

The NPA Postdoctoral Core Competencies
Prepared by the NPA Core Competencies Committee (2007-2009)
(see Appendix for list of Committee members)

Rationale for Core Competencies

In an era of increasing complexity for the research enterprise, postdoctoral scholars pursue professional opportunities not only in academia but also in industry, government, nonprofits, and entrepreneurship. The variety of career options available today demands a diverse array of skills, such as writing grant proposals and CVs or mastering the principles of effective resource management, that are often neglected during doctoral study and postdoctoral research. The postdoctoral experience will be more relevant to career and professional development if the scholar seeks or is offered opportunities to acquire, maintain, or improve such skills.¹

The National Postdoctoral Association (NPA) has established six core competencies to offer guidance to individual postdoctoral scholars who must seek out relevant training experiences, in collaboration with mentors, institutions, and other advisors who provide this training.

“Competency” has been defined as “an acquired personal skill that is demonstrated in [one’s] ability to provide a consistently adequate or high level of performance in a specific job function.”² These competencies are meant to serve primarily as: (1) a basis for self-evaluation by postdoctoral scholars and (2) a basis for developing training opportunities that can be evaluated by mentors, institutions, and other advisors.

The six core competencies are:

1. Discipline-specific conceptual knowledge
2. Research skill development
3. Communication skills
4. Professionalism
5. Leadership and management skills
6. Responsible conduct of research

¹ According to the 2004-2005 Sigma Xi postdoc survey of U.S. postdoctoral scholars: “Postdocs who reported the highest levels of oversight and professional development [including training in many of the competencies noted herein] were more satisfied, gave their advisors higher ratings, reported fewer conflicts with their advisors, and were **more productive** than those reporting the lowest levels.” Davis, G. 2005. Doctors without orders. *American Scientist* 93(3, supplement). <http://postdoc.sigmaxi.org/results/> (accessed 06/24/2009)

² BNET Business dictionary, <http://dictionary.bnet.com/definition/competence.html>.

How to Use This Document

The goal of a postdoctoral fellowship is to provide the training necessary for the postdoctoral scholar to achieve intellectual and professional independence and success. This document was developed to provide definition for the scholar and his/her support community as to the competencies essential to achieving this independence. Some of these competencies will have been acquired during graduate training. Thus, some aspects of the competencies will describe refinements of skills already achieved, and some will represent new or advanced skills.

Life-long Learning: A Customized Approach

Life-long learning is essential to career independence and success and requires on-going self evaluation. Throughout the postdoctoral fellowship training period, scholars should continuously refer to the competencies to measure their own desired goal and skill acquisition.

Postdoctoral training will be experienced in a variety of ways as a result of the singular aspects of the postdoctoral appointment, such as the focus on research over coursework or on other skills relevant to the individual's intended professional outcome, as well as the integral role of the supervisor and the diversity of graduate training among postdoctoral scholars. Roughly half of such scholars have received their Ph.D. degrees outside the United States and, thus, they may begin the postdoctoral training period with strengths and challenges that vary from those of U.S.-trained scholars.³ As such, the six core competencies are not intended to be prescriptive or limiting. They are provided as a resource to be used and adapted in a variety of ways by the many stakeholders involved in the training experience of postdoctoral scholars.

It is expected that each institution and other users will employ different local, regional and national resources to provide training in selected competency areas. The career aspirations and prior experience of each postdoctoral scholar will also result in selection of different competencies for more in-depth focus by the postdoctoral scholar, mentor(s), and institution.

It should be noted that the Core Competencies are often interrelated. Competency in one area often affects competency in another area. For example, effective leaders are usually (but not always) effective communicators, and understanding the principles of Responsible Conduct of Research will enhance one's professionalism. Thus, the most effective use of the Core

³ Sigma Xi Postdoc Survey results <http://postdoc.sigmaxi.org/> (accessed 08/12/2008)

Competencies may be to identify and focus on development in areas that will lead to growth in more than one competency.

Examples of Potential Uses of the Competencies

- *Postdoctoral scholars* can use the competencies as a basis for self-evaluation and to determine areas for their own self-improvement.
- *Investigators* can incorporate training in these skills into mentoring activities or group meetings. They can also use the competencies as a framework for a formal postdoctoral training plan, a new requirement for all NSF grants supporting postdoctoral scholars. Some topics could be incorporated into faculty professional development to encourage their use in informal training situations with postdoctoral scholars.
- *Postdoctoral scholars' office leaders* can develop professional development programs around the competency areas.
- *Institutions* can play a more substantive role in the training of postdoctoral scholars by adopting an overarching curriculum of training opportunities.
- *Institutions responsible for the development of graduate curricula* could use the competencies as a template for preparing graduate students so that they can continue their training in these areas as postdoctoral scholars.
- *Disciplinary societies* can tailor their programming and the services they offer to their postdoctoral scholar constituents to enhance these competencies.
- *Those providing resources* to the postdoctoral community could use the competencies as a guide for their content.

Training Methods: Combining Formal and Informal Methods

A key component to the postdoctoral experience is the mentoring received from postdoctoral supervisors. Many of the skills outlined in this document can be acquired using informal methods such as one-on-one mentoring, journal clubs, informal chalk talks, and group meetings. The latter also provide the opportunity for “mentoring ladders” or multi-generational learning, as undergraduate and graduate students can learn alongside the postdoctoral scholars. One on one instruction however may not be feasible in today’s large interdisciplinary research groups and with demanding schedules. Nor is it prudent to assume that every mentor will have the mastery required to teach all of these topics. Therefore, formal instruction is an important complement to informal methods.

Effective formal teaching methods must conform to the individual postdoctoral scholar's optimal learning style and the technological limits of the institution. No one didactic method works for all members of an audience. Many trainees benefit from accessible, individualized online courses while others would benefit from focused group discussions or didactic lectures. Consequently, trainers must be prepared to use multiple teaching methods, for example, brownbag lunch seminars, interactive workshops, podcasts and tele/videoconferences, or guest lecture seminars, to deliver critical information. Reinforcement of subject matter using different teaching formats may be organized into a series of frequently-scheduled courses, seminars, or workshops.

Evaluation

One of the most important uses of the Core Competencies is to provide a framework for constructive evaluation and feedback. The diversity of competencies and skills outlined in this document can be evaluated using a number of mechanisms including informal feedback on particular skills, formal job evaluations, an Individual Development Plan (IDP) and other training program assessments. It is not the intent of this document to outline or list evaluation methods. Rather, the document should be used to help the fellow proactively create a balanced portfolio of structured oversight and self-assessment through input from advisors, mentors, peers and colleagues. **The NPA Core Competencies enforce the notion that the successful transition to intellectual and professional independence depends on the individual's responsibility to embrace self-assessment and to apply it to all the Core Competencies.**

Six Core Competencies

I. DISCIPLINE-SPECIFIC KNOWLEDGE

A. Rationale/Conceptual Foundation: In order to expand the knowledge base of a field, both research concepts and approaches must remain on the cutting edge. An understanding of the overall relevance of the work to the broader field is also essential. Graduate students are taught the nature of scientific inquiry and begin to develop an understanding of the approach to scientific research. The postdoctoral experience should amplify this knowledge and include an understanding of the importance of innovation and creativity in scientific investigation, including multidisciplinary approaches to scientific discovery. Specific knowledge of the culture, language and technical aspects of any discipline, and the maintenance of these through continuing education efforts, provide a strong foundation for both traditional and non-traditional professions.

B. Components/Principles: Postdoctoral scholars are expected to demonstrate a knowledge base of established and evolving information and research within their discipline and as applicable to their specific area of research. They are also expected to master hypothesis development, understanding gaps and conflicts, limits, and challenges, such that they can frame testable hypotheses. A thorough understanding of data interpretation/analysis and statistical analyses are critical to establishing the significance of results. Fluency in the language as well as proficiency with the techniques of a specific discipline or other disciplines with which it may cross provides the framework in which multidisciplinary studies can be undertaken. A broad knowledge base also provides an excellent foundation for those individuals who pursue non-bench related professions.

C. Delineation of Specific Skills

1. Analytical approach to defining scientific questions
2. Design of scientifically testable hypotheses
3. Broad based and cross-disciplinary knowledge acquisition
4. Interpretation and analysis of data

D. Resources

Please note: Much of what postdoctoral fellows need to learn under this topic is discipline specific. The following resources are examples.

1. American Society for Cell Biology (ASCB). *CBE—Life Sciences Education*. [online]. Available from: <http://www.lifescied.org/>. Accessed 2009 June 24
2. ASCB. *Cell WEB*. [online]. Available from: <http://www.ascb.org/cellweb/index.cfm>. Accessed 2009 June 24.
3. McGhee C., Gilhotra A.. Ophthalmology and vision science research: part 2: How to commence research--Eureka or that's a little unusual? *J Cataract Refract Surg*.31(11):2205-11.
4. Hart, C. (2001). *Doing a literature search: A comprehensive guide for the social sciences*. London: Sage Publications.

II. RESEARCH SKILL DEVELOPMENT

A. Rationale/Conceptual Foundation: The implicit expectation of a Ph.D. degree is that the individual is prepared to conduct original research in a specific discipline. Postdoctoral training should build on the research developed in graduate school to ensure that the individual is adequately equipped to carry out independent research, whether in bench- or non-bench related professions.

For postdoctoral scholars focused on a research-oriented career, mastering a broad range of skills is essential preparation for becoming independent investigators within a complex scientific enterprise. It is vitally important that research-focused postdoctoral scholars receive formal training in preparation for their new roles as managers of independent research laboratories or enterprises.

B. Components/Principles: Postdoctoral scholars are expected to have the fundamental knowledge necessary to identify important gaps in their field, be capable of designing sound experimental protocols, and competent to perform the techniques necessary to produce valuable new research findings or to report/teach these findings.

C. Delineation of Specific Skills

1. Research techniques and laboratory safety

2. Experimental design
3. Data analysis and interpretation
4. Statistical analysis
5. Effective search strategies and critical evaluation of the literature
6. Principles of the peer review process

D. Resources

Please note: Much of what postdoctoral fellows need to learn under this topic is discipline specific. The following resources provide information that is of general relevance to scientific research.

1. Barker, K. (1998). *At the bench: laboratory navigation*. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
See:
Chapter 5: Lab Notebooks and Data Management.
Chapter 7-9: Making and Disposal of Solutions:
2. *Making the right moves*, 2nd ed. (2006). Research Triangle Park, NC: Burroughs Wellcome Fund. Chevy Chase, MD: Howard Hughes Medical Institute. [online].
Available from: <http://www.hhmi.org/resources/labmanagement/moves.html>.
Accessed 2009 June 24.
See:
Chapter 8: Lab Notebooks and Data Management.
Chapter 10: Research Funding Process.
3. Boss, J. and Eckert, S. (2006). *Academic scientists at work: Navigating the biomedical research career*. New York: Kluwer Academic/Plenum Publishers.
See:
Chapter 3: Grant Writing and Review Process.
Chapter 6: Peer Review Process for Scientific Manuscripts.
4. McCabe, L. and McCabe, E. (2000). *How to succeed in academics*. San Diego, CA: Academic Press.
See:
Chapter 12: Writing Research Manuscripts.
Chapter 14: Peer Review Process.

III. COMMUNICATION SKILLS

- A. **Rationale/Conceptual Foundation:** In any professional environment, the ability to communicate one's thoughts in a way that people readily understand is critical. Although postdoctoral scholars learn many communication skills throughout their educational lifespan, these skills take time to master. Communication is more than preparing and sending a message; it is making every effort to be sure that the message is heard and understood by the appropriate audience
- B. **Components/Principles:** Postdoctoral scholars are expected to demonstrate interpersonal and other communication skills that enable them to communicate effectively with colleagues at all levels. They must also be prepared to communicate with students, media, and society at large. They need to develop writing, speaking, and listening skills.
- C. **Delineation of Specific Skills**
1. Writing
 - a. Scientific publications
 - b. Grants/applications
 - i. Government
 - ii. Corporations
 - iii. Foundations
 - c. Career
 - i. CV and resume
 - ii. Cover letters
 - iii. Research and teaching statements or portfolios
 - iv. Letters of recommendation or collaboration
 2. Speaking
 - a. Presenting your research
 - i. Poster sessions
 - ii. Conferences/seminars
 - iii. PowerPoint presentations
 - b. The job interview
 - i. Job talks
 3. Teaching

- a. Teaching methods
- b. Learning styles
- 4. Interpersonal Communication Skills
 - a. Style, tone and non-verbal cues
 - b. Negotiation
 - i. This skill is especially important in difficult economic times, when a postdoctoral scholar must be able to have a formal conversation with the PI/mentor/advisor to ask about the lab's funding in relation to his or her position.
 - c. Performance reviews/feedback
 - d. Difficult conversations/minimizing conflict
- 5. Special Situations
 - a. Networking
 - b. Conflict resolution
 - c. Managing the news media

D. Resources

Please note: There are numerous articles archived at sciencecareers.org regarding communication skills. Additionally, the National Communication Association provides general resources on communication (<http://www.natcom.org/index.asp?sid=34>).

Communication in General

1. Cutlip, A., Center, A., and Broom, G. (2006). *Effective public relations*. Upper Saddle River, NJ: Pearson Prentice Hall.
See:
Chapter 8: Communications and Public Opinion
Chapter 10: External Media and Media Relations
2. Robbins, S. and Judge, T. (2007). *Organizational behavior*. Upper Saddle River, NJ: Pearson Prentice Hall.
See:
Chapter 11: Communication

Conflict Resolution

1. Stone, D., Patton, B., and Heen, S. (1999). *Difficult conversations*. New York: Penguin Books.

Negotiating

1. Fisher, R., Ury, Wi. and Patton, B. (1991). Getting to yes: Negotiating agreement without giving in. Boston: Houghton-Mifflin.

Scientific Writing

1. Zeiger, M. (2000). Essentials of writing biomedical research papers. New York: McGraw-Hill.
2. Gopen, G. and Swan, J. (1990). The science of scientific writing. American Scientist 78:550-558. [online]. Available from: <http://www.americanscientist.org>. Accessed 2009 June 24.

Scientific Presentations

1. Rhodes, J. (1995) and Gargett, A. and Abbott, M. (2005). The Oceanography Society Council, Cullen, V. and Kappel, E., editors. Scientifically speaking. [online]. Available from: http://www.tos.org/resources/publications/sci_speaking.html. Accessed 2009 June 24.
2. Purrington, C. (2009). Advice on designing scientific posters. [online]. Available from: <http://www.swarthmore.edu/NatSci/cpurri1/posteradvice.htm>. Accessed 2009 June 24.

Teaching

Please note: It is recommended that postdoctoral scholars attend workshops on teaching that are specific to their disciplines.

1. Silver, H. Strong, R. and Perini, M. (2000). So each may learn: Integrating learning styles and multiple intelligences. Association for Supervision and Curriculum Development.
2. Advanced Life Support Group and Walker, M. (1999). Pocket guide to teaching for medical instructors. London: BMJ Books.

IV. PROFESSIONALISM

A. Rationale/Conceptual Foundation: Professionalism is inseparable from an individual's identity as a scholar and is a lifetime trait that matures with time and experience. The community of scholars defines the accepted etiquette and expected

behaviors of its members to instill and enforce the virtues of honor, integrity, compassion, cooperation, reliability, and responsibility. Reflecting the values of the communities in which the scholar works, professionalism enhances the perception of this work in society.

B. Components/Principles: One's professionalism is relevant in different contexts that govern and define the potential interactions the scholar engages with his/her environment. A proper discussion of professionalism should integrate concepts of:

1. **Workplace** professionalism, connecting with the immediate working team
2. **Institutional** professionalism, connecting with the research infrastructure
3. **Collegial** professionalism, connecting with the discipline of expertise
4. **Universal** professionalism:, connecting with society in representing an expertise.

C. Delineation of Specific Skills

1. **Workplace** professionalism: developing social skills and an inclusive environment as a member of a research team or among different teams through effective and respectful interactions with diverse students, employees, peers, and supervisors.
 - a. Assess and uphold workplace etiquette, performance standards, and project goals with members of a team or in other immediate work environments (classroom, committee boardroom, editorial boardroom, virtual lab, etc.)
 - b. Respect, evaluate, and enhance the intellectual contribution of others by encouraging nourishing attitudes and relationships
 - c. Allow others the right to self-expression and opinion to deeply understand and respect the complex identities of others, their histories, and their cultures
 - d. Preserve and promote mentoring relationships within the workplace.
 - e. Develop confidence in expressing one's attitudes, observations, or opinions using positive or reinforcing language.
2. **Institutional** professionalism: connecting as an employee or representative of an institution by developing advocacy skills with and seeking assistance from compliance officers, senior management, or administration (at the institution, across institutions, or with funding stakeholders).
 - a. Compliance with rules and regulations
 - b. Respect, adjust, and comply with unit-specific and institutional norms and expectations of appearance, conduct, and values

- c. Collaborate with senior management and administration through participation on institutional committees or other internal leadership opportunities.
3. **Collegial** professionalism: engaging colleagues, collaborators, and experts as a citizen to scholarship to maintain the intellectual integrity of the discipline and the profession.
- a. Identify, establish, and maintain effective and trustworthy partnerships with mentors and collaborators
 - i. Informal communication (networking and follow-through)
 - ii. Respecting others' time and needs in completing goals
 - iii. Data confidentiality and ownership
 - iv. Developing rules, expectations, and evaluations for collaborations
 - v. Peer-review of manuscripts, grant proposals, and competitive awards.
 - b. Advance and promote the discipline by participating in public and professional service activities, such as professional societies, editorial and advisory boards, peer review panels, and institutional committees.
 - c. Advance and promote the discipline by participating in partnerships with government agencies, foundations, and/or non-profit organizations, such as funding agency grant panels or other advocacy/advisory boards to contribute to the advancement and promotion of the discipline.
 - d. Identify and manage apparent and actual conflicts of interest, ethical violations, and violations of expected professional behavior.
4. **Universal** professionalism: bearing responsibility for the universal perception of the profession and his/her contribution towards social justice or improvement as a representative of the community.
- a. Engage and serve the general public (schools, government officials, other professions, media) to promote the profession
 - b. Identify societal needs and communicate the impact of the profession to address those needs to the public's benefit.

D. Resources

Please note: The NPA Web site provides resources on career development, mentoring, and other related topics.

Career Resources for Postdocs

1. American Association for the Advancement of Science. (2009). Career basics: Advice and resources for scientists from Science Careers. [online]. Available from: <http://sciencecareers.org/careerbasics.pdf>. Accessed 2009 October 14.
2. American Association for the Advancement of Science. (2009). Career trends: Careers away from the bench. [online]. Available from: <http://sciencecareers.org/booklets>. Accessed 2009 October 14.
3. American Association for the Advancement of Science. Science careers. [online]. Available from: <http://sciencecareers.sciencemag.org/>. Accessed 2009 June 24.
4. Vitae: Realising the potential of researchers. [online]. Available from: <http://www.vitae.ac.uk/>. Accessed 2009 October 5.

Discussing Professional Identities

1. The National Academies (1989, 1995, 2008). On being a scientist. Washington, D.C.: National Academy Press.
2. National Institutes of Health. Research and training opportunities. [online]. Available from: <http://www.training.nih.gov/careers/workshops.asp>. Accessed 2009 October 5.
See:
How to Succeed in Science
<https://webmeeting.nih.gov/p33253210/>.

Diversity Resources for Postdoctoral Scholars

1. American Medical Students Association. (2007). Cultural competency in medical education: A guidebook for schools. [online]. Available from: <http://www.amsafoundation.org/pdf/CulturalCompCurriculum.pdf>. Accessed 2009 October 5.

Resources for Trainers and Organizers

1. Klein, F. (2008). Giving notice: Why the best and brightest are leaving the workplace and how you can help them stay. San Francisco: Josey-Bass.
See: <http://www.givingnoticethebook.com/>
2. The Level Playing Field Institute (www.lpfi.org)
3. The [National Coalition Building Institute International \(NCBI\)](http://ncbi.org/) (<http://ncbi.org/>)

V. LEADERSHIP AND MANAGEMENT SKILLS

A. Rationale/Conceptual Foundation: The development of effective leadership styles and management skills is crucial for career progression. Understanding which leadership styles are appropriate for any given time and situation will benefit the person and the organization and increase performance and productivity. Leaders must also be able to competently manage projects, budgets, and staff. Outside of the immediate work environment, leadership skills are essential in order to be active and productive in professional societies and national organizations, obtain administrative positions, and collaborate with colleagues both intra- and extramurally. Opportunities to understand the basic principles of leadership and to develop leadership and management skills need to be incorporated into the postdoctoral training period. These skills will also help the person to mentor others more successfully.

B. Components/Principles: Postdoctoral scholars are expected to demonstrate an understanding of the importance of collaboration within teams and organizations and an understanding of the skills and techniques needed to facilitate effective team work. Additionally, they are expected to effectively manage day to day operations as appropriate within their fields.

1. Management Skills

Postdoctoral scholars are expected to be able to effectively manage staff, understand principles of project management, develop personal and team priority setting and time management skills, and collaborate effectively. They must also develop skills in budget and financial management, demonstrate an understanding of institutional culture and of institutional compliance and regulatory requirements, and effectively manage data and resources.

2. Leadership Skills

Postdoctoral scholars should demonstrate self-awareness and an understanding of individual temperament traits and leadership styles, develop skills needed to work with individuals with different traits, and pursue leadership opportunities at the local, institutional, regional and national level through professional committees, organizations, or societies.

C. Delineation of Specific Skills

1. Management Skills

- a. Research Staff Management
 - i. Writing job description
 - ii. Recruitment
 - iii. Hiring/terminating
 - iv. Mentoring/Retention
 - v. Performance reviews/feedback
 - vi. Working with individuals of diverse gender, ethnic, cultural, and religious backgrounds
 - vii. Conflict management/difficult conversations
- b. Project Management
 - i. Establishing priorities
 - ii. Time management
 - iii. Collaborations (intra/interlab)
 - iv. Planning
 - a. Development of overall plan
 - b. Strategic planning
 - v. Developing/managing budgets
 - vi. Tracking material and equipment use
- c. Data and Resource Management
 - i. Recordkeeping in print and electronic media, establishing protocols for backups of data
 - ii. Developing/managing budgets
 - iii. Tracking material and equipment use
- d. General Management
 - i. Running a meeting
 - ii. Delegating responsibilities

2. Leadership Skills

- a. Identifying and clarifying goals
- b. Motivating/inspiring others
 - i. Understanding the long-term strategic vision and helping others to see where their work/roles fit in this picture

- ii. Understanding how to use appropriate leadership styles in any given situation
- c. Serving as a role model

D. Resources

Leadership in General

1. Northouse, P. (2004). *Leadership theory and practice*, 3rd ed. Thousand Oaks: Sage Publications.

Leadership in the Laboratory

1. Barker, Kathy (2002). *At the helm: A laboratory navigator*. New York: Cold Spring Harbor Laboratory Press.
2. Boss, Jeremy M., Eckert, Susan H. (2003). *Academic scientists at work: Navigating the biomedical research career*. New York: Kluwer Academic/Plenum Publishers.
See:
Chapters 2-5.
3. *Making the right moves*, 2nd ed. (2004). Research Triangle Park, NC: Burroughs Wellcome Fund. Chevy Chase, MD: Howard Hughes Medical Institute. [online]. Available from: <http://www.hhmi.org/labmanagement>. Accessed 2009 June 24.
See:
Chapters 3-8.
4. *Training scientists to make the right moves* (2006). Research Triangle Part, NC: Burroughs Wellcome Fund. Chevy Chase MD: Howard Hughes Medical Institute. [online]. Available from: <http://www.hhmi.org/labmanagement>. Accessed 2009 October 5.

VI. RESPONSIBLE CONDUCT OF RESEARCH (RCR)

A. Rationale/Conceptual Foundation: The pursuit and advancement of knowledge depend on openness, honesty, objectivity, and trust. Although the focus of many aspects of the responsible conduct of research is on the biomedical field, the 2005 Office of Science and Technology Policy federal misconduct definition applies to all disciplines of science.

The ethical dimensions extend beyond simple adherence to rules and guidelines and parallels of ethical behavior exist in other fields. Accordingly, fellows within or outside the field of the biomedical sciences should also be trained in those core educational areas that are appropriate to their field. Moreover, they should be familiar with codes, guidelines or best practices that their professional societies have generated and be aware of the federal policies adopted by their granting institutes.

Standards of integrity and professional honor permeate daily professional activities. Postdoctoral scholars are in the unique position of having little official standing and significant dependence upon the goodwill of their supervisor, which is especially true for international scholars whose visa status depends upon continued employment. Postdoctoral scholars, therefore, may be more vulnerable, and at greater risk, when encountering issues and challenges associated with the responsible conduct of research (RCR). Although funding agencies endorse an RCR education requirement and academic institutions are encouraged to provide RCR instruction to their trainees, no formal standards on RCR education exist. As future mentors and leaders, however, postdoctoral scholars will be responsible for upholding and engaging the ethical norms of their field.

B. Components/Principles: Postdoctoral scholars would be expected to⁴:

1. Improve their ability to make ethical and legal choices.
2. Develop appreciation for the range of accepted practices for conducting research.
3. Be familiar with the regulations, policies, statutes, and guidelines that govern the conduct of government-funded research, as appropriate.
4. Be aware of the available tools and resources to which they can turn when ethical questions and concerns arise (see comment under “research misconduct” bullet).

C. Delineation of Specific Skills

1. Data ownership and sharing
 - a. Sharing of data with collaborators, including industry-specific concerns as appropriate
 - b. Ownership and access to data, particularly once a postdoctoral fellow’s appointment ends
 - c. Legal ramifications of intellectual property, patents and copyright.

⁴ Adapted from the objectives of the *Policy on Instruction in the Responsible Conduct of Research*, Office of Research Integrity (ORI), 2000.

2. Publication practices and responsible authorship
 - a. Criteria for authorship
 - b. The elements of responsible publication
3. Research with human subjects (where applicable)
 - a. Ethical principles for conducting research with human subjects
 - b. Informed consent and subject confidentiality
 - c. Institutional Review Boards
 - d. Reporting clinical trials.
4. Research involving animals (where applicable)
 - a. Ethical principles and federal policies for conducting research with animals
 - b. Understanding the Three Rs: Replace, reduce and refine animal use in research
 - c. Institutional Animal Care and Use Committee (IACUC).
5. Identifying and mitigating research misconduct
 - a. Definitions (federal, ORI/PHS, NASA, NEH, NSF, etc.)
 - b. Reporting procedures
 - c. The role and risks of being a whistleblower.
6. Conflicts of interest
 - a. Personal and intellectual conflicts
 - b. Conflicts of commitment
 - c. Financial conflicts
 - d. Profits and intellectual property rights
 - e. Confidentiality and bias in peer review
 - f. Conflicts and potential competition between mentor and trainee.

E. Resources

Please note: resources are available on the Office of Research Integrity Web site (<http://ori.hhs.gov/education/rcrrdp>) and the National Postdoctoral Web site (<http://www.nationalpostdoc.org/publications/rcr>).

1. Anderson M. (2007). Collective openness and other recommendations for the promotion of research integrity. *Science and Engineering Ethics* 13(4): 387.
2. European Science Foundation. (2009). ESF-ORI First World Conference on research integrity: Fostering responsible research.[online]. Available from: <http://www.esf.org/index.php?id=4479>. Accessed 2009 October 5.

3. Macrina, F. (2005). *Scientific integrity: Text and cases in responsible conduct of research*, 3rd ed. Washington, D.C.: ASM Press
4. Office of Research Integrity, U.S. Department of Health and Human Services. (2006). Federal research misconduct policy. [online]. Available from: http://ori.hhs.gov/policies/fed_research_misconduct.shtml. Accessed 2009 October 5.
5. Steneck, N. and Bulger, R. (2007). The history, purpose, and future of instruction in the responsible conduct of research. *Academic Medicine* 82(9): 829.



Appendix

The National Postdoctoral Association Core Competencies Committee*

- Lida Anestidou, Ph.D., Program Officer, The National Academies Program
- Joan Chesney, M. D., Member, Department of Infectious Diseases, St. Jude Children's Research Hospital
- Emil Chuck, Ph.D., Faculty Member, Student Academic Affairs and Advising, Health Professions Advisor & Term Assistant Professor, George Mason University
- Phil Clifford, Ph.D., Professor of Anesthesiology and Physiology & Associate Dean for Postdoctoral Education, Medical College of Wisconsin
- Lisa Curtis, Ph.D., Instructor of Medicine, Department of Medicine, Division of Nephrology, University of Alabama at Birmingham
- Jennifer Hobin, Ph.D., Senior Science Policy Analyst, Office of Public Affairs, Federation of American Societies for Experimental Biology, joined committee in 2009
- Cathee Johnson Phillips, M.A., Former Executive Director, NPA (2008-2013), joined committee in 2009
- Keith Micoli, Ph.D., Postdoctoral Program Manager, NYU School of Medicine, Sackler Institute of Graduate Biomedical Sciences
- Lucia Mokres, D.V.M., Program Specialist, Hantel Technologies
- Alyson Reed, M.B.A., Former Executive Director, NPA
- Nancy Schwartz, Ph.D., Dean for Graduate and Postdoctoral Affairs, University of Chicago

**Titles and institutions listed here were correct during the members' terms of service on the committee and may have changed since then.*