Responsible Conduct of Research Toolkit

Tools for developing programs on
responsible conduct of research
for postdocs

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http://www.nationalpostdoc.org/rcr-toolkit

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TABLE OF CONTENTS

APPENDIX

INTRODUCTION

Postdocs and the Need for RCR Training

Research integrity has become an emerging topic with many high profile cases of misconduct. In such dramatic cases, it is perhaps easy to think that a scientist's inner moral compass should be able to navigate such issues without training. For some integrity-related decisions the answers can be plain, for example: Should I fabricate data? Should I steal someone else's ideas? But, responsible conduct of research (RCR) – especially for early career scientists – is much more of a grey area than just "doing the right thing" and in fact constitutes all the small decisions made during the research activities of every day. Some of the common decisions faced by postdocs may not be so clear cut, such as: Who should be first author on your first lab paper? Can you photoshop your publication images to make them easier to interpret? What role should your advisor play in your new collaborations outside the lab? Such questions can be harder to answer, especially without good training or mentorship.

Despite recent moves at the federal level towards requiring training in RCR [1], many postdocs still do not receive guidance on these issues. Sigma Xi's 2005 nationwide survey of postdocs found that nearly a third (31%) of respondents indicated having received no training in research ethics, with another third (33%) having received only informal, "on-the-job" training. In the specific areas of intellectual property and conflict resolution skills, however, they found that almost two-thirds had received no training [2]. Other studies find similar results [3]. In the case of authorship, for example, studies find that most postdocs are unaware of the authorship guidelines mandated by their institution or professional community [4]. Other data suggest that this lack of training may result in instances of scientific misconduct among postdocs. In 2005, a study reported in Nature [5] found that 28% of early-career scientists – the majority of whom were postdocs – anonymously self-reported having committed at least one of the ten most common acts of questionable research behavior [6]. Similarly, the Office of Research Integrity found that between 1994 and 2003, postdocs accounted for 20% of proven misconduct cases [7]. Yet while there seems to be a need for such training, it is also important that the training be responsive to the particular needs and concerns of postdocs and their phase of career advancement.

Many reports (see [8] and references therein) recommend that RCR is best taught in the broader context of general research skills, where responsible authorship, for example, is taught alongside scientific writing. Whether incorporated into research and technical skill courses or taught as a stand-alone seminar, RCR should be framed within the larger context of the research enterprise and utilize case studies, interactive learning and other adult learning principles to engage postdocs. For postdoctoral scholars who no longer have a core curriculum of research courses, RCR topics have successfully been integrated into a range of professional development programs that teach such topics as grant writing, personnel management, budget development and leadership skills. When asked on the Sigma Xi Postdoc Survey what kind of formal training they would be interested in receiving, postdocs ranked research ethics last, whereas they put grant writing, lab management and project management at the top. Postdocs' clear interest in these types of professional development suggests they can provide a useful platform for teaching

integrity-related topics. See the toolkit article on Choosing a Program Format for a sample of RCR programs using a range of formats.

RCR Topics for Emphasis

ORI has recommended nine core areas [9] for RCR training. Drawing on these, the NPA emphasizes the following areas for such training for postdocs:

* Data Acquisition, Management, Sharing and Ownership;
* Mentor/Trainee Responsibilities;
* Publication Practices and Responsible Authorship;
* Peer Review;
* Collaborative Science;
* Research Misconduct; and
* Communication and Difficult Conversations.

While the first six topics are taken directly from the ORI core areas, the final topic, communication and difficult conversations, has been added due its particular relevance for postdocs. It has been noted that perhaps the most effective form of RCR training is from one's research advisor [10]; however, the success of this approach relies upon effective communication within the postdoc-supervisor relationship. Furthermore, discussion of ethical situations in research, whether with colleagues, collaborators or supervisors, can lead to uncomfortable or difficult conversations especially for postdocs who may feel that their job security or visa status depends upon the goodwill of these individuals. Thus, training in effective communication can be an important part of mastering the other six RCR topic areas.

Those interested in developing an RCR training program directed at postdocs are encouraged to peruse the remainder of this toolkit, which provides articles with advice and model programs. In addition, the NPA Project Manager is available for consultation and assistance with such programs.

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[1] In recent years the Office of Research Integrity has considered requiring research staff supported on public health-related grants to undergo RCR training (see this article in *Science* Careers for an overview). NIH already requires this for those supported on its training grants (see http://grants.nih.gov/grants/guide/notice-files/not92-236.html).
[2] Sigma Xi Postdoc Survey (2005), see data on Institutional Environment: http://www.sigmaxi.org/postdoc/all/inst_environment_short.html
[3] Eastwood, S., Derish, P., Leash, E., and Ordway, S. (1996) Ethical issues in biomedical research: Perceptions and practices of postdoctoral research fellows responding to a survey. *Science and Engineering Ethics* 2: 89-114.
[4] c.f. Sigma Xi Postdoc Survey (2005) and Tarnow, E. (1999) The Authorship List in Science: Junior Physicists' Perceptions of Who Appears and Why. *Science and Engineering Ethics* 5: 73-88.
[5] Martinson, B.C., Anderson, M.S., and de Vries, R. (2005) "Scientists Behaving Badly." *Nature*, 435, 737-738

[6] Diverging somewhat from the integrity community's definition of research misconduct as fabrication, falsification and plagiarism, Martinson et al. include a broader definition of misconduct which includes "behaviour [that], if discovered, would get a scientist in trouble at the institutional or federal level."
[7] Rhoades, L. J. (2004) *ORI Closed Investigations into Misconduct Allegations Involving Research Supported by the Public Health Service: 1994-2003*
http://ori.dhhs.gov/publications/documents/Investigations1994-2003-2.pdf
[8][10] Board on Health Sciences Policy and Institute of Medicine (2002) *Integrity in Scientific Research: Creating an Environment That Promotes Responsible Conduct*
Washington, DC: National Academies Press
http://www.nap.edu/books/0309084792/html
[9] 9 Core Areas: Data Acquisition, Management, Sharing and Ownership; Conflict of Interest and Commitment; Human Subjects; Animal Welfare; Research Misconduct; Publication Practices and Responsible Authorship; Mentor / Trainee Responsibilities; Peer Review; and Collaborative Science

QUICK START GUIDE

Responsible conduct of research (RCR) programming can take a number of different forms depending on what your goals are for your postdoc community. For example, ensuring that postdocs are familiar with a set of research integrity guidelines can often be accomplished with online modules that can introduce and review material as well as provide some testing and interactivity. In contrast, helping postdocs develop a lasting understanding of the principles involved in research integrity and how they might apply them throughout their own career may require a more dynamic and engaging approach, such as small-group seminar or workshop that allows instruction to adapt to the experiences and concerns of the students.

As a first step, determine what might already be available at your institution. Many institutions may already have some sort of RCR training available for postdocs whether as a consequence of funding agency requirements or a more general institutional offering. In some cases, these programs may merely be expanded to reach all postdocs, in others it may be necessary or prudent to create a new or complementary program that can be tailored to the needs and challenges of postdoctoral scholars. In either case, it is important to marshal the existing resources you may have available on these topics and identify the potential stakeholders such as the office of research, the office of postdoctoral affairs or the graduate school.

Designing your program

Next, consider the type of training you would like to offer, and what would work best for your overarching curriculum. There are a number of options:

- Credit bearing course?
- Brown bag series?
- Occasional symposium?
- Weekend seminar?

Some aspects involved in this decision are:

- How often will you offer it?
- To whom will you offer it?
- Is it required, encouraged or optional?
- Who will teach it?
- What will students take away from it – enlightenment? certification? credit?
- What resources will you need for it?

Answering some of these questions can help determine your approach for others. For example, if you have local speakers or instructors you can perhaps more easily offer an ongoing series, but if you must bring in experts from outside, you may want to offer a more occasional series. For an overview of various program formats, with examples of existing programs, consult the NPA's RCR Toolkit article on "Choosing a Program Format."

A 2002 report from the National Academies on Integrity in Scientific Research: Creating an Environment That Promotes Responsible Conduct examined the best approaches for

RCR education. They found that the best model is learning from a supervisor or advisor, for example through individual meetings, group meetings, journal clubs or seminars, although this is not always the most practical or uniformly implemented method. In lieu of this, they recommend approaches that teach RCR alongside everyday research skills – a commonly held recommendation [1] – and methods that incorporate adult learning principles, such as fostering active learning and participation and adapting to the diversity of experiences and learning styles among students. They also recommend that instruction take place over an extended period of time, either regular meetings over a year-long course or periodic seminars held over a year or more throughout a postdoc's career. Finally, they suggest that instructors need both science and ethics knowledge, and so ideally instruction would involve a collaboration between research faculty and ethics experts. They stress that involving research faculty also creates role models for postdocs within their own disciplines, emphasizing the importance of these topics.

For more details on pedagogical approaches for teaching RCR, consult Chapter 5 of this report on "Promoting Integrity in Research through Education."

Another important question is what content or material should the program cover. Should it emphasize a few RCR topics to cover briefly, or just one to cover in depth? Should the RCR material be incorporated into a lab management style course, focusing on professional development skills? Should you offer a survival skills type workshop, geared more towards surviving postdoc life? Of course, no program need cover all RCR topics; however it is important to define which aspects you will cover. For more detailed information on defining the goals and scope of your program, visit the RCR Toolkit articles on "Determining the Goals and Content of your Program" and "RCR Topics for Postdocs."

Some other useful articles from *Science* Careers on how to approach teaching scientific integrity topics:

Ethics and Policy Minifeatures
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/2030/ethics_and_policy_mini_features
A compilation of *Science* Careers articles on ethics

Additional resources on ethics
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/2030/ethics_resources/

On Teaching Scientific Integrity
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/1050/scientific_integrity_the_view_from_the_teaching_side
An instructor's perspective on designing an RCR course from scratch for grad students She describes her challenges in engaging the students until she transformed the course into a "survival skills" course.

Getting Scientists to Do the Right Thing

http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/2030/getting_scientists_to_do_the_right_thing
Perspectives on how to approach RCR training, including mention of the NAS report on Integrity in Scientific Research

Targeting postdocs

Regardless of whether postdocs are classified as students, trainees, or employees at an institution, a postdoc's main priority is producing research results instead of taking courses. Therefore research integrity programming will undoubtedly require some tailoring to draw postdocs from their offices and labs. Some suggestions for marketing your program to postdocs are included in the toolkit article "Marketing RCR Programs to Postdocs;" however, below are some introductory considerations.

- Try to integrate RCR topics with other everyday professional development topics, since they are an integral part of so many of the decisions postdocs navigate everyday. This can make the topics more attractive to postdocs as well as frame them as part of essential tasks.

- Try to stay away from lecturing or on-line modules and consider more interactive modes, such as using case studies and lots of discussion in order to really engage postdocs intellectually in the subject.

- Take into consideration the unique and multiple roles a postdoc fills. For example, try to probe issues of being the mentor and the mentee, collaborator and apprentice. Be mindful of roles like that of whistleblower, which can be difficult for postdocs who depend upon the goodwill of their supervisor or colleagues.

- Acknowledge the breadth of cultural backgrounds you will likely have among a postdoc cohort, since 60-70% of postdocs in the U.S. are visa holders.

For additional guidance on tailoring your program to the needs postdocs, visit the RCR Toolkit article on "Tailoring RCR Programs for Postdocs." For insight on RCR issues of particular pertinence to postdocs, visit the RCR Toolkit article on "RCR Topics for Postdocs."

In addition, some good background resources on postdocs are available at:

- The NPA website, in particular, an overview of What is a Postdoc?, and the NPA Agenda for Change
- National Research Council report, *Bridges to Independence: Fostering the Independence of New Investigators in Biomedical Research*
- Sigma Xi Postdoc Survey Report, *Doctors Without Orders*

Good resources with which to start

1. Alexander, M. and Williams, W.R. *A Guidebook for Teaching Selected RCR Topics to Culturally Diverse Trainee Groups.* Philadelphia: Children's Hospital of Philadelphia.
   This is a good place to start because it focuses on postdocs. In particular, it includes the results from some postdoc focus groups which provide considerable insight. It also includes instructional guidance and teaching materials for selected RCR topics: Data Management, Sharing and Ownership; Intellectual Property; and Research Misconduct.
   http://ori.dhhs.gov/documents/Alexander.RCR%20Guidebook.BW.pdf

2. Macrina, F.L. (2005) *Scientific Integrity: Text and Cases in Responsible Conduct of Research* (Third Edition). Washington, D.C.: American Society for Microbiology Press.
   This textbook is a comprehensive source of course material for teaching RCR with a number of case studies on a range of topics

3. Steneck, N.H. (2004) *ORI Introduction to the Responsible Conduct of Research*
   This guide provides a good introduction to the subject of RCR
   http://ori.dhhs.gov/documents/rcrintro.pdf

4. Board on Health Sciences Policy and Institute of Medicine (2002) *Integrity in Scientific Research: Creating an Environment That Promotes Responsible Conduct.* Washington, DC: National Academies Press.
   Again, Chapter 5 provides a good overview of considerations in teaching RCR
   http://books.nap.edu/openbook.php?record_id=10430&page=84

The NPA's RCR Toolkit also offers advice and program models that can help with beginning to plan an RCR program for postdocs. It can be found online at http://www.nationalpostdoc.org/rcr-toolkit.

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[1] See for example, Fischer, B.A. and Zigmond, M.J.(1996) "Teaching Ethics: Resources for researchers." *Trends in Neurosciences* 19: 523-524, and National Academies (1992) *Responsible Science: Ensuring the Integrity of the Research Process,* Vol. 1. Washington, DC: National Academies Press, and references therein.

DETERMINING THE GOALS AND CONTENT OF YOUR PROGRAM

As a first step, it is important to determine the goals of any responsible conduct of research (RCR) program. Mann, Kalichman and Macrina (2004) [1] describe the most common goals found among such programs. They fall in the following categories:

- Knowledge: Informing about rules, policies or guidelines; Expanding awareness of tools and resources available when faced with ethical dilemmas
- Skills: Enhancing such skills as: ethical reasoning and decision-making; lab and people management; and communication and conflict resolution
- Attitudes: Improving awareness and positive disposition toward scientific integrity issues
- Behaviors: Increasing transparency and discussion of ethical issues; Reducing the likelihood of misconduct occurrences

Having clear goals and objectives for a program is a critical step to ultimately evaluating its success and effectiveness. An evaluation tool should refer back to these objectives and assess the extent to which they have been met.

Along with your goals, determine the content you wish to cover as well as the information that holds the most interest for your target audience. There are a range of topics in RCR, usually characterized into the nine core areas put forward by the Department of Health and Human Services' Office of Research Integrity and each of these areas covers a range of subtopics. Information on particular issues for postdocs in some of these core topic areas is detailed in the following section on "RCR Topics for Postdocs." Your program could cover a series of these topics and address scientific integrity in general, or it could focus on one or two topics. Alternatively, you could integrate these topics into a program on other professional skills for scientists, such as a comprehensive survival skills or lab management course, or into a program focusing on one topic like grant writing that also addresses issues like responsible authorship, collaborative science and peer review. Thus the choice of program content goes hand-in-hand with the choice of the type and format of your program.

One way to design a program that has the most traction with your postdocs is to find out which topics or approaches hold the most interest for them and how much time they would be willing to commit. This can be done informally through individual consultations and in-person focus groups, or through more formal surveys. The NPA Postdoc Association Toolkit has an article on "Strategies for Conducting a Postdoc Survey." Aggregate data on U.S. postdocs from the Sigma Xi Postdoc Survey might also be helpful.

- Sigma Xi summary report, *Doctors Without Orders*
- Sigma Xi survey data: http://postdoc.sigmaxi.org/results/data

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[1] Mann, M.D., Kalichman, M.W., and Macrina, F.L. (2004) "Education in the responsible conduct of research." *The Physiologist*. 47(4): 149 http://www.the-aps.org/publications/tphys/2004html/AugTPhys/educresp.htm

RCR TOPICS FOR POSTDOCS

This section details some key RCR content areas, identifying some key issues of particular relevance for postdocs and listing some useful case studies and course materials.

A. Data Acquisition, Management, Sharing and Ownership
B. Mentor/Trainee Responsibilities
C. Publication Practices and Responsible Authorship
D. Peer Review
E. Collaborative Science
F. Research Misconduct
G. Communication and Difficult Conversations

A. DATA ACQUISITION, MANAGEMENT, SHARING AND OWNERSHIP

The data acquisition, management, sharing and ownership topic covers accepted practices and procedures for acquiring, storing, documenting, analyzing, sharing and maintaining data. It includes definitions for what constitutes data, procedures for maintaining the confidentiality and integrity of data, and proper methods for keeping records and processing and analyzing data. It also examines guidelines for who 'owns' data as well as the legal ramifications for intellectual property, patent and copyright laws.

These are critical areas where postdocs must understand the issues involved. Since postdocs typically work on a supervisor's project for a limited period of time, a number of questions will arise about the postdocs' rights with regard to the data collected and analyzed during the course of their appointment. This is particularly true when a postdoc leaves that institution for his or her next position and wants to continue working on some aspect of that project. The temporary nature of the postdoc appointment also makes data management and documentation procedures very important for when the postdoc leaves and the supervisor or other collaborators want to continue the work or need the records for contractual or intellectual property purposes. Furthermore, there are additional issues involved if the postdoc's research is funded in any way through industry which might have additional rules governing the ownership and publication of any data.

Since every discipline and every lab have slightly different accepted practices and procedures and funding agencies and institutions have a variety of requirements on data sharing and ownership, there are no one-size-fits-all guidelines for these issues. Upon starting a new appointment every postdoc and postdoc supervisor should have a frank and detailed conversation about these issues so that uniform practices can be utilized from day one and surprises can be avoided at the end of the appointment. However, grey areas and other questions inevitably arise and this is an area where a good RCR program can help equip postdocs with information and tools for answering them.

Data Sharing and Ownership

There are many different guidelines to which researchers must adhere when determining ownership and sharing of their data. These can include their funding agency, their institution or the source of the data themselves (e.g. databanks, museum collections, research subjects). An additional dimension for postdocs is what role they may play in the ownership of data that they collect while working for someone else. While some of these data may be collected in their supervisors' labs they may also be collected at other facilities, perhaps as part of a proposal submitted solely by the postdoc. The relative role of postdoc and supervisor in managing these data, including whether the postdoc can take any part with him or her upon leaving that institution, is a critical and sensitive one.

Case Studies and Teaching Materials

Some useful articles on data management from the *Science* Careers series on ethics in science. These articles present a fictitious case study and then provide comments on the case from individuals and experts in the field:

University-Industry Collaborations: Whose Data? A case study on sharing of data within a Ph.D. student's industry collaboration.
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/1260/university_industry_collaborations_whose_data

Sharing in the Sciences Another case study on "custody" of unpublished data
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/1680/sharing_in_the_sciences

Chapter 9 of the textbook Scientific Integrity deals with Ownership of Data and Intellectual Property:
Macrina, F.L. (2005) *Scientific Integrity: Text and Cases in Responsible Conduct of Research* (Third Edition). American Society for Microbiology Press, Washington, D.C.

Chapter 4 on Teaching Materials for Data Management, Sharing, and Ownership provides teaching materials and case studies for postdocs:
Alexander, M. and Williams, W.R. *A Guidebook for Teaching Selected RCR Topics to Culturally Diverse Trainee Groups*. Philadelphia: Children's Hospital of Philadelphia.
http://ori.dhhs.gov/documents/Alexander.RCR%20Guidebook.BW.pdf

Additional case studies on Responsible Authorship from the Online Ethics Center at the National Academies of Engineering
http://www.onlineethics.diamax.com/cms/research/modindex/moddata.aspx#method

Intellectual Property

Postdocs provide the intellectual stimulus for much of the research that is conducted in today's laboratories. Working with Principal Investigators who are leading the research enterprise, postdocs make invaluable intellectual contributions to the productivity of the

lab. In some cases, postdocs may develop new ideas that they want to test in the lab and ultimately publish the results of those tests. Given the complex nature of the postdoc's relationship with the PI and the institution, it is essential that postdocs have a working knowledge of intellectual property issues. This should include a basic understanding of patents. This knowledge will protect the postdoc and also those who work with postdocs, including the institutions that host them. There are numerous workshops, articles and other resources available on this topic:
(*excerpt from the NPA Postdoc Office Toolkit article on "*Providing Complementary Skills Development Programs*"*)

Case Studies and Teaching Materials

Science Careers has published a resource guide on this topic, which includes articles on protecting your patent, ownership of inventions and getting commercial funding for your academic research.
http://sciencecareers.sciencemag.org/career_development/issue/nextwave/0070/intellectual_property_feature_index/

The Penn Career Workshop series covers this topic as an alternative career path.
http://www.aamc.org/members/great/ee_penn_pdoffice_services_descript.pdf

The University of Alberta offers a session on Intellectual Property Guidelines and Patents as part of its professional development program:
http://www.aamc.org/members/great/ee_alberta_profdvlpmntprogrm_profunit.pdf

Chapter 5 on Teaching Materials for Intellectual Property provides teaching materials and case studies for postdocs:
Alexander, M. and Williams, W.R. *A Guidebook for Teaching Selected RCR Topics to Culturally Diverse Trainee Groups*. Philadelphia: Children's Hospital of Philadelphia.
http://ori.dhhs.gov/documents/Alexander.RCR%20Guidebook.BW.pdf

From *Science* Careers series on Lab Management articles, the following focus on the opportunities and considerations in intellectual property, such as inventions, patents and other "hidden" forms of IP:

Opportunities: Intellectual Property, Part 1
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/2006_11_10/opportunities_intellectual_property_part_1

Opportunities: Intellectual Property, Part 2
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/2006_12_08/opportunities_intellectual_property_part_2

Chapter 11, Understanding Technology Transfer from Burroughs Wellcome Fund and the Howard Hughes Medical Institute (2006) *Making the Right Moves: A Practical Guide to Scientific Management for Postdocs and New Faculty*, Second Edition

Data Management and Record Keeping

Data management and record keeping practices also vary from lab to lab and institution to institution, although some aspects may also be mandated by a funding agency or other group for the purposes of auditing. An advantage of good lab notebook maintenance on the part of postdocs is that it provides an easy and low-conflict way for postdoc supervisors to keep in touch with research progress on their projects. A potential issue for postdocs, however, is the fact that the majority in the U.S. are visa holders, many of whom may prefer to keep their notes in their native language instead of English. Postdoc supervisors need to take this into consideration and establish guidelines for the extent to which record keeping must be generally accessible.

Case Studies and Teaching Materials

Chapter 8, Data Management and Laboratory Notebooks from Burroughs Wellcome Fund and the Howard Hughes Medical Institute (2006) *Making the Right Moves: A Practical Guide to Scientific Management for Postdocs and New Faculty*, Second Edition

Chapter 11 of the textbook Scientific Integrity deals with Scientific Record Keeping, as well as Appendix VI on Laboratory Notebook Instructions used by the research division of a biotech company:
Macrina, F.L. (2005) *Scientific Integrity: Text and Cases in Responsible Conduct of Research* (Third Edition). American Society for Microbiology Press, Washington, D.C.

Do's and Don'ts for Keeping Lab Notebooks
http://www.fr.com/practice/pdf/LABBOOK2.pdf

B. **MENTOR/TRAINEE RESPONSIBILITIES**

The topic of mentor and trainee responsibilities covers the relative roles and responsibilities of both the mentor and the trainee. This includes the best approaches for selecting a mentor, managing conflicts and potential competition between mentor and trainee, mapping out the extent of collaboration between mentor and mentee and constructive procedures for mitigating abuses and resolving grievances. It is also important to make the distinction that a mentor is not always a direct research supervisor and so may play a different role than the supervisor in the trainee's professional development.

Postdocs are often in the unique position of simultaneously serving as both mentor and trainee. Since they are typically the most senior researcher in a group, they are frequently called upon to supervise the research of graduate and undergraduate students. While learning the extent of their role as research mentor, postdocs will also need to understand the potential limitations on their role since they may not be the *official* supervisor for these trainees.

The importance of the postdoc's supervisor to his or her future career cannot be overstated, since the good recommendation of the supervisor is key to obtaining the next position. This considerable dependence of the postdoc on the supervisor's goodwill can lead to conscious or unconscious abuses and can be a particular challenge for international postdocs who may be concerned about jeopardizing their visa status. Formal grievance procedures can help; however, it is important to note that even in the event that a postdoc wins in a formal ruling, they will still lose to some extent due to the loss of job recommendation and other fall out.

RCR programs that can provide guidance and information on these topics will greatly help postdocs navigate their relationships with their supervisors, mentors and trainees. Some institutions are also moving towards mentoring resources and programs for faculty and more senior mentors as well, since formal training on mentoring is not widespread.

Case Studies and Teaching Materials

Mentoring Scientists: An Ethical Dilemma An articles from *Science* Careers examining a case study on the ethics of mentoring, such as how to choose a mentor and who is the most appropriate person.

Chapter 3 of the textbook Scientific Integrity deals with Mentoring:
Macrina, F.L. (2005) *Scientific Integrity: Text and Cases in Responsible Conduct of Research* (Third Edition). American Society for Microbiology Press, Washington, D.C.

Additional case studies on Responsible Authorship from the Online Ethics Center at the National Academies of Engineering
http://www.onlineethics.diamax.com/CMS/research/modindex/advis.aspx#method

Handbooks and Guidelines

Adviser, Teacher, Role Model, Friend: On Being a Mentor to Students in Science and Engineering
The 1997 National Academies handbook on mentoring:
http://www.nap.edu/readingroom/books/mentor/

Entering Mentoring: A Seminar to Train a New Generation of Scientists, HHMI-sponsored handbook by Jo Handelsman, Christine Pfund, Sarah Miller Lauffer, and Christine Maidl Pribbenow; it outlines a seminar on how to be a mentor
http://www.hhmi.org/resources/labmanagement/downloads/entering_mentoring.pdf

How to Get the Mentoring You Want: A Guide for Graduate Students at a Diverse University
How to Mentor Graduate Students: A Guide for Faculty in a Diverse University
Some useful handbooks on mentoring for both the mentor and the mentee from the University of Michigan's Rackham Graduate School
http://www.rackham.umich.edu/StudentInfo/Publications/StudentMentoring/contents.html

"Mentoring and Being Mentored"
Chapter 5 from Burroughs Wellcome Fund and the Howard Hughes Medical Institute (2006) *Making the Right Moves: A Practical Guide to Scientific Management for Postdocs and New Faculty*, Second Edition

Mentoring International Postdocs: Working to Advance Science & Careers
An online module available from the federal Office of Research Integrity, developed by the Children's Hospital of Philadelphia, an NPA member institution.
http://www.ori.hhs.gov/education/products/chop_mentoring/

On the Right Track: A Manual for Research Mentors (2003) is available for a fee from the Council of Graduate Schools. This manual discusses the individual and corporate responsibilities of graduate faculty in producing competent scholars capable of conducting independent, original and ethically sound research.

The University of California, San Francisco, has developed mentoring guidelines for its faculty:
http://student.ucsf.edu/postdocs/assets/MentorGuidelines2003.doc

Articles

"*Nature*'s guide for mentors"
A guide on mentoring from *Nature*
Lee, A., Dennis, C., and Campbell, P. (2007) "*Nature*'s guide for mentors." *Nature* 447: 791-797

"Mentoring for the Postdoctoral Fellow"
An article in the NPA's quarterly newsletter, Summer 2004.

"Mentoring Minority Science Students: Can a White Male Really be an Effective Mentor?"
Article from the American Indian Graduate Center on a thorny topic in mentoring
http://www.aigc.com/articles/mentoring-minority-students.html

Science Careers has multiple resources on mentoring, including this article on "Enduring Qualities in Mentoring"
http://sciencecareers.sciencemag.org/career_development/issue/nextwave/1470/enduring_qualities_in_mentoring

Other resources

A Comprehensive Pilot Mentoring Program at the University of California, San Francisco
The NPA offered a workshop on this topic at its 3rd Annual Meeting.

Individual Development Plan for Postdoctoral Fellows
Developed by FASEB, a Friend of the NPA. The process of developing a work plan and long-term strategy with postdocs for their postdoctoral training is also a great tool for mentoring
http://opa.faseb.org/pdf/idp.pdf

MentorNet is an internet based mentoring resource that connects individuals seeking mentors with those willing to serve as mentors through e-mail exchanges:
http://www.mentornet.net/

The Association for Women in Science (AWIS) has a number of resources focused on mentoring:
http://www.serve.com/awis/mentoring.html

The American Association of Medical Colleges has developed a compact for postdocs and their supervisors and lays out their relative roles and responsibilities. Some institutions have implemented the compact as a (non-binding) contract to be signed upon beginning the postdoctoral appointment.
http://www.aamc.org/research/postdoccompact/

C. **PUBLICATION PRACTICES AND RESPONSIBLE AUTHORSHIP**

This topic examines the responsibilities of authors in scientific publication. It includes procedures for assigning credit and authorship, the responsibilities of each author, as well as accepted practices for detailing methods, analyses and results and including appropriate citations. It also can focus on some of the pitfalls such as the pressure to publish.

As for any researcher, a postdoc's publication record is the first consideration during any hiring or promotion review. The challenge for postdocs is to publish as many papers as possible during the limited time they have in a particular appointment. Their relative success in this endeavor can be inhibited by many things, from failed experiments to projects that require more time than the length of the appointment to obtain publishable results. Having a research plan with timelines and objectives can help both the postdoc and his or her supervisor keep the project on target and facilitate communication about their goals and outcomes.

Determining Authorship

A significant challenge for a postdoc coming into a new lab or new research group is learning the authorship practices for that group. While many scientific communities have guidelines for publication studies show that postdocs generally are unaware of these and rarely discuss such practices with their supervisors. These facts coupled with supervisors who may also have little familiarity with official guidelines can lead to confusion in the best case and conflict in the worse case.

Case Studies and Teaching Materials

Some useful articles on responsible authorship from the *Science* Careers series on ethics in science. They examine how to determine authorship by presenting a case study and comments on the case study from a panel of experts and relevant stakeholders.

The Ethics of Authorship: Feature Overview--How Should Authorship Be Decided?
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/0910/the_ethics_of_authorship_feature_overview_how_should_authorship_be_decided

Do You Really Want Your Name on That Paper? Another case study on authorship that focuses on a scientist's responsibilities once he or she is listed as an author. It includes several articles offering perspectives on the case study.
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/2170/do_you_really_want_your_name_on_that_paper

American Society of Plant Biologists Guidelines for Ethics in Publishing
http://aspb.org/publications/ethics.cfm

Chapter 4 of the textbook Scientific Integrity deals with Authorship and Peer Review: Macrina, F.L. (2005) *Scientific Integrity: Text and Cases in Responsible Conduct of Research* (Third Edition). American Society for Microbiology Press, Washington, D.C.

Northern Illinois University's Responsible Authorship Quick Guide: Common Mistakes
http://ori.dhhs.gov/education/products/niu_authorship/mistakes/index.htm

Additional case studies on Responsible Authorship from the Online Ethics Center at the National Academies of Engineering
http://www.onlineethics.diamax.com/CMS/research/modindex/auth.aspx#method

Image Manipulation for Publication

A growing issue in the age of Photoshop is how extensively one can manipulate a digital image for publication until the data are no longer faithfully represented. This issue is more prevalent among early career scientists since these image manipulation tools have always been available throughout their scientific careers. The consensus seems to be that some manipulation is allowable if it makes the data presentation more clear and does not mislead. However, where are the limits? It is the journals that have pioneered guidelines on digital data manipulation, with the *The Journal of Cell Biology* leading the way.

Case Studies and Teaching Materials

Journal guidelines on digital images

The Journal of Cell Biology
http://www.jcb.org/misc/ifora.shtml

Nature
http://www.nature.com/nature/authors/submissions/images/index.html

Articles

Rossner, M. and Yamada, K.M. (2004) "What's in a picture? The temptation of image manipulation." *Journal of Cell Biology* 166:11-15
http://www.jcb.org/cgi/content/full/166/1/11

North, A.J. (2006) "Seeing is believing? A beginners' guide to practical pitfalls in image acquisition." *Journal of Cell Biology* 172:9-18
http://www.jcb.org/cgi/content/full/172/1/9

D. PEER REVIEW

Peer review is the process through which the relative merits of scientific research are determined. It includes the definition and process of peer review, the variety of activities that utilize peer review from publication to proposal submissions, the role and responsibilities of reviewers, and understanding impartiality and confidentiality. Postdocs will have begun to be invited to review papers for journals and sit on review panels so learning about this process will be a very pertinent skill for them. Furthermore, this burgeoning experience on the part of the postdoc makes it attractive for busy PIs to pass on their own review responsibilities to their postdocs, making guidance in the ethics of peer review also important.

Case Studies and Teaching Materials

Chapter 4 of the textbook Scientific Integrity deals with Authorship and Peer Review: Macrina, F.L. (2005) *Scientific Integrity: Text and Cases in Responsible Conduct of Research* (Third Edition). American Society for Microbiology Press, Washington, D.C.

"Peer-Review Techniques for Novices" by Lesley McKarney
Science Careers article with guidance directly for the early-career scientist on how to approach peer review
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/0980/peer_review_techniques_for_novices/

"Reviewers Can Help Get Your Paper Published" by David Grimm
Science Careers article examining findings that suggesting your own peer reviewers may bias acceptance of your paper or proposal
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/3710/reviewers_can_help_get_your_paper_published/

"Academic Scientists at Work: I Can't Believe They Didn't Like It!" by Jeremy M. Boss and Susan H. Eckert
Science Careers article explaining the peer review process and how scientists can use it to improve their papers and proposals
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/2590/academic_scientists_at_work_i_can_t_believe_they_didn_t_like_it

Additional case studies on Responsible Authorship, including peer review, from the Online Ethics Center at the National Academies of Engineering
http://www.onlineethics.diamax.com/CMS/research/modindex/publ.aspx#method

An Overview of the Peer Review Process at NIH from the NIH Center for Scientific Review
http://www.csr.nih.gov/review/policy.asp

E. **COLLABORATIVE SCIENCE**

Collaborative science covers all aspects of developing and maintaining research collaborations. This includes communicating and establishing the parameters of the collaboration, such as authorship determinations and sharing of data and materials. Another dimension is collaboration between researchers from academia and industry, which will have additional guidelines.

Postdocs are in the process of transitioning to independence and building their professional network. As this professional network grows and new project ideas emerge, postdocs and their supervisors should be sure to have clear communication about the responsibilities of their own collaboration as well as the possibilities for collaboration with others.

Setting up these ground rules is a critical first step for postdocs, who, depending upon the nature of their appointment and the concerns of their PI, may not be aware of potential complications with their participation in collaborations. For example, some PIs may be concerned about postdocs collaborating outside of their primary project, especially when 100% of the postdoc's effort is funded by that project. Postdocs will naturally want to broaden their scholarly network to benefit both their science and their career prospects. However, building these networks through outside collaboration can increase the postdoc's potential for conflict with the interests of his or her PI, making communication about the nature and scope of the collaboration as well as the expectations of the PI critically important.

Case Studies and Teaching Materials

Chapter 8 from the textbook *Scientific Integrity* deals with Collaborative Research: Macrina, F.L. (2005) *Scientific Integrity: Text and Cases in Responsible Conduct of Research* (Third Edition). American Society for Microbiology Press, Washington, D.C.

Chapter 12, Setting Up Collaborations from Burroughs Wellcome Fund and the Howard Hughes Medical Institute (2006) *Making the Right Moves: A Practical Guide to Scientific Management for Postdocs and New Faculty*, Second Edition
http://www.hhmi.org/resources/labmanagement/downloads/moves2_ch12.pdf

Silence is Not Golden: Making Collaborations Work By Joan P. Schwartz, Ph.D., NINDS
http://ori.dhhs.gov/education/science_not_golden.shtml

Articles on Industry Collaborations

Some useful articles on industry partnerships from the *Science* Careers series on ethics in science. These articles present a fictitious case study and then provide comments on the case from individuals and experts in the field.

University-Industry Collaborations: Whose Data? A case study on sharing of data within a Ph.D. student's industry collaboration.
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/1260/university_industry_collaborations_whose_data

Sharing in the Sciences Another case study on corporate sponsorship and "custody" of data
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/1680/sharing_in_the_sciences

Gluck, M.E., Blumenthal, D., and Stoto, M.A. (1987) "University-Industry Relationships in the Life Sciences: Implications for Students and Post-Doctoral Fellows." *Research Policy* 16: 327-336.
A study on potential conflicts of interest for graduate students and postdocs when their funding comes directly from industry supporters

F. **RESEARCH MISCONDUCT**

The definition of research misconduct is constantly evolving as institutions and agencies continue to establish guidance for their communities on how to conduct research with integrity. The basic components, however, of research misconduct remain: falsification, fabrication, and plagiarism in the course of research activities. This is often referred to as "FFP." There is another component that is receiving increasing attention that involves research practices that are not as egregious as FFP but are found to occur with much greater frequency. These are called questionable research practices, or "QRP," and studies have suggested that those who engage in QRP will have an increased tendency to commit FFP (see M. Anderson and collaborators, as reported at the 2008 ORI Conference on RCR Education, Instruction and Training).

Training in this topic typically involves the various agency definitions of misconduct, how to report occurrences and the roles and responsibilities of the whistleblower. For postdocs it is important to also identify the risk involved in whistleblowing, since they are particularly vulnerable to repercussions. Furthermore, even in a situation where postdocs may succeed in reporting misconduct, they often still lose since their position and immediate career future may depend upon the PI or lab that has engaged in misconduct. For these reasons it is also important to make clear the avenues available to postdocs for asking advice and questions about sensitive situations, whether that is through the ombudsman, the postdoc office director or a peer network of some kind.

Teaching Materials and Case Studies

Chapter 4 on Teaching Materials for Research Misconduct provides teaching materials and case studies for postdocs:
Alexander, M. and Williams, W.R. A Guidebook for Teaching Selected RCR Topics to Culturally Diverse Trainee Groups. Philadelphia: Children's Hospital of Philadelphia.
http://ori.dhhs.gov/documents/Alexander.RCR%20Guidebook.BW.pdf

Martinson, B.C., Anderson, M.S., and de Vries, R. (2005) "Scientists Behaving Badly." Nature, 435, 737-738.
Study on self-reported research "misbehaviors" or QRP, with comparison of late-, mid- and early-career scientists. Surveyed early-career scientists, 58% of which are postdoctoral fellows, showed different patterns in misconduct, and reported a somewhat lower rate of committing misconduct than mid-career scientists (28% compared with 38%).

Articles on Whistle Blowing

A useful article from Science Careers about the issues involved in being a whistle blower in science:
Scientific Integrity and Ethics: A Dilemma

Protecting Whistleblowers--Tell ORI What You Think! A *Science* Careers discussion of ORI regulations for protecting whistleblowers (rules passed in 2001) http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/0770/protecting_whistleblowers_tell_ori_what_you_think

Overview of Whistleblower Policies at ORI
http://ori.dhhs.gov/misconduct/whistleblowers.shtml

Another article that considers the potential consequences of being a whistle blower:
Hoke, F. (1995) "Veteran Whistleblowers Advise Other Would-Be 'Ethical Resisters' To Carefully Weigh Personal Consequences Before Taking Action" *The Scientist* 9(10):1
http://www.the-scientist.com/article/display/16504/ *(subscription required)*

A very accessible article from *New York Times Magazine* in 2006 describes the experience of former University of Vermont lab tech Walter DeNino, who was the whistleblower in the Eric Poehlman case, the first research misconduct case that resulted in jail time.
Interlandi, J. "An Unwelcome Discovery." New York Times Magazine October 22, 2006

G. **COMMUNICATION AND DIFFICULT CONVERSATIONS**

Communication and difficult conversations is a topic not include among the standard nine education areas recommended by the Office of Research Integrity. Nevertheless, it is a topic of particular importance for postdocs whose position at any institution is one with little official status often requiring that postdocs rely upon persuasion and goodwill to navigate some aspects of the research environment. In particular, a postdoc's sole reliance upon his or her supervisor for resources, support, approval, and future job recommendations means that communication is a critical skill as is diplomacy when conversations turn towards difficult or sensitive topics. These skills are doubly important for international postdocs who come from a different cultural perspective, with different norms and assumptions, and may have to have these difficult conversations in a second language.

Communication for Difficult Situations

Dealing with people in any environment can lead to difficult situations, and the research environment is no different. Despite the "scholar in an ivory tower" allusions, research requires significant collaboration and people management skills. Postdocs have the disadvantage of having little status or power within their institution, which can create additional difficulties. Thus communication in such situations can be the key to amicable resolutions.

Teaching Materials

High Conflict People in Legal Disputes by Bill Eddy.
It provides an overview of the 4 difficult personality types (Borderline, Narcissistic, Antisocial, Histrionic) that can be encountered in any kind of dispute, not just legal, as well as advice on how to deal (or not deal) with each one.

"Dealing with Difficult People and Difficult Situations" by Dale Cameron
A New York Academies of Science eBriefing

Lab Dynamics: Management Skills for Scientists by Carl M. Cohen and Suzanne L. Cohen
Book published by Cold Spring Harbor Laboratory Press that covers general management skills, among which are dealing with conflicts

"Dealing with Conflict" by Carl Cohen
Article in The Scientist (2007, Vol 21, Issue 2) (*subscription required*) drawing on information from Cohen's *Lab Dynamics* book

Influence Without Authority by Allen R. Cohen and David L. Bradford
This book deals more with workplace influence such as how to get things done when you are not in charge.

Influence: The Psychology of Persuasion by Robert Cialdini

The book probes other aspects of influencing people, in particular, how human psychology can be used in marketing and sales

"Obtaining and Negotiating a Faculty Position" and
"Laboratory Leadership in Science"
Chapters 1 and 3 from Burroughs Wellcome Fund and the Howard Hughes Medical Institute (2006) *Making the Right Moves: A Practical Guide to Scientific Management for Postdocs and New Faculty,* Second Edition

Conflict Resolution

Having a complete set of management skills should help postdocs to avoid conflict, but when conflict does arise, the postdoc should be prepared to seek an amicable resolution with the parties involved. Given the highly competitive nature of scientific research, and the increasing trend toward team science, postdocs will need training in conflict resolution. Because postdocs have very little status or power within an institution, training in this area should emphasize how to avoid conflict by clearly communicating expectations, concerns, and questions in a forthright and respectful manner. Building on the negotiation skills addressed in the previous section will be helpful in this regard. *(Excerpt from the NPA Postdoc Office Toolkit article on "*Providing Complementary Skills Development Programs*")*

Teaching Materials

There are numerous workshops, articles and other resources available on this topic:

The NPA offered a workshop on this topic at its 2nd Annual Meeting. The workshop was entitled: Pragmatic Leadership: Finding Your Leverage Points for Success

The University of Pittsburgh Health Sciences Office of Academic Career Development offers a Postdoctoral Professionalism Series, including a workshop on "Enhancing Your Professional Skills: Strategies for Conflict Management."
http://www.aamc.org/members/great/ee_pitt_progrms_descript.pdf

Science Careers has published a series of helpful articles on this topic:

Lab Rage: Dealing with Personality Conflicts
http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/0490/lab_rage_dealing_with_personality_conflicts/

Butting Heads: Conflict Resolution for Postdocs, Part I
http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2001_03_16/noDOI.13497987501303093089
Butting Heads: Conflict Resolution for Postdocs, Part II

http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/0980/butting_heads_conflict_resolution_for_postdocs_part_ii/

See also:
Dysfunctional Advisee-Adviser Relationships: Methods for Negotiating Beyond Conflict
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/0000/dysfunctional_advisee_adviser_relationships_methods_for_negotiating_beyond_conflict

TAILORING RCR PROGRAMS FOR POSTDOCS

Training programs in RCR are often directed primarily at the student who is still learning how to be a researcher and may not have experience with many of the topics covered. Postdocs on the other hand are already professional researchers and many RCR topics will resonate with them from previous experience. In addition, postdocs have a number of unique concerns due to the nature of the postdoc appointment, from its short-term nature to its inherent lack of official standing. Below are six general recommendations for tailoring a program to needs and habits of postdocs.

Customize your program content to the specific concerns of postdocs – To design a program that targets postdocs, it is recommended to review the seven individual RCR content areas described in the toolkit article "Determining the Goals and Content of your Program" which each outline issues of particular relevance to postdocs.

Supervisors are key to a postdoc's RCR training – It is acknowledged by most sources (c.f. National Academies 2002 [1]; Anderson et al. 2007 [2]) that the best method for influencing responsible behavior is through mentoring from an advisor, which can include one-on-one mentoring as well as participating in group meetings or journal clubs. The relationship between a postdoc and his or her supervisor is a critical one, since postdocs are particularly reliant upon their supervisors for both financial and infrastructural support, as well as further career advancement. Thus it is important to involve postdoc supervisors with RCR training, whether they actively participate as a mentor in these topics or merely support the postdoc's participation in a more formal program. Since extensive mentoring is not always feasible in today's busy research environment, formal training is often necessary to supplement individual mentoring. In any case, having a supervisor's support for such training activities can be critical for postdocs to feel comfortable taking time away from research in order to participate.

Establish a postdoc training curriculum that includes RCR – One way to reinforce RCR education is to incorporate training in RCR into a core curriculum [3]. As the postdoc position is increasingly acknowledged as a training period (as evidenced, for example, by the new NIH and NSF postdoc definitions), it is important to give coherence to that training via a curriculum. The importance of this training is further underscored by the NIH requirement for RCR training for all NIH-supported trainees as well as the 2007 America COMPETES Act which instructs NSF to require training in RCR for all NSF grant-funded postdocs. The NPA's Recommended Practices recommends establishing a postdoc curriculum, and is currently developing a recommended curriculum of core competencies for postdocs that include responsible conduct of research.

Incorporate RCR with everyday "survival" skills – Another recommendation from the NRC report *Integrity in Scientific Research* [4] is to teach RCR alongside "survival" skills. This is an increasingly popular approach that has become very successful as a vehicle for delivering research integrity training, especially for postdocs. Not only does this have pedagogical advantages by integrating the topic with other basic research skills and thus improving long term retention, it also makes RCR training much more attractive

for postdocs. If a training program appears to have a more direct benefit to a postdoc's career, such as preparing them to be a better lab manager, then postdocs are much more likely to attend. For example, when asked on the Sigma Xi Postdoc Survey what kinds of formal training they would be interested in receiving, postdocs ranked research ethics last, whereas they put grant writing, lab management and project management at the top.

Two primary models have emerged for these types of programs: Survival Skills courses and Lab Management courses. Part of the success of these approaches is due to the very useful "train-the-trainers" workshops that provide instruction on designing and offering such programs.

- The Survival Skills and Ethics program at the University of Pittsburgh offers a series of workshops on survival skills as well as an annual train-the-trainers conference on designing your own survival skills course. Their website also offers a number of resources for those mounting their own program, especially designed for those who have completed their training conference.

  Some other examples:
  - University of Pennsylvania School of Medicine: Research Survival Skills course
    http://www.med.upenn.edu/postdoc/training.shtml
    Focuses on scientific writing, grant writing, and laboratory management

  - UC San Diego Research Ethics Program – Ethics and Survival Skills Course
    http://ethics.ucsd.edu/courses/survival/index.html

  - University of Miami Miller School of Medicine: Professional Skills and Ethics courses
    http://www.biomed.miami.edu/postdocs/prospective-professional.html

- Lab Management courses were widely promoted through a joint initiative of the Burroughs Wellcome Fund and the Howard Hughes Medical Institute. The initiative offered train-the-trainers workshops for those who would like to develop a lab management course. Along with these workshops, they also developed excellent resources both for those teaching such a course and those who would take the course. In particular, they produced two publications, which can be ordered for free from HHMI or downloaded:
  - *Training Scientists to Make the Right Moves: A Practical Guide to Developing Programs in Scientific Management*
    http://www.hhmi.org/resources/labmanagement/training.html and
  - *Making the Right Moves: A Practical Guide to Scientific Management for Postdocs and New Faculty*
    http://www.hhmi.org/resources/labmanagement/moves.html
  - In addition to these publications, the Lab Management website includes a number of useful tools for planning a lab management course, such as example syllabuses, evaluation forms, and case studies.

Some examples of lab management courses:

- Philadelphia Postdoctoral Consortium Scientific Management Course for Postdocs
  http://www.jefferson.edu/JCGS/postdoc/sci_mgmt_course/postdoc_sci_mgmt_course.cfm

- UC Davis Laboratory Management Institute
  http://www.research.ucdavis.edu/home.cfm?id=OVC,14

- UC San Diego Lab Management Symposium
  http://research.ucsd.edu/postdoc/events/labmgmt2007/index.html

- UC San Francisco Scientific Leadership and Laboratory Management Course
  http://medschool.ucsf.edu/postdocs/leadership.html

- University of Pittsburgh Course in Scientific Management and Leadership
  http://www.oacd.health.pitt.edu/leadershipcourse/

- For other organizations mounting lab management courses based on training from the BWF-HHMI program, visit:
  http://www.hhmi.org/resources/labmanagement/partners.html

Address the cultural diversity among postdocs – It is important to take into account the range of cultural backgrounds among postdocs, since the majority will be visa holders. Expect postdocs trained in different countries to have a range of experiences with RCR, different scientific cultures and norms upon which to draw, and certainly different personal experiences with research. Focus groups with international postdocs on RCR at the Children's Hospital of Philadelphia found that while postdocs from all countries indicated a need for RCR training, it was important to allow the opportunity for postdocs to share their varied experiences. Another consideration is that the vulnerability of postdocs due to their lack of official standing is doubly true for postdocs from other countries and those from underrepresented groups.

Some useful resources on this are:

- Alexander, M. and Williams, W.R. *A Guidebook for Teaching Selected RCR Topics to Culturally Diverse Trainee Groups.* Philadelphia: Children's Hospital of Philadelphia.
  http://ori.dhhs.gov/documents/Alexander.RCR%20Guidebook.BW.pdf

- Williams, W.R. *Mentoring International Postdocs: Working Together to Advance Science and Careers.* Philadelphia: Children's Hospital of Philadelphia.
  http://ori.dhhs.gov/education/products/chop_mentoring/

- NPA International Postdoc Survival Guide
  http://www.nationalpostdoc.org/site/lookup.asp?c=eoJMIWOBIrH&b=1482617

Consider How to Attract Postdocs – In deciding which format is most appropriate for your postdoc community, take into account some of the big issues for attracting postdocs to your program. It can be a challenge to draw them from their labs and offices, even with the support of their supervisors. Some questions to consider are:

- *What will postdocs get out of it?* Consider whether the course will be required or optional. Consider whether postdocs will be satisfying a requirement, or perhaps receiving a certification. Postdocs will likely be more interested in a program where they receive something tangible upon completion that may help with future job prospects.

- *Is it a time/location when the postdocs will be willing to the leave their lab or office?* The distance and time of day of a program can be critical for increasing postdoc participation. See "Marketing RCR Programs to Postdocs" for suggestions on this and other concerns.

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[1][3][4] Board on Health Sciences Policy and Institute of Medicine (2002) *Integrity in Scientific Research: Creating an Environment That Promotes Responsible Conduct.* Washington, DC: National Academies Press. http://books.nap.edu/openbook.php?record_id=10430&page=84

[2] Anderson, M.S., Horn, A.S., Risbey, K.R., Ronning, E.A., De Vries, R., and Martinson, B.C. (2007) "What Do Mentoring and Training in the Responsible Conduct of Research Have To Do with Scientists' Misbehavior? Findings from a National Survey of NIH-Funded Scientists." *Academic Medicine*. 82(9): 853

CHOOSING A PROGRAM FORMAT

There are a range of formats for programs that can suit different goals and needs in an RCR program. Here are just a handful of general format types to consider.

A. Short Course or Single Workshop

The length of a program must balance practical concerns with pedagogical theory. While a program that is too short may not have sufficient depth, it is also important to remember that postdocs are busy and their primary responsibility is producing research results. Thus, keeping the program to a manageable length, such as a short course or a weekend workshop, can increase your attendance. Shorter programs like this can be effective if they are devoted to a particular topic – such as preparing a protocol for human subjects review board – or if they are connected to a comprehensive program that grounds the course in a larger context.

Such courses should also attempt to make the information pertinent and engaging to postdocs using the active learning methods. Some suggested techniques:

- *Use case studies*: some good case studies appear in the textbook *Scientific Integrity*, on the HHMI Lab Management website, and on the ORI RCR education website; see also, *A Guidebook for Teaching Selected RCR Topics to Culturally Diverse Trainee Groups*, which has adapted some case studies for postdocs on the topics of: Data Management, Sharing and Ownership; Intellectual Property; and Research Misconduct. Additional examples appear in the Sample materials article in this toolkit.

- *Perform in-class or pre-surveys*: Surveying the participants can help them examine their own opinions and compare with those of others—see example surveys in Macrina's *Scientific Integrity* textbook. For additional baseline knowledge examples consult the RCR Surveys and Program Evaluation article in this toolkit.

- *Employ role playing*: Role playing different case study situations is another way of engaging participants actively in the decision making process. One example is LabAct, offered by the Lab Management Institute at UC Davis. This has also been utilized at Penn State in their RCR postdoc training (see the online description here: http://www.nationalpostdoc.org/publications/rcr/198-rcr-program-abstracts#pennstate). The RCR textbook, *Scientific Integrity*, includes some role playing exercises in its Appendix II. See also research-ethics.net for additional guidance on role playing: http://www.research-ethics.net/index/distools/role/index.php

- *Other interactive activities:*

    - Mock IRB Review Board: Offer an opportunity for participants to do their own ethical review of studies involving human subjects as an Institutional Review Board.

- Postdoc Supervisor Interview: For an example of this assignment, download a handout developed by the University of North Carolina – Chapel Hill: http://www.nationalpostdoc.org/index.php?option=com_rubberdoc&view=doc&id=227&format=raw

Some Examples of Courses:

- University of California San Diego: "How to Write and Publish a Scientific Paper"
  http://www.nationalpostdoc.org/publications/rcr/198-rcr-program-abstracts#ucsd
  Embeds RCR information on responsible authorship and peer review with strategies for writing and publishing

- University of Washington: "Communication with Difficult Colleagues"
  http://www.nationalpostdoc.org/publications/rcr/198-rcr-program-abstracts#washington
  Workshop on strategies for ethical persuasion and dealing with difficult personalities, with special emphasis on the sensitive nature of a postdoc's communication with his or her postdoc supervisor

- Boston University: Responsible Conduct of Research Program
  http://www.bu.edu/research/policies/ethicsprogram.html
  Case studies have many examples with postdocs and grad trainees involved; offers certification good for satisfying NIH requirements

- MIT: "Survival Skills for Researchers: The Responsible Conduct of Research."
  http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-502Survival-Skills-for-Researchers--The-Responsible-Conduct-of-ResearchSpring2003/CourseHome/index.htm

- Stanford University: Responsible Conduct of Research Course
  http://postdocs.stanford.edu/education/ethics.html.

- University of Minnesota: RCR Courses
  http://www.research.umn.edu/first/
  UMN also has a Small Grants program, fostering the development of continuing educational opportunities in RCR:
  http://www.research.umn.edu/opportunities/intramural/RCR_grantsprogram.html

- University of Missouri-Columbia: RCR courses for grads and postdocs
  http://gradschool.missouri.edu/RCR/index.htm

- Virginia Commonwealth University: Scientific Integrity Resources and Course
  http://www.courses.vcu.edu/rcr/

Includes information on RCR resources at VCU plus information on a Scientific Integrity course for grads and postdocs

- ***See also the descriptions for additional RCR programs at the NPA's RCR for Postdocs Web site: http://www.nationalpostdoc.org/publications/rcr/130-rcr-program-descriptions***

B. Course or Workshop Series

A shorter program often can be more effective if it is part of a longer series. The advantage of a series of programs allows learning over longer periods of time and links individual programs to a broader picture. This could include regular meetings over a year-long course or periodic seminars held over a year or more throughout a postdoc's career. Creating a series can also create some flexibility for postdocs who may not be able to attend all the workshops. Multiple events may also allow for smaller class sizes, which can foster more individualized instruction that adapts to varying backgrounds and learning styles. Another advantage of having a comprehensive program or series of events can allow for different types of formats to be used, for example discussion groups, lecturing, or peer teaching, which can serve to reinforce the material through these different venues.

Some examples:

- University of Texas Health Science Center at Houston: Postdoctoral Certificate Training Program
  http://www.uth.tmc.edu/postdocs/postdoc_certificate_program.html
  A two-year, 15 semester credit hour certificate program with courses on various professional development topics including RCR

- Washington University in St Louis: Professional Development Series
  http://dbbs.wustl.edu/dbbs/website.nsf/6c18fc53358d390286256cde00604464/5337a89f8118e82d86257296006f53d6?OpenDocument
  A series of monthly workshops for postdocs on non-scientific skills, including mentoring, lab management, and difficult conversations. Postdocs receive a certificate for attending all.

- University of Texas MD Anderson Cancer Center: Postdoc Toolkit Series
  http://www.nationalpostdoc.org/publications/rcr/198-rcr-program-abstracts#mdand
  A series of workshops on: What is Responsible Conduct of Research? How to Make a Career Development Plan with Your Mentor; Your words, your reputation: understanding copyright and plagiarism in scientific publication; Back and Forth Through the Journal's Doors: Responsible Authorship and Effective Peer Review; Talk the Talk: Developing Ideal Communication between Postdoc and Mentor

C. Occasional Seminar or Brown Bag Discussion

Holding an informal series of events has some of the same advantages of linking shorter programs to a large context with a coherent theme and curriculum. The less formal nature, however, can allow postdocs to attend when time permits and avoids the stigma of merely "checking a box" for a requirement. In particular, brown bag events that take place over lunchtime make use of existing "downtime" for postdocs and so may increase attendance and participation. They also offer the opportunity to integrate RCR topics with other professional development opportunities such as networking with senior faculty.

Some examples:

- Penn State Brown Bag Seminars
  http://www.research.psu.edu/orp/education/offerings/index.asp#bb

- UC Davis Brown Bag Series
  http://www.research.ucdavis.edu/rcr/

- University of Kansas Graduate School Brown Bag Seminars
  http://www.graduate.ku.edu/~graduate/rcrmedia/

- Indiana University
  http://research.iu.edu/rschcomp/announce.html
  Brown bag series primarily on human subjects in research

D. Computer-based or Online Courses

A number of institutions have developed online modules for RCR training. Such online modules can provide a good base for designing a course – and avoiding reinventing the wheel – and they can make the information easily accessible. In practice, they can be useful for teaching a set of policies or rules; however, typically they are not as effective at engaging postdocs in the more subtle aspects of scientific integrity as in-person, interactive learning techniques.

Some examples:

- Office of Research Integrity website: ORI has an extensive website with links to a number of educational tools for teaching RCR:
  http://ori.dhhs.gov/education/products/

- CITI RCR course: Collaborative Institutional Training Initiative (CITI) is a cross-institutional online teaching portal. The RCR course is currently available for free to the research community:
  https://www.citiprogram.org/rcrpage.asp

- Open Seminar in Research Ethics: Another freely available online course in ethics: http://www.openseminar.org/ethics/

E. Non-Traditional Training Formats

The formats included above highlight only a few of the more common approaches. There are many opportunities for creativity when designing these programs and developers should continue to experiment and think outside the box. For example, talking to postdocs about their interests and needs could reveal new approaches or topics. The RCR education community also continues to innovate so watch for conferences or programs that highlight these ideas and innovations. The ORI website and the RCR INSTRUCTION listserv at NIH are great sources for information, as are the other articles in the NPA RCR Toolkit.

Some examples:

- RCR Orientation for International Postdocs
    - Medical University of South Carolina: International Scholar Orientation Program
      http://www.nationalpostdoc.org/publications/rcr/198-rcr-program-abstracts#musc
      Program orients incoming international postdocs to the U.S. research culture, preparing them to participate in an RCR retreat offered to all incoming postdocs at MUSC

- Train-the-Trainers sessions for teaching postdocs to teach RCR to graduate students
    - Wake Forest University
      http://www.nationalpostdoc.org/publications/rcr/198-rcr-program-abstracts#wake
      Wake Forest provides training to postdocs on "problem-based learning" teaching strategies for teaching RCR
    - University of North Carolina at Chapel Hill
      http://www.nationalpostdoc.org/publications/rcr/198-rcr-program-abstracts#unc

- Embed in professional and career development activities
    - Stanford: Soft Skills Workshops for Postdocs
      http://www.nationalpostdoc.org/publications/rcr/198-rcr-program-abstracts#stanford
      Workshops embedded RCR topics with other skill development: "Developing a career progress plan", "Interviews and interviewing – how to get what you want", and "Managing, motivating, and mentoring your workforce"
    - Brown University: "PI 101: Key Advice for the Newly Independent Investigator and Those Who Hope to Be"
      http://www.nationalpostdoc.org/publications/rcr/198-rcr-program-abstracts#brown

Workshop places RCR in the context of professional survival skills, in particular providing guidance and insight to postdocs on becoming a successful and ethical independent investigator

- Massachusetts General Hospital Postdoc Association: Mentored Lunches on Difficult Topics
  http://www.nationalpostdoc.org/publications/rcr/198-rcr-program-abstracts#massgen
  The MGH postdoc association invited postdoc-recommended faculty mentors to talk over lunch about various topics that can be difficult to discuss with one's own supervisor, such as: balancing work and life; where to look for good mentoring; building self-image and self-confidence; and the hirable qualities of an assistant professor: publications vs. independent funding vs. personality

Whatever form your program takes, the NPA can provide technical assistance to help you reach your postdoc audience. Be sure to consult the other articles in the RCR Toolkit, or contact the NPA Project Manager directly. Additional programs are listed on the NPA RCR for Postdocs page. Also, if you would be interested in sharing the details of your program, the NPA is always looking for additional models to feature in the toolkit. Contact the NPA Staff for further details.

SAMPLE AGENDA, SYLLABUSES AND MATERIALS

Below is a list of various sample curricula, agenda and program materials that are available for download at the NPA Web site. In order to do so, it is recommended that you visit this article online at: http://www.nationalpostdoc.org/publications/toolkits/rcr-toolkit/309-rcr-toolkit-samples

Program Agenda and Syllabuses

- "Interviews and Interviewing: How to get what you want" Workshop, Stanford University Postdoctoral Association
- "Managing, Motivating and Mentoring your Workforce" Workshop, Stanford University Postdoctoral Association
- "Developing a career progress plan" Workshop, Stanford University Postdoctoral Association
- International Scholar Orientation Program, Medical University of South Carolina
- "RCR ON THE PATHWAY TO INDEPENDENCE: A program for postdoctoral fellows," RCR Workshop Series, University of South Alabama
- "Postdoc Survival Skills," University at Buffalo
- "Train-the Trainer" Biomedical Research Ethics Course for Postdoctoral Scholars, University of North Carolina at Chapel Hill
- Ethics Training Short Course for Postdocs, University of North Carolina at Chapel Hill
- Learning Goals for Training and Education in the Responsible and Ethical Conduct of Research / Scholarship, Michigan State University

Exercises and Case Studies

- PI Interview Assignment, University of North Carolina at Chapel Hill
- Postdoc Case Studies (and Responses) on Data Ownership & Sharing, Intellectual Property, and Research Misconduct, Oak Ridge Associated Universities
- Data Ownership Case Studies, University of South Alabama
- Grant Writing Case Study, including visa issues for international postdocs, University of South Alabama
- Mentoring Case Study, University of South Alabama
- Research Misconduct Case Studies, University of South Alabama
- Peer Review Case Study, University of South Alabama
- Authorship and Collaboration Case Studies, University of South Alabama

RCR Brochures and Completion Certificates

- RCR Informational Brochure for Postdocs, Brown University
  Provides information on RCR topics targeted for postdocs
- RCR Brochure for Postdocs, including information on RCR training courses, University of South Alabama
- RCR Series Completion Certificate, Michigan State University
- Brochure on RCR Training Courses, Michigan State University

Program Evaluation Forms and Surveys

- RCR Baseline Knowledge Pre-Survey, MD Anderson Cancer Center Postdoc Association
- International Postdoc RCR Survey, Medical University of South Carolina
  Pre-test to assess knowledge and attitudes towards RCR topics among international postdocs
- Postdoc RCR Attitudes Survey, University of Washington
  Postdoc Baseline RCR Knowledge Pre-Test, Oak Ridge Associated Universities
- Children's Hospital of Philadelphia Pre-Assessment and Course Evaluation

Flyers and Other Marketing Materials

- Conference Flyer with speakers, "Scientific Integrity: Conflicts in Research and Education," University of Pennsylvania
- Ethics Training Short Course, University of North Carolina at Chapel Hill

Postdoc Performance Evaluations

- Postdoc Annual Performance Evaluation Form, Brown University
- Postdoctoral Scholar Annual Evaluation Form, UCLA
  Feedback and assessment on postdoc's overall performance
- Research / Career Development Plan & Periodic Evaluation Form, UCLA
  Tool for setting and assessing progress towards short- and long-term research and career goals

Presentation Slides

- Powerpoint slides with questions for use with "clickers" or personal response systems, Michigan State University
  The following were developed for use with the *TurningPoint* response system
  - Basic RCR Awareness questions
  - Case Studies: Human Subjects and Publishing
  - Case Studies: Data Ownership and Animal Subjects
  - RCR Attitude questions

Other

- Tool Kit for Postdoctoral Scholars and Faculty Mentors, UCLA
- Compact Between Postdoctoral Scholars and Faculty Mentors, UCLA
  Articulates the roles and responsibilities of both the Postdoctoral Scholar and Faculty Mentor.

RCR SURVEYS AND PROGRAM EVALUATION

When determining the goals of an RCR program, it is also important to consider how to evaluate whether these goals have been achieved. The RCR community has made significant strides in assessing the overall effectiveness of RCR education. However, attempts to determine a change in behavior – arguably the intended ultimate result of RCR training – have been difficult due to the multiple variables that impact behavior, the challenge of defining a control sample, and the question of whether an individual's hypothetical behavior in a case study actually mirrors their behavior when faced with the situation in the real world (see for example Elliott & Stern 1996). Thus, the achievement of goals focusing on changes in knowledge or skills in RCR might be somewhat easier to assess than a change in attitude or behavior.

The most common approach to evaluating individual gains from a course or program is to use pre- and post-testing. This can assess an individual's knowledge coming in to the program and then compare this to their knowledge of the same information upon completing the program. It can also assess to some extent attitudes and skills.

For a concise overview of considerations when evaluating a program, visit the ethics education repository research-ethics.net:
http://www.research-ethics.net/index/introduction/eval/index.php

Common Evaluation Tools from the Literature

Defining Issues Test (DIT-2)
Rest, Narvaez, Thoma, &. Bebeau, 1999 "DIT2: Devising and testing a revised instrument of moral judgment." *Journal of Educational Psychology* 91(4):644-659

The DIT-2 (version 2 of the Defining Issues Test) assesses moral judgment using a series of case studies to which subjects respond. Many programs have used the DIT-2 as a pre-test and post-test to gauge the degree to which an RCR program has impacted the moral reasoning of students.

To order the survey, visit The Center for the Study of Ethical Development website:
http://www.centerforthestudyofethicaldevelopment.net/index.html
There you can purchase the exams and the Center will score them for you. They have a sliding fee scale depending on how many tests you order.

Ethical Decision Making Measure
Mumford, M., Davenport, L.D., Ryan, P.B., Connelly, S., Murphy, S.T., Hill, J.H., and Antes, A.L. 2006 "Validation of Ethical Decision Making Measures: Evidence for a New Set of Measures." *Ethics and Behavior* 16(4):319-345.
These measures use a range of ethical situations and case studies to probe the respondent's ethical decision making.

Baseline Knowledge Test

Heitman, E., Olsen, C.H., Anestidou, L., and Bulger, R.E. 2007 "New Graduate Students' Baseline Knowledge of the Responsible Conduct of Research" Academic Medicine 82(9):838-845

This test provides an assessment of baseline knowledge of RCR topics targeting graduate students. While the test is designed for research purposes and encompasses all topic areas of RCR, a reduced set could be appropriate for a course assessment.

Views on Science-Technology-Society (VOSTS)
Aikenhead, G.S. and Ryan, A.G. 1992 "The Development of a New Instrument: "Views on Science-Technology-Society" (VOSTS)" Science Education 76(5): 477-491

The questionnaire probes attitudes about a scientist's and engineer's social responsibility. It can be found on the author's webpage at:
http://www.usask.ca/education/people/aikenhead/vosts.pdf

Pre-Test and Post-Test Examples

Example attitude surveys for use during an RCR course
These surveys are more commonly used to engage participants during a course, but could form the basis for some pre- and post-test questions as well. Examples for all the RCR core areas can be found in Appendix I of the Scientific Integrity textbook companion website, scientificintegrity.net.

University of Washington Postdoc RCR Attitudes Survey
Assesses current attitudes and practices regarding professional development and responsible conduct of research program targeting postdocs
http://www.nationalpostdoc.org/index.php?option=com_rubberdoc&view=doc&id=212&format=raw

Medical University of South Carolina International Postdoc RCR Survey
This survey was used as a pre-test to assess knowledge and attitudes towards RCR topics among international postdocs attending an orientation to responsible research practices and norms in the U.S.
http://www.nationalpostdoc.org/index.php?option=com_rubberdoc&view=doc&id=213&format=raw

Florida State University Pre- and Post-tests on Graduate Student RCR Knowledge
Tests developed by Florida State University to test incoming and outgoing knowledge of RCR issues among graduate students. This was part of a program funded by the federal Office of Research Integrity and the Council of Graduate Schools:

Pre-test: http://www.cgsnet.org/portals/0/pdf/RCR_Pre-Test.pdf
Post-test: http://www.cgsnet.org/portals/0/pdf/RCR_Post-Test.pdf
Exit Survey: http://www.cgsnet.org/portals/0/pdf/RCR_ExitSurvey.pdf

Children's Hospital of Philadelphia Pre-Assessment and Course Evaluation
These surveys were developed by Children's Hospital of Philadelphia for use in their RCR courses for trainees. The Pre-Assessment is primarily a gauge of who the audience is and their general preparation. The course evaluation assesses the course usefulness and design.

CHOP Pre-Assessment Survey:
http://www.nationalpostdoc.org/index.php?option=com_rubberdoc&view=doc&id=211&format=raw
CHOP Course Evaluation Survey:
http://www.nationalpostdoc.org/index.php?option=com_rubberdoc&view=doc&id=210&format=raw

MD Anderson Cancer Center Postdoc Association Pre-Survey of RCR Training and Attitudes
A pre-survey conducted of MD Anderson's postdocs probing their past training, interests and attitudes with regard to RCR topics.
Download:
http://www.nationalpostdoc.org/index.php?option=com_rubberdoc&view=doc&id=223&format=raw

Oak Ridge Associated Universities Postdoc Baseline RCR Knowledge Pre-Test
Probes postdoc awareness of RCR issues prior to participating in training
Download:
http://www.nationalpostdoc.org/index.php?option=com_rubberdoc&view=doc&id=232&format=raw

University of North Carolina at Chapel Hill Postdoc Ethical Decision Making Survey
Examines the ethical decision making choices of postdocs and can be used to assess the impact of RCR training
Download:
http://www.nationalpostdoc.org/index.php?option=com_rubberdoc&view=doc&id=246&format=raw

Course Evaluations

In addition to assessing the impact of the course material, it is also important to do an evaluation of the program delivery to identify the relative success of the program format and potential improvements. Several examples of these are included below.

Examples of workshop evaluation forms:
Stanford; http://aic.stanford.edu/education/forms/wrkeval.pdf
Oregon State; http://osulibrary.oregonstate.edu/instruction/workshop.htm
North Carolina State: http://www2.chass.ncsu.edu/CWSP/fac_seminar/sem_eval.html
UCLA: http://www.library.ucla.edu/college/reference/email/seminar.htm

Other examples of evaluation questionnaires from HHMI Lab Management courses:
http://www.hhmi.org/resources/labmanagement/resources.html#evaluation

Selected References on Assessment of RCR Training Effectiveness

Elliott, D. & Stern, J. E. (1996). Evaluating teaching and students' learning of academic research ethics. *Science and Engineering Ethics* 2(3): 345-366.
In a study of the outcomes of a research integrity course, the authors find a null effect of the course on ethical behavior and suggest that evaluation should return to focusing on knowledge and skills.

Martinson, B.C., Anderson, M.S., and de Vries, R. (2005) "Scientists Behaving Badly." Nature, 435, 737-738.
Study on self-reported questionable research practices, with comparison of late-, mid- and early-career scientists.

Anderson, M.S., Horn, A.S., Risbey, K.R., Ronning, E.A., De Vries, R., and Martinson, B.C. (2007) "What Do Mentoring and Training in the Responsible Conduct of Research Have To Do with Scientists' Misbehavior? Findings from a National Survey of NIH-Funded Scientists." *Academic Medicine*. 82(9): 853
A broad study of NIH PIs and trainees that finds that the RCR training method that seems to have the best result is mentoring.

Kalichman, M.W. and Plemmons, D.K. 2007 "Reported Goals for Responsible Conduct of Research Courses." Academic Medicine 82(9):846-852
A survey of instructors of RCR courses for NIH training grant trainees finds a lack of consensus about stated goals of instruction.

MARKETING RCR PROGRAMS TO POSTDOCS

This article was adapted from the NPA Postdoc Office toolkit article on "Organizing Career Development Workshops"(requires NPA member login) as well as from advice contributed to the ScienceCareers.org forums on how to encourage postdocs to attend career development events:
http://sciencecareers.sciencemag.org/career_development/tools_resources/forum/view?id=23905

There are many different strategies for marketing your program to postdocs, which depend upon a variety of characteristics, from your institutional culture to the size of your postdoc community. The following suggestions on how to attract postdocs to a professional development event should be applied with these broad considerations in mind.

Making the content attractive

Perhaps the most important aspect of making your event attractive to postdocs is to ensure that they feel it will have a return on their time. Your event needs to provide a benefit that makes a busy postdoc take time away from his or her research, so be sure to emphasize what they will get out of the event in all your publicity. You might even consider taking the straightforward approach and bulletize these things in your announcements, such as professional development, aid in career advancement, or ability to compete effectively for grants.

Another consideration is building "buy-in" from administration or faculty. If a postdoc's supervisor supports the event, he/she may feel more comfortable leaving the lab in order to attend. An added benefit is that support from the institution could also lead to additional resources for your event. Some ways to do this are to emphasize the benefits to the PI, such as fulfillment of training requirements, strengthening of a postdoc's writing and publication skills, or even reducing the likelihood of research misconduct.

Research integrity programs in particular can benefit from integrating responsible conduct of research (RCR) topics into a larger context of professional development or lab management skills for postdocs. Not only will this make the program more attractive to postdocs it will reinforce the connections between RCR and everyday research tasks and skills. The advantages of these types of approaches are discussed in the toolkit articles on "Tailoring RCR Programs for Postdocs" and "Choosing a Program Format."

Another way of attracting postdocs – and building faculty support – is to try to enhance the prestige of participating in the program. This could mean instituting an application process that makes it an honor to be selected for the program or offering a certificate of completion or a certification that can be listed on a CV. An application process can accomplish several things. It can add selectivity to participation, and thus increase interest and attendance. It also has several practical benefits, such as gauging the level of interest in advance and providing a vehicle with which to request endorsement for postdoc participation directly from PIs. Requiring a signature from the postdoc's supervisor not only ensures that the supervisor supports his or her attendance, but it can also foster communication on research integrity between them.

Receiving some kind of certification is another way that postdocs can feel they are deriving a concrete benefit. Several institutions have begun offering "Certificates of Participation" to postdocs who attend a certain number of professional development events or who participate in some sort of defined curriculum. These offerings have been successful in increasing postdoc attendance, which in turn can encourage faculty and administration support. Many institutions may already have something like this in place for any required training programs. A potential downside of institution-specific certifications is that they typically have no official recognition outside the institution. So while they can demonstrate a participant's interest and commitment to professional development, they may have little tangible benefit towards future employment.

Scheduling and Logistics

Another important consideration is the location and scheduling of your event. Make the event location convenient to the audience you are trying to attract. For example, do they have to walk down the hall or across campus? Similarly, try to make the time and date convenient for your community, while acknowledging that there is likely no perfect solution for everyone. Lunchtime events like brown bag meetings or seminars let postdocs turn "down" time into productive time and can often avoid friction with supervisors. On the other hand, your lunchtime event may incur competition from other institutional events also held during that popular timeslot. Late afternoon events can be convenient because experiments can be set to run and coffee breaks are often taken then in any event; however, some postdocs can be reticent to leave the lab during "business hours." An alternative is early evening events which cause fewer conflicts with research and supervisors, but can be problematic, for example, for postdocs who have young children. The best approach is to know your community and its habits and be flexible and responsive to their needs. You may, for example, choose the time of day based on the type of event you are offering. Often one-hour seminar-style workshops can be successful during lunch, whereas more open-ended or longer types of events, like round-table or panel discussions, work best when held in the evening or on a weekend. Along the same lines, all-day events for postdocs will have a much higher attendance on a Saturday than during the week. No matter what time of day you hold your event, food always provides a major incentive for people to attend. This is especially true if your event encroaches on a mealtime. Moreover, it can make your event seem like an efficient use of time, since at some point they will have to eat anyway.

A critical component to planning your event is feedback and assessment. Be sure to evaluate any program you run, which can give you valuable feedback on your planning process and can help you garner resources and support for future events. Another approach that can provide feedback in advance of your event is to require pre-registration. This can give you a sense of the interest level, can help you tune your program to the interests of your postdocs, can help you optimize your resources such as how many cookies you should buy, and can allow you the option of rescheduling to a time that might give you a better turn out. Some examples of evaluation forms, with varying audiences, topics, and formats, are below:

http://aic.stanford.edu/education/forms/wrkeval.pdf
http://osulibrary.oregonstate.edu/instruction/workshop.htm

http://www2.chass.ncsu.edu/CWSP/fac_seminar/sem_eval.html
http://www.library.ucla.edu/college/reference/email/seminar.htm

A tool that can help you plan such events is the Conference and Event Planning Checklist (http://www.nationalpostdoc.org/index.php?option=com_rubberdoc&view=doc&id=52&format=raw). Distributed at the 2006 NPA Annual Meeting in a session on "Organizing Career Fairs and Professional Development Events," it provides a series of planning milestones for professional development events.

Spreading the Word

A first step in publicizing your event is finding a good way to identify and reach the postdocs. Postdoc offices and associations often have a list of all current postdocs. Other places to talk to are human resource offices, graduate schools, and sponsored research offices. Once you know where the postdocs are, you need to decide how you will reach them. Email lists can be effective at getting the word out, although they are often impersonal and risk being unread in a full inbox. Other ways are to reach postdocs through their departments or offices, either via email or through actual snail mailings. Compared with an email from an external source, an email sent from a local contact – such as someone known, like the department assistant or chair – not only seems more targeted to the postdoc, it also tends to carry some degree of endorsement of the event which can make postdocs more comfortable with leaving their offices or labs. Another traditional but effective approach is posting flyers on bulletin boards or distributing flyers during other events at which there will be postdocs.

Your announcements themselves also need some consideration in design and content. Try to be creative with event titles and information and really try to catch postdocs' attention. This can help make it more of an "event" that should not be missed, as opposed to the weekly seminar that often is. You may also want to consider "branding" your events, with a logo or slogan that is used in all your advertisements. An event that is regularized in scheduling is also easier to plan around (e.g. "First Friday Seminars")

Part of your publicity effort should focus on building support and interest from faculty, administrators, and staff. This of course requires a somewhat different approach than in reaching out to postdocs. Identify individuals who have oversight of research and training policies. This may include the "usual" suspects who work with postdocs, such as Postdoc Office Directors, VPs of Research, Graduate Deans, and Human Resource Officers. But, also talk to people in Employee Assistance Programs, Career Centers, Teaching and Learning Centers who may have an interest in helping with professional development and training programs.

You can find more information on these issues in the NPA Postdoc Association toolkit articles on "Identifying Administrators Responsible for Research and Training Policies" and "Gaining Support from Faculty and Administrative Advocates" (*requires NPA member login*).

Other Marketing Resources

A general introduction to marketing in the business world: Marketing: An Introduction

Science Careers has a series of articles written for scientists on some lessons that can be learned from MBA training. The following articles are part of a larger series, but deal specifically with aspects of marketing.

Marketing I, Introduction see also the nine subsequent articles
http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/0070/marketing_i_part_1_introduction_part_viii_of_learnin_s_from_my_mba_series

For additional information on organizing such events, peruse the NPA Postdoc Office toolkit article on "Organizing Career Development Workshops".

APPENDIX

SELECTED RESOURCES ON THE RESPONSIBLE CONDUCT OF RESEARCH

I. GENERAL REFERENCES

RCR TOPICS

- **General**
- **On Postdocs**

RCR TRAINING

- **General**
- **On Postdocs**

RCR TOPICS

General

American Society of Plant Biologists guidelines for Ethics in Publishing
http://aspb.org/publications/ethics.cfm

The AAAS-ORI Bibliography and Resources on the Responsible Conduct of Research (Feb 2005)
http://www.aaas.org/spp/sfrl/projects/ori.shtml
Large database of references and online resources on RCR

Collaborative Institutional Training Initiative, University of Miami, CITI Responsible Conduct of Research Program
https://www.citiprogram.org/rcrpage.asp
Extensive on-line RCR courses; although postdocs might be less likely to be engaged by on-line courses, these modules provide a significant source of instructional material

ORI's RCR Educational Resources Web page
http://ori.dhhs.gov/education/products/
ORI's extensive database of educational products and resources on the topics and teaching of RCR

Responsible Scientific Conduct Bibliography from University of Pittsburgh Survival Skills and Ethics Program
http://www.survival.pitt.edu/library/biblio/responsilble.asp

Steneck, N.H. (2004) *ORI Introduction to the Responsible Conduct of Research*
http://ori.dhhs.gov/documents/rcrintro.pdf
An introduction to RCR, with a useful list of resources in its bibliography.

On Postdocs

Burroughs Wellcome Fund and the Howard Hughes Medical Institute (2006) *Making the Right Moves: A Practical Guide to Scientific Management for Postdocs and New Faculty, Second Edition*
http://www.hhmi.org/labmanagement
Text on lab management skills for postdocs and junior faculty, based on courses held in 2002 and 2005 by BWF and HHMI

Children's Hospital of Philadelphia *Mentoring International Postdocs: Working Together to Advance Science and Careers*
http://ori.dhhs.gov/education/products/chop_mentoring
A video guidebook, sponsored by ORI, centered on case studies to raise awareness and training in mentors of postdocs.

Eastwood, S., Derish, P., Leash, E., and Ordway, S. (1996) Ethical issues in biomedical research: Perceptions and practices of postdoctoral research fellows responding to a survey. *Science and Engineering Ethics* 2: 89-114.
Study of ethical matters relating to research and publishing involving postdoctoral research fellows at UC San Francisco; nearly 40% reported having had no guidance on research ethics from a mentor.

Gluck, M.E., Blumenthal, D., and Stoto, M.A. (1987) "University-Industry Relationships in the Life Sciences: Implications for Students and Post-Doctoral Fellows." *Research Policy* 16: 327-336.
A study on potential conflicts of interest for graduate students and postdocs when their funding comes directly from industry supporters

Martinson, B.C., Anderson, M.S., and de Vries, R. (2005) "Scientists Behaving Badly." *Nature*, 435, 737-738.
Study on self-reported research "misbehaviors" or questionable research practices, with comparison of late-, mid- and early-career scientists. Surveyed early-career scientists, 58% of which are postdoctoral fellows, showed different patterns in misconduct, and reported a somewhat lower rate of committing misconduct than mid-career scientists (28% compared with 38%).

National Academies Committee on Science, Engineering, and Public Policy (2000) *Enhancing the Postdoctoral Experience for Scientists and Engineers: A Guide for Postdoctoral Scholars, Advisors, Institutions, Funding Organizations, and Disciplinary Societies* Washington, DC: National Academies Press
http://www.nap.edu/books/0309069963/html
A guide on various aspects of professional development for postdocs

National Academy of Sciences, National Academy of Engineering, and Institute of Medicine (1997) *Adviser, Teacher, Role Model, Friend: On Being a Mentor to Students in Science and Engineering,* Washington, DC: National Academies Press

http://books.nap.edu/catalog.php?record_id=5789
Specifically addresses issues of mentoring of and for postdocs

Sigma Xi (1999) *The Responsible Researcher: Paths and Pitfalls*. Research Triangle Park, NC: Sigma Xi, The Scientific Research Society.
http://www.sigmaxi.org/programs/ethics/ResResearcher.pdf
General advice for students, postdocs, as well as faculty and scientists in government and industry. Chapter 4 focuses on Postdoctoral Fellows; while it is directed at the postdoc, it highlights some of the most pertinent concerns and issues in RCR for postdocs

Tarnow, E. (1999) The Authorship List in Science: Junior Physicists' Perceptions of Who Appears and Why. *Science and Engineering Ethics* 5: 73-88.
A study of the awareness of physics postdocs of authorship guidelines in their community, finding that there was low awareness and little discussion of authorship criteria between postdocs and supervisors.

RCR TRAINING

General

American Association for the Advancement of Science. Integrity in Scientific Research. http://www.aaas.org/spp/video/.
A video guide on case studies of various RCR topics

Bebeau, M.J., Pimple, K.D., Muskavitch, K.M.T., Borden, S.L., and Smith, D.L. (1995) *Moral Reasoning in Scientific Research: Cases for Teaching and Assessment*. Bloomington, IN: Indiana University.
http://poynter.indiana.edu/mr/mr-main.shtml
Handbook for teaching scientific ethics through moral reasoning; uses a case study approach

Board on Health Sciences Policy and Institute of Medicine (2002) *Integrity in Scientific Research: Creating an Environment That Promotes Responsible Conduct* Washington, DC: National Academies Press
http://books.nap.edu/openbook.php?record_id=10430&page=84
Primary on research integrity in the biomedical sciences, but note in particular Chapter 5: "Promoting Integrity in Research through Education" which contains advice on how to teach RCR and how it should be integrated with the teaching of basic research skills

Fischer, B.A. and Zigmond, M.J. (2001) "Promoting Responsible Conduct in Research Through "Survival Skills" Workshops: Some Mentoring is Best Done in a Crowd." *Science and Engineering Ethics* 7(4): 563-87.
Article oriented towards the efficacy of these types of programs for teaching graduate students, but many have successfully adapted this approach for postdocs

Korenman, S.G. and Shipp, A., eds. (1994) *Teaching the Responsible Conduct of Research Through a Case Study Approach: A Handbook for Instructors*. Washington, DC: Association of American Medical Colleges
Guidance and useful case studies for teaching RCR

ORI's RCR Educational Resources Web page
http://ori.dhhs.gov/education/products/
ORI's extensive database of educational products and resources on the topics and teaching of RCR

RCR Education Consortium Home Page (2002-2004) http://rcrec.org/
An extensive online repository of RCR education resources for instructors.

On Postdocs

Alexander, M. and Williams, W.R. Children's Hospital of Philadelphia
A Guidebook for Teaching Selected RCR Topics to Culturally Diverse Trainee Groups
http://ori.dhhs.gov/documents/Alexander.RCR%20Guidebook.BW.pdf
A handbook, sponsored by ORI, on how to teach RCR topics to postdocs using case studies, based on findings gathered from postdoc focus groups; focus was given to identifying potential differences in approach for international postdocs, but they found few differences in approach were necessary

Burroughs Wellcome Fund and the Howard Hughes Medical Institute (2006) *Training Scientists to Make the Right Moves: A Practical Guide to Developing Programs in Scientific Management*
http://www.hhmi.org/resources/labmanagement/training.html
A guide on how to teach a lab management course for postdocs and junior faculty
http://www.hhmi.org/resources/labmanagement/downloads/bwf_hhmi_case_study.pdf
A specific case study of a course on how to teach a lab management course
http://www.hhmi.org/resources/labmanagement/resources.html
Sample materials and resources for teaching a lab management class

Macrina, F.L. (2005) *Scientific Integrity: Text and Cases in Responsible Conduct of Research* (Third Edition). American Society for Microbiology Press, Washington, D.C.
Many of his case studies involve postdocs, and his course on scientific integrity at Virginia Commonwealth University is designed for grads and postdocs

Macrina, F.L., Funk, C.L., and Barrett, K. (2004) Effectiveness of Responsible Conduct of Research Instruction: Initial Findings. *Journal of Research Administration* 6: 6-12.
http://www.srainternational.org/NewWeb/publications/Journal/pdf/VolXXXVNoII.pdf
Initial results of study of effectiveness of RCR training on postdocs; they find some evidence of greater attention to authorship issues among those with RCR training, but they also find significant awareness among those without RCR training

NSF 2010 RCR REQUIREMENT

Overview

The 2007 America COMPETES Act directed NSF to require that all funded students and postdocs undergo training in the responsible conduct of research (RCR). The implementation of this requirement becomes effective January 4, 2010, when all institutions submitting proposals to NSF must certify that they have a training plan in place for undergraduate and graduate students and postdoctoral scholars who will be supported by NSF to conduct research. This certification must be in place at the time of proposal submission. Training plans need not be submitted with the proposal, however, they must be provided for review upon request. Institutions are responsible for verifying that their undergraduate students, graduate students and postdoctoral scholars receive training.

These guidelines are enumerated in detail in the January 2010 NSF Proposal and Award Policies and Procedures Guide, specifically in Part I – Grant Proposal Guide, Chapter II. C.1e (http://www.nsf.gov/pubs/policydocs/pappguide/nsf10_1/gpg_2.jsp#IIC1e) and in Part II – Award and Administration Guide, Chapter IV.B (http://www.nsf.gov/pubs/policydocs/pappguide/nsf10_1/aag_4.jsp#IVB). Additional details on the implementation, including responses to the concerns submitted by the community during the open comment period, are included in the Federal Register Notice of August 20, 2009 (Volume 74, Number 160).The pertinent excerpts from these sections are quoted later in this article.

Developing an RCR Training Plan

The NSF has stated that it does not intend to release guidance or standards on what should be included in a training plan. In the Federal Register Notice of August 20, 2009, the agency emphasized the need for institutions to tailor their training to the needs, diversity and intended careers of their students and postdocs. It encouraged institutions to determine their own plan for both content and delivery, although this might include newly developed resources as well as use of existing materials. This differs somewhat from the required RCR training of biomedical trainees supported by National Institutes of Health (NIH) training grants, which has long adopted the nine core content areas recommended by the federal Office of Research Integrity at the Department of Health and Human Services: Data Acquisition, Management, Sharing and Ownership; Conflict of Interest and Commitment; Human Subjects; Animal Welfare; Research Misconduct; Publication Practices and Responsible Authorship; Mentor / Trainee Responsibilities; Peer Review; and Collaborative Science.

Institutions developing training plans for their postdoctoral scholars therefore should be responsive to the unique needs of these early-career researchers. Many postdocs have not received formal training in RCR, and this is more often true for international postdocs who comprise the majority of postdocs working in the U.S. Any training program should be cognizant of the breadth of cultural diversity among postdocs, and among graduate students, and that some cultural and research norms may differ; for example, the norms for attribution, record keeping and assignment of authorship. The NPA finds that postdocs are more likely to engage in a program that has clear career implications for

career development. When designing a training curriculum, consider embedding ethics issues alongside training in research and professional development topics, such as authorship practices with scientific publishing tips or peer review principles with grant writing guidance. Finally, take into account other unique issues for postdocs, such as the implications of short-term appointments on data ownership, the dual role they fill of both mentor and mentee, and postdocs' dependence upon their supervisor for career advancement, which can influence conflict management in the lab/research group. Guidance on these needs and approaches for establishing effective training programs for postdocs can be found in the NPA's RCR Toolkit.

Some additional suggestions:

1. Find out how NIH-funded trainees on training grants satisfy their RCR training requirement. You may be able to generalize this training to include NSF-funded trainees.
2. Consult the NPA's RCR Toolkit, in particular, the Quick Start Guide, RCR Topics for Postdocs, and Sample curricula, agenda and course materials.
3. When released, consult the forthcoming NSF's RCR education clearinghouse.

Excerpts from NSF Guidelines:

Implementation Plan from Federal Register Notice:

> Implementation Plan: Effective January 4, 2010, NSF will require that, at the time of proposal submission to NSF, a proposing institution's Authorized Organizational Representative certify that the institution has a plan to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students, and postdoctoral researchers who will be supported by NSF to conduct research. While training plans are not required to be included in proposals submitted to NSF, institutions are advised that they are subject to review upon request. NSF will formally implement the new RCR requirement via an update to the NSF Proposal and Award Policies and Procedures Guide (PAPPG). It is anticipated that the revisions to the PAPPG will be issued on October 1, 2009. NSF also will modify its standard award conditions to clearly stipulate that institutions are responsible for verifying that undergraduate students, graduate students, and postdoctoral researchers supported by NSF to conduct research have received RCR training. In addition, NSF will support the development of an on-line RCR resource containing research findings, pedagogical materials, and promising practices regarding RCR in science and engineering. The development and evolution of the ongoing online RCR resource will be informed by the research communities that NSF supports, and it will serve as a living resource of multimedia materials that may be used to train current and future generations of scientists and engineers in RCR.

From January 2010 Award & Administration Guide (AAG), Chapter IV.B, Page IV-3:

> 2. Institutional Responsibilities
>
> a. An institution must have a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates,

graduate students, and postdoctoral researchers who will be supported by NSF to conduct research. As noted in GPG Chapter II.C.1.e, institutional certification to this effect is required for each proposal.

b. While training plans are not required to be included in proposals submitted to NSF, institutions are advised that they are subject to review, upon request.
c. An institution must designate one or more persons to oversee compliance with the RCR training requirement.
d. Institutions are responsible for verifying that undergraduate students, graduate students, and postdoctoral researchers supported by NSF to conduct research have received training in the responsible and ethical conduct of research.

From January 2010 Grant Proposal Guide (GPG), Chapter II.C.1e:

- Certification Regarding Responsible Conduct of Research (RCR): The AOR is required to complete a certification that the institution has a plan16 to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students, and postdoctoral researchers who will be supported by NSF to conduct research.

  Additional information on NSF's RCR policy is available in the AAG, Chapter IV.B. While training plans are not required to be included in proposals submitted to NSF, institutions are advised that they are subject to review upon request.

References:

NSF Federal Register Notice on RCR Implementation: Federal Register Notice of August 20, 2009 (Volume 74, Number 160) http://edocket.access.gpo.gov/2009/E9-19930.htm.

NPA RCR Toolkit: http://www.nationalpostdoc.org/rcr-toolkit

ORI's RCR Education Materials Clearinghouse http://ori.dhhs.gov/education/products/

National Academy of Engineering Workshop Report: Ethics Education and Scientific and Engineering Research: What's Been Learned? What Should be Done?
http://www.nap.edu/catalog.php?record_id=12695

REVISION HISTORY

June 29, 2010:

- Minor formatting changes and copy editing.

Oct 8, 2009:

- Addition of Sample Agenda, Syllabuses and Materials section
- Separation of section on RCR Topics for Postdocs from Determining the Goals and Content of Your Program
- Addition of overview of new NSF RCR requirement for postdocs
- Minor text edits