnerable postdoc. The NPA's interactions with biomedical and behavioral postdocs, as well as some survey results[4], suggest that there remains a vast communication gap between most PIs and the postdocs they fund. PIs are often overwhelmed with seeking funding and struggle to find the time to provide career guidance to the postdocs.
- Many postdocs do not receive formal performance evaluations, let alone have regular meetings with their PIs (see responses to the Sigma Xi Postdoc Survey, "Your Advisor" section, http://www.sigmaxi.org/postdoc/all/your_advisor_short.html).
- Postdocs and faculty/PIs have different ideas of a successful postdoc experience[5].
- The 100% time and effort reporting requirements on research grants keeps the postdoc from pursuing professional development opportunities, even at universities with active postdoc offices and many such opportunities.

Intellectual Property/Pursuing Independent Ideas

- Intellectual property rights are usually not well articulated to postdocs, who most likely did not negotiate with the PI regarding ownership of data and publication rights and then are surprised to find that the PI/university controls the postdoc's data. The NPA receives frequent complaints regarding intellectual property rights; for example, the PI or university does not give the postdoc any credit for his/her work; the PI does not grant the postdoc the appropriate level of authorship; or the PI does not keep his/her verbal promise to fund the postdoc when a research grant proposal written by the postdoc is successful.
- The current system does not promote exploration of independent ideas because the postdoc must focus on the research for which she/he is funded.

Family Leave/Care

- The financial aspects of family leave have already been discussed, but it is important to note that balancing family and career expectations remains a significant issue that impacts retention of women in research[6]. Many postdoc women are concerned that taking family leave and time off will endanger their chances of career success.
- The majority of postdocs do not have access to institutional day care centers.

International Postdoc Issues

- The NPA's interactions with PIs have shown that there are some who are frustrated with postdocs for whom English is a second language and who do not handle English well. The result is a communication gap that hinders productivity and creates tense working environments.
- The most vulnerable of postdocs may be those in the United States on J-1 visas, which only allow them 30 days to find other positions after termination. Certainly, the NPA has heard horror

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[3] Focus group conducted as part of the NPA's ADVANCE project in October 2010 (www.nationalpostdoc.org/advance).

[4] Bonetta, L. (2010, August 27). "The postdoc experience: Taking a long term view." *Science Career Magazine*. Retrieved from http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2011_08_26/science.opms.r1100106.

[5] Ibid.

[6] Goulden, M., Frasch, K., and Mason, M.A. and the Center for American Progress. (2009). *Staying competitive: Patching America's leaky pipeline in the sciences.* Berkeley Center on Health, Economic & Family Security. http://www.americanprogress.org/issues/2009/11/women_and_sciences.html

stories regarding the treatment of these postdocs, who are desperate to keep their positions and will put up with almost any kind of treatment to do so. Regardless of these stories, however, the fact is that the 30-day limitation creates an almost intolerably insecure work environment.

- International postdocs who leave the country to visit family or attend conferences may find it difficult to return; often waiting weeks to be allowed re-entry.
- International postdocs face other challenges besides visa concerns and language barriers. They are often culturally isolated, unaware of their basic workplace rights (e.g. sick days); have additional needs for career guidance; may have limited networks in the United States; are less familiar with U.S.-based funding procedures; and have fewer funding opportunities.

Postdocs with Disabilities

- There is little understanding in the research community about providing accommodations to postdocs with disabilities. The NPA's interactions with biomedical and behavioral postdocs with disabilities suggest that these postdocs are usually expected to bring funding with them to support any needed accommodations and that they face unique challenges in the research environment.

The Benefits of the Postdoc

In spite of these challenges, the postdoc position offers new scientists the opportunity to move towards independence: specifically, to expand their knowledge base; explore new geographic areas and institutions; conduct or lead research in a more creative, focused, or broader manner than previously; engage in interdisciplinary collaboration; interact with thought leaders in their fields; and establish a networking base for future career options—all without the constraints of a faculty position. For some who did not have the best graduate student experience, it is seen as the opportunity to receive more mentoring and build professional skills[7]. More and more, new scientists are considering postdoc positions in light of their long-term career path and have expectations that the postdoc will advance them along that path[8]. Whether the postdoc experience fulfills their expectations depends greatly upon their **relationships with their PIs/supervisors/mentors, the support they receive from institutions, and their own ability to shape their experiences in a proactive manner.**

Continued…

[7] Bonetta, L. (2010, August 27). "The postdoc experience: Taking a long term view." *Science Career Magazine*. Retrieved from http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2011_08_26/science.opms.r1100106.

[8] Ibid.

Comment Box 2: Please identify and explain which of the issues you identified are, in your opinion, the most important for the working group to address and why.

Supply and Demand

The most important of these issues to address are:

- Moving forward as quickly as possible with data collection on postdocs and developing appropriate data analysis plans to make the best use of this data.
- Educating graduate students, postdocs, and PIs/advisors/postdoc office administrators regarding career options for scientists.
- Encouraging, supporting, and building effective mentor networks.

If these things are done well, they should positively affect the pipeline issues.

Characteristics of Ph.D. Training in Biomedical/Behavioral Research (Length, Curriculum, Multiple Career Paths)

The most important issues to address are:

- Support the NIH-NSF definition of the postdoc with appropriate language and policies in regard to non-training research grants (e.g., requiring mentoring plans for grants that include postdocs in their personnel budget), and to continue to improve and maintain that support in regard to training grants.
- Provide resources for PIs and postdoc offices to allow them to effectively mentor or be mentored.

Length of Post-doctoral Training

It is not clear whether the time limits have improved the overall postdoctoral experience. Before any significant changes are made to these policies and recommendations, a study should be conducted regarding the pros and cons of these limits on the postdoctoral experience.

The Ratio of Postdoctoral Fellows on Training Grants to Those Supported by Research Grants

The most important issues to address in regard to postdoctoral funding mechanisms are:

- The feasibility of increasing the number of postdocs on training grants;
- The projected outcomes for these postdocs;
- And the short-term and long-term impact on biomedical and behavioral research productivity and innovation.

Possibilities for Professional/Staff Scientist Positions and the Level of Training Required for Such Positions (e.g. Ph.D. or M.Sc. Degrees)

- The recommended ratio of postdocs on training grants to postdocs on research grants may directly impact the creation of more staff scientist positions.
- If the NIH moves forward with an effort to facilitate the creation of more staff scientist positions, it will need to educate its PIs and grant reviewers regarding the benefits of doing so.

Issues Related to the Attractiveness of Biomedical Research Careers (E.g., Salary, Working Conditions, and Availability of Research Funding)

Postdocs share personal responsibility for the progression and outcomes of their careers. Nevertheless, inequities within the postdoctoral community should be rectified to the maximum extent practicable,

while recognizing the unique needs of each stakeholder. The most important issues to address, which hopefully will help to reduce the disenfranchisement of postdocs, are:

- Providing fair compensation and appropriate, equitable benefits;
- Encouraging institutions to put into place policies that support the career development of the postdoc and provide better working conditions; and
- Addressing the needs of international postdocs and postdocs from underrepresented groups.

Continued…

Comment Box 3: Please comment on any specific ways you feel these issues would or should affect NIH policies or processes.

Supply and Demand

Through requiring postdocs to be identified in the eRA Commons, the NIH has already taken steps to collect better data on the postdocs supported in its extramural and intramural programs. **The NIH should, however, consider tracking postdoctoral researchers on all of its grants in the same way that it tracks them on its training grants. Perhaps most importantly, the NIH needs to develop data analysis plans that use the data to provide information relevant to workforce issues.** Hopefully, the NIH and NSF will build upon their current partnership in collecting data on postdocs.

The NIH needs to clarify the definition of "success" for institutional training grants and to make a significant and ongoing effort to educate its reviewers and personnel regarding acceptable outcomes in regard to employment of trainees. Although the current wording in the solicitation is broad enough to include independent research careers in industry, government, and other fields as well as academia, the workforce culture is such that wording like "productive scientific careers" is interpreted by the reviewers and principal investigators (PIs) as "productive [academic] scientific careers. (The NPA has been given to understand that this interpretation was not intended by the NIH.) The NIH could help to change the culture by including specific wording that clearly states that independent research careers outside of academia are equally acceptable indicators of training "success."

Furthermore, the NIH should consider broadening the definition of "success" for training grants to include science-related positions. The NPA understands that doing so would enter a gray area of "What is science-related?" but believes that it should be seriously considered, given the lack of independent research positions today.

The NIH should require release time for postdocs funded through its non-training grants to develop soft skills (e.g., teaching, lab management, leadership). Many PIs will not allow postdocs to take time to develop these skills because of the 100% time-and-effort required by most NIH grant guidelines. Building in from 5% to 20% release time for postdocs to pursue opportunities to build these skills will help to prepare them for diverse careers. Rather than take away from productivity, this time will help them to be more productive and help to ensure their future productivity and success[9].

The NIH should consider allocating increased funding for biotech research, in order to build and support this career trajectory within the biomedical workforce. If the NIH increases support of biotech research, however, then by nature it should also dedicate resources to the proper training of the research workforce, which means training for soft-skills, management, and accounting principles for postdocs in the "biotech" track.

Characteristics of Ph.D. Training in Biomedical/Behavioral Research (Length, Curriculum, Multiple Career Paths)

The NIH should provide stricter guidelines and expectations for the role of the PI in supervising postdocs and the role of the institution in supporting the PI and the postdocs. At the minimum, the NIH

[9] "Postdocs reporting the greatest amount of structured oversight and formal training are much more likely to say they are satisfied, to give their advisors high ratings, to experience relatively few conflicts with their advisors and to be more productive in terms of numbers of publications compared with those with the least oversight and training." Davis, G. (May-June 2005). *Doctors without orders: Highlights of the Sigma Xi postdoc survey*. Special supplement to the *American Scientist*.

should require a mentoring plan for all NIH-supported postdocs, including those on research grants, and require reporting on the outcomes of that plan in the annual reports.

The NIH should pay attention to the additional needs of international postdocs and postdocs from underrepresented groups, as well as postdocs with disabilities, and continue to consider elements that increase diversity in regard to all mentoring and career development activities. Given the international and diverse nature of the postdoctorate now, it is crucial for the NIH to ensure that resources are available to aid in cross-cultural and diversity aspects of mentorship and career development – for mentors, postdoctoral offices, and postdocs alike.

The NPA Core Competencies were developed to serve as a framework for providing professional development that prepares postdocs for diverse career paths. **The NIH should develop NIH-wide core competencies to guide the formal and "informal" training (on research grants) of biomedical and behavioral postdocs.** In some respects, the NIH has already begun to do so in the training program language (e.g., requirements for training in responsible conduct of research).

The NIH should provide training supplements that could be used by institutions to (1) adapt NIH-recommended competencies or the NPA competencies and develop discipline-specific core competencies; (2) "train the trainers," and (3) develop workshops and other resources. The NIH could also encourage the use of these mentoring tools: an individual development plan and the Association of American Medical Colleges (AAMC) Compact Between Postdoctoral Appointees and Their Mentors.

The NIH should provide incentives for institutions to establish and maintain postdoc offices, through including that information as part of the review process for grants supporting postdocs. The NIH could work with the NPA, the AAMC, and other groups to establish a definition with minimum qualifications for "postdoc office" and ask about the postdoc office during the grant application process (e.g., Does your institution have a postdoc office? Will a portion of your indirect costs support that office?).

The NIH should provide centrally produced career development activities to support local efforts and provide funding for the development of these activities. The NIH does not necessarily have to "reinvent the wheel" but could build upon or expand the dissemination of the resources that have been developed by the NIH Office of Intramural Research, the NPA, and other groups.

Considering the global nature of the current and future research enterprise, **the NIH should consider requiring training for biomedical postdocs in the areas of biosecurity, biosafety, and dual use.**

The National Academies review of the National Research Service Award (NRSA) Program (released in early 2011) called for better data management, increased training in responsible conduct of research, increased training in career options and outcomes, and increases in recruitment of underrepresented groups in the social, biomedical, and health sciences**. These recommendations and others in the report should be broadened and adopted to include postdocs funded on any and all NIH grants.**

<u>Length of Post-doctoral Training</u>

The NIH has been responsive to the issue of time limits and the retention of women in biomedical/behavioral research, such as extending Early Stage Investigator eligibility and supporting re-entry through supplements. **The NIH should continue these efforts and should examine and improve as needed its dissemination of this information.** For example, the grant application process could include the question, "Has the PI read and understood the family-friendly policies of the NIH?" The response to that question could be a simple Yes or No. The question could include a link to those policies (http://grants.nih.gov/grants/family_friendly.htm).

The NIH should develop a data analysis plan for determining the impact of its time limits on postdocs.

The Ratio of Postdoctoral Fellows on Training Grants to Those Supported by Research Grants

This ratio could have a great impact on NIH policies and processes. For example, with a substantial increase in the number of training grants, PIs will need to hire higher-paid staff scientists to replace the postdocs, which could result in the need to establish larger research awards.

The NIH should consider a gradual increase over the next ten years in the number of postdocs funded by training or career grants, from 6,800+ to 8,500+, changing the ratio from a little over 1/4 to approximately 1/3. The NPA has only one caveat to this recommendation: that the entry-level stipend is $45,000.

Possibilities for Professional/Staff Scientist Positions and the Level of Training Required for Such Positions (e.g. Ph.D. or M.Sc. Degrees)

Please see above.

Issues Related to the Attractiveness of Biomedical Research Careers (E.g., Salary, Working Conditions, and Availability of Research Funding)

The NIH should continue to work towards fair compensation of postdoctoral trainees, including stipends and benefits, in order to continue to attract the best and the brightest.

- The NIH should increase the entry-level stipend to $45,000 as quickly as possible.
- The NIH should increase its financial oversight of institutional training grants. For example, the NIH should develop a way to ensure that postdoc fellows on institutional training grants actually receive the appropriate stipends each year; the NPA has heard from too many fellows whose stipends are less than they should be.
- The NIH should promote or endorse guidelines that would allow regional salary adjustments to trainee stipends.
- The NIH should work with the Office of Budget and Management to revise the policies governing F32 and T32 fellowships (1) to allow postdocs funded on F32 and T32 fellowships to be classified by their institutions in a manner similar to postdocs funded by their mentors' R01 grants and (2) to allow and require that postdocs funded on F32 and T32 fellowships be accorded the same benefits as other scientists in comparable positions at the same institution without paying increased taxes.

The NIH should maintain accommodation funding for postdocs with disabilities, which will act to alleviate the burden on the institution and/or mentor, and concomitantly, the expectation on the individual postdoc with a disability to bring this funding with them prior to starting a new position.

In regard to funding, the NIH should:

- Increase independent funding for postdocs, including increasing support for international postdocs;
- Increase the number of postdocs funded by the NIH training and career development programs;
- Consider allowing foreign postdocs to be funded on T32/F32 training grants;
- Continue funding for training programs such as the Institutional Research and Academic Career Development Awards (IRACDA);
- Continue the NIH Director's Early Independence Awards program;
- Continue funding for programs designed to increase the participation of underrepresented minorities and persons with disabilities in the postdoctorate; and
- Create new funding opportunities for postdocs interested in careers in industry, government, nonprofits, and entrepreneurship.

Effect of Changes in NIH Policies on Investigators, Grantee Institutions, and the Broader Research Enterprise

The hoped-for outcomes of changes in NIH policies suggested in this response are that:

- The NIH will lead the nation in preparing for a better-trained and more innovative biomedical/behavioral workforce;
- All stakeholders will work together to enhance the quality of the biomedical/behavioral postdoctoral experience for all participants and thereby maximize the effectiveness of the present and future research community;
- The U.S. Congress will recognize the need to maintain and increase funding for the NIH in order to ensure U.S. leadership of global research and discovery; and
- Accordingly, the U.S. biomedical/behavioral workforce will become one that no longer takes advantage of new scientists but is able to support them and provide for their advanced mentored training in a fair, effective, and respectful manner.

Appendices follow.

APPENDIX A

Current State of Ph.D. Supply and Career Opportunities (with Supporting Data)

The issue of **supply** (number of domestic and foreign-trained Ph.Ds. and postdocs) and **demand** (i.e., post-training career opportunities) is difficult to address because of the lack of reliable data that capture the entire postdoc workforce. The NPA's response to the NIH regarding this issue is based on the current state of the supply of postdocs and of scientific career opportunities. Based on the best available data, the current state can be summarized with these statements:

(1) The number of research doctorate degrees awarded in the United States in all major fields but psychology continues to increase;
(2) The unemployment rate for science and engineering (S&E) Ph.D. holders, including those in the biomedical and behavioral research workforce, remains low in comparison with other populations;
(3) The number of postdocs across all fields has been increasing since 1972, but the majority of postdocs continue to be in the life sciences;
(4) The majority (69%) of postdocs in the life sciences and psychology receive federal funding;
(5) The majority of new Ph.D. recipients will not easily or quickly find academic tenure or tenure-track (T/TT) positions, nor will the majority of them be employed by academia;
(6) The average age at which a first-time principal investigator acquires NIH-R01 funding is 42.6, and the percentage of R01 awards going to first-time investigators reached 25% in 2007;
(7) An estimated 60% of postdocs are international postdocs;
(8) The number of women postdocs and the number of postdocs from underrepresented groups have increased since the 1970s;
(9) During the postdoc, a significant number of women are lost in the biological sciences pipeline (fewer in the behavioral sciences);
(10) Institutional recognition and support of postdocs is increasing;
(11) The increasing investments in research and development (R&D) by other countries/regions in the world will continue to impact the U.S. R&D infrastructure, process, and advancement in the coming decades.

Supporting Data for these Statements

Statement 1

The number of research doctorate degrees awarded in the United States continued to increase in 2009, although not as much from 2004 to 2007. The number of these degrees in all major fields except psychology but including the biological sciences and the social sciences increased; the most degrees were awarded in the biological sciences[10].

Statement 2

In 2006, the unemployment rate for recent Ph.D. recipients, one to five years after receiving their degree, was 1.1% across all S&E disciplines. **For the life sciences, it was 0.6%; for the social sciences, 4%.** It is important to consider that many of not most of these recipients in the life sciences are most likely postdocs[11]. The number of Ph.D. holders who were "involuntarily out of field (IOF)" also remains low; as of 2003, the number of Ph.D. holders in 2003 who were IOF was a little over 2%, compared with nearly 2.5% in 1999[12].

[10] National Science Foundation, Division of Science Resources Statistics. (November 2010). "Numbers of Doctorates Awarded Continue to Grow in 2009; Indicators of Employment Outcomes Mixed." Arlington, VA. Retrieved October 2, 2011, from http://www.nsf.gov/statistics/infbrief/nsf11305/.

[11] National Science Foundation Division of Science Resource Statistics. (January 2010). *Science and engineering indicators 2010.* Arlington, VA: National Science Board, p. 3-41, Table 3-16.

[12] Ibid, p. 3-43, Table 3-41.

According to the NSF report "Unemployment Among Doctoral Scientists and Engineers Remained Below the National Average in 2008," unemployment among doctoral holders **in the biological, agricultural, and environmental life sciences increased from 1.1% in 2001 to 1.9% in 2008**. Across all fields, the rate varied from 1.0% (mathematics and statistics) to 2.4% (physical sciences)[13].

Statement 3

From before 1972 through 2006, the number of S&E Ph.D. holders ever holding a postdoc has increased overall across all fields; **in the life sciences, from a little over 45% to 60%**[14]. The majority of postdocs are in the life sciences[15]. The NSF report "Numbers of Doctorates Awarded Continue to Grow in 2009; Indicators of Employment Outcomes Mixed," however, showed a slight decrease in the number of **life sciences Ph.D. holders** (U.S. citizens or permanent residents) who had "definite postgraduation commitments" to a postdoc position (from 75.5% to 73.3%)[16]. Additionally, the number of postdocs supported by the NIH has more than doubled, from less than 10,000 in 1985 to 20,000 in 2009[17].

Statement 4

According to the NSF *2010 Science and Engineering Indicators*, "Almost half of those with recently earned doctorates reported receiving federal support, with 30% of those in full-time faculty positions, 49% in other full-time positions, and 69% in postdoc positions receiving federal support." Among postdocs, the percentages range from 27% for those in the social sciences to more than 77% for those in the physical sciences, with life sciences at 68% and psychology at 67% [18]

Statement 5

While the postdoc has traditionally led to academic T/TT positions, the NSF Survey of Doctorate Recipients shows that, in 2006, across all fields, only 25.8% of Ph.D. recipients four to six years from their degree held T/TT appointments. By fields, since 1993, the percentage increased by approximately 5% in the physical sciences and social sciences but **declined in the life sciences by 4%**, computer/mathematical sciences by 10%, and engineering by 8%[19]. Only 42% of S&E doctorate holders are employed in 4-year colleges or universities (in all positions including T/TT), while 28% are employed in for-profit organizations; 11% are self-employed, 4% in other educational institutions, and the remaining are employed by the government or non-profit organizations[20].

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[13] National Science Foundation, Division of Science Resources Statistics. (January 2011). "Unemployment Among Doctoral Scientists and Engineers Remained Below the National Average in 2008." Arlington, VA. Retrieved October 1, 2011, from http://www.nsf.gov/statistics/infbrief/nsf11308/.

[14] National Science Foundation Division of Science Resource Statistics. (January 2010). *Science and engineering indicators 2010.* Arlington, VA: National Science Board, p. 3-46, Table 3-46.

[15] Ibid, p. 3-46, Figure 3-45.

[16] National Science Foundation, Division of Science Resources Statistics. (November 2010). "Numbers of Doctorates Awarded Continue to Grow in 2009; Indicators of Employment Outcomes Mixed." Arlington, VA. Retrieved October 2, 2011, from http://www.nsf.gov/statistics/infbrief/nsf11305/.

[17] National Institutes of Health (NIH) Data Book. (Fiscal Year 2009). "National Statistics on Postdoctorates in the Biomedical, Behavioral, Social, and Clinical Sciences: Primary source of support for postdoctorates in the biomedical sciences." Retrieved from http://report.nih.gov/NIHDatabook/Charts/Default.aspx?showm=Y&chartId=264&catId=20.

[18] National Science Foundation Division of Science Resource Statistics. (January 2010). Science and engineering indicators 2010. Arlington, VA: National Science Board, p. 5-28, Table 5-12.

[19] National Science Foundation Division of Science Resource Statistics. (January 2010). *Science and engineering indicators 2010.* Arlington, VA: National Science Board. This particular data comes from the National Science Foundation, Division of Science Resources Statistics, Survey of Doctorate Recipients (1993, 2003, and 2006), Scientists and Engineers Statistical Data System (SESTAT), http://sestat.nsf.gov.

[20] Ibid; this particular data comes from the National Science Foundation, Division of Science Resources Statistics, Scientists and Engineers Statistical Data System (SESTAT) (2006), http://sestat.nsf.gov.

Statement 6
The average age of a first-time principal investigator (Ph.D. holder) at the NIH has hovered around 42 since 2000[21], and only recently, in 2007, did the percentage of R01 award funding first-time investigators hit 25%, for the first time since 1998[22].

Statement 7
An estimated 60% of postdocs conducting research in the United States hold temporary visas[23]. It should be noted, however, that according to the report "Two Decades of Increasing Diversity More than Doubled the Number of Minority Graduate Students in Science and Engineering," the number of international postdocs had decreased to 55% in 2009[24].

Statement 8
This report also stated that the number of women postdocs increased by approximately 60% from 2000 to 2009. Additionally, during this time, the report stated: "…the growth of engineering postdocs (approximately 95%) substantially outpaced that of science postdocs (approximately 30%). Single-year growth rates for engineering postdocs were 10.5% in 2008 and 17.5% in 2009. … The fastest growing science fields for postdocs from 2000 to 2009 were mathematical sciences (approximately 90% growth), computer sciences (approximately 75% growth), and psychology (approximately 65% growth)"[25]. Since 1973, the number of S&E Ph.D. holders from underrepresented groups who are in a postdoc position increased from 2.4% to 7.5%[26].

Statement 9
According to the 2007 National Research Council report "Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering, "…at every academic career milestone the proportion of women in science and engineering declines. … In examining the transition into academic positions…, the declines are greatest in fields [**includes biological sciences**] requiring a period of postdoctoral study" [27].

Statement 10
Based on the NPA's Institutional Policy Database (http://database.nationalpostdoc.org/pddb), there are now 128 postdoc offices in the United States, compared with 13 offices in the year 2000. The NPA currently has more than 180 institutional members, and of these, 64 have joined since 2008. In 2011, 12 new institutions joined, and at least one new postdoc office was formed at a research institution.

Statement 11
Although the 2007 U.S. expenditures on research and development (R&D) exceeded that of any other country/region, from 1996 to 2007, the U.S. R&D/GDP ratio held steady, while China's ratio doubled.

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[21] National Institutes of Health Office of Extramural Research. (May 2008). "Average Age of Principal Investigators." Slide 3. Retrieved from http://grants.nih.gov/grants/new_investigators/index.htm.
[22] National Institutes of Health Office of Extramural Research. (May 2008). "First-time Principal Investigators." Slide 8. Retrieved from http://grants.nih.gov/grants/new_investigators/index.htm.
[23] National Science Foundation Division of Science Resource Statistics. (January 2010). *Science and engineering indicators 2010.* Arlington, VA: National Science Board, p. 3-46.
[24] National Science Foundation Division of Science Resources Statistics. (July 2011). "Two Decades of Increasing Diversity More than Doubled the Number of Minority Graduate Students in Science and Engineering." Arlington, VA. Retrieved from http://www.nsf.gov/statistics/infbrief/nsf11319/.
[25] Ibid.
[26] National Science Foundation Division of Science Resource Statistics. (January 2010). *Science and engineering indicators 2010.* Arlington, VA: National Science Board, p. 5-24, Table 5-10.
[27] Committee on Maximizing the Potential of Women in Academic Science and Engineering, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. (2007). *Beyond bias and barriers: Fulfilling the potential of women in academic science and engineering.* Washington, DC: National Academies Press.

From 1996 to 2007, the R&D growth rate for the Asia/Pacific region increased from 24 to 31 percent, while the North American region's growth rate decreased from 40 to 35 percent. From 1996 to 2007, the United States average annual growth of R&D expenditures averaged 5 percent, whereas China's average annual growth topped 20 percent[28].

[28] National Science Foundation Division of Science Resource Statistics. (January 2010). *Science and engineering indicators 2010.* Arlington, VA: National Science Board.

APPENDIX B

Institutional Classification of Postdocs: Examples

The ten institutions in this table were selected from the list of 61 institutions that have developed postdoc handbooks, according to the National Postdoctoral Association's Institutional Policy Database (http://database.nationalpostdoc.org/pddb).

Institution	Postdoc Classifications	Find more information at:
Albert Einstein College of Medicine of Yeshiva University: Belfer Institute for Advanced Biomedical Studies; http://www.einstein.yu.edu/research/belfer-institute/postdocs.aspx?id=3060&ekmensel=15074e5e_4074_4075_3060_1	Research Fellow	http://www.einstein.yu.edu/research/belfer-institute/postdocs.aspx?id=28739&ekmensel=15074e5e_4074_4075_28739_6
Case Western Reserve University; http://postdoc.case.edu/	Postdoctoral Scholar; Postdoctoral Trainee	http://postdoc.case.edu/downloads/PostdocScholarsEmploymentHandbook.pdf; http://postdoc.case.edu/downloads/PostdocTraineeHandbook.pdf
Columbia University of New York City; http://postdocs.columbia.edu/	Postdoctoral Research Scientist/Scholar, Postdoctoral Clinical Fellow; Postdoctoral Research Fellow	http://postdocs.columbia.edu/compensation.html
Duke University; http://www.postdoc.duke.edu/	Postdoctoral Associates; Postdoctoral Scholars; Postdoctoral Scholars-Paid Direct	http://www.postdoc.duke.edu/content/duke-university-postdoctoral-policy-revised-july-1-2009
Fred Hutchinson Cancer Research Center; http://www.fhcrc.org/science/education/grad_postdoc/index.html	Postdoctoral Fellow	http://www.fhcrc.org/science/education/grad_postdoc/spac/handbook/The_FHCRC_Survival_Guide_10th_Ed_2011a.pdf
New York School of Medicine; http://sackler.med.nyu.edu/postdoc/	Postdoctoral Fellow; Postdoctoral Training Fellow; Postdoctoral NIH NRSA Training Fellow	http://sackler.med.nyu.edu/postdoc/files/postdoc/attachments/pdh2008.pdf
Stanford University; http://postdocs.stanford.edu/	Postdoctoral Scholar	http://postdocs.stanford.edu/handbook/
University of Kansas Medical Center; http://www2.kumc.edu/aa/pa/	Postdoctoral Scholar	http://www2.kumc.edu/aa/pa/documents/Handbook_FINAL.pdf
University of Pennsylvania Schools of Medicine, Veterinary Medicine, and Dental Medicine; http://www.med.upenn.edu/postdoc/	Postdoctoral Researcher; NRSA-Postdoctoral Fellow; Postdoctoral Fellow	http://www.med.upenn.edu/postdoc/policies.shtml
Vanderbilt University; https://medschool.vanderbilt.edu/postdoc	Postdoctoral Research Fellow Trainees; Postdoctoral Research Fellows; Visiting Research Fellow	https://medschool.vanderbilt.edu/postdoc/benefits