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# Office of Research Integrity

## NEWSLETTER

The *ORI Newsletter* is published quarterly by the Office of Research Integrity, Office of the Assistant Secretary for Health, Department of Health and Human Services, and distributed to applicant or awardee institutions and PHS agencies to facilitate pursuit of a common interest in handling allegations of misconduct and promoting integrity in PHS-supported research. Please duplicate and circulate this newsletter freely. An electronic copy is available on the ORI home page at http://ori.hhs.gov.

IN THIS ISSUE



## Spotlight on Mentoring

In this edition, we invited writers to share with us their views and perspectives about mentoring. They were each asked to explore some facet of mentoring that will invite readers to consider mentoring issues from a different perspective.

The first article, by **Donald S. Kornfeld**, urges us to recognize how mentors' efforts and involvement with their own trainees are the most powerful means of preventing research misconduct. He provides examples of deficient and absentee mentoring in trainees convicted of research misconduct. Hence, it becomes essential to consider options on how to build better mentoring efforts.

**Catherine Woodstock Striley** introduces us to considering "awareness level" as a factor in developing mentoring efforts. She suggests that mentees often go through stages of being unaware of the need for a mentor or how to interact with mentors. In contrast, mentors go through stages of awareness and competencies in knowing how to be a resourceful and involved mentor. **Ted Usdin** succinctly brings this issue of self-awareness to the fore by using a sport's metaphor. It highlights a missed opportunity by a senior lab chief to include all *team members'* names in the press release on their team's accomplishment.

**Wendy J. Fibison** specifically dissects many ways that a senior scientist, including those at the National Institutes of Health, can benefit from having several mentors. Mentoring is not just needed for trainees, but also needed for all faculty members. She suggests the value of having diverse mentors so that trainees can gain business coaching from one mentor while increasing their technology skills or communication expertise from another mentor.

**Lauren M. Anderson's** evaluation schema illustrates that a strong way to enhance mentoring efforts would be to focus on dimensions such as evaluating the mentor's personal development, determining whether mentees are empowered, understanding the components of a mentoring agreement, and establishing a formal evaluation. In the second evaluation paper, **Sandra Titus** urges training program developers and institutional leaders to step outside the box and evaluate five diverse areas. Through such areas, an institution can evaluate its overall efforts, including having institutional guidelines for faculty roles, using feedback from mentees, and giving awards to the best mentors. Diverse evaluations can promote overall institutional integrity.

## Responsible Conduct of Research Courses Do Not Reduce Trainee Research Misconduct. What Can? Good Mentors.

*Donald S. Kornfeld, M.D., Professor Emeritus of Psychiatry, Columbia University College of Physicians and Surgeons*

The readers of this newsletter are familiar with the history of the establishment of ORI and the mandated Responsible Conduct of Research (RCR) Course, which was intended to reduce research misconduct in trainees.[1] They may not know that after 20-plus years, it has been established that such courses are ineffective.[2-4]

That failure should not have come as a surprise; research misconduct, that is, fabrication, falsification, and plagiarism, is science-speak for lying, cheating, and stealing. Graduate school is a bit too late to be teaching those ethical principles.

A study of 149 ORI case reports confirmed that acts of research misconduct are not the product of ignorance but the consequence of the interaction of individual psychological traits and the circumstances in which researchers find themselves.[5] For example, there are those trainees who, under ordinary circumstances, would not falsify a document, forge a signature, or steal a dime. However, when convinced that their future in science depends on the publication of the successful outcome of their current experiment, these trainees will, somehow, find the data which confirm their hypotheses. They justify their actions as necessary for survival and vow never to do so again. In contrast, there are faculty members who have achieved tenured status based on a long history of published research incorporating fabricated or falsified data and, given the opportunity, will continue to do so.

Research misconduct in trainees is thus a very different problem from misconduct in faculty. Trainees require policies that will reduce their fear of failure. Faculty require policies that will increase their fear of detection.

In keeping with the theme of this issue of the *ORI Newsletter*, this essay will be limited to the problem of misconduct in trainees. The issue of faculty misconduct is addressed in an earlier publication.[5]

Ours is not the first generation to concern itself with the problem of research misconduct by trainees. In 1986, Robert Petersdorf, a leading figure in academic medicine at the time, expressed concern that an era of "*big science*" had created training programs with "*inadequately supervised trainees*."[6] The National Institutes of Health (NIH) research

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## Introducing Zoë H. Hammatt, Director, Division of Education and Integrity

Ms. Zoë H. Hammatt will join the Office of Research Integrity as its new Director of the Division of Education and Integrity on June 2, 2014. Ms. Hammatt currently serves as Director of the Research Integrity Program and as Research Integrity Officer for a diverse research portfolio at the University of Hawaii. This university is one of only a dozen in the United States designated as a Land, Sea and Space grant college. A licensed attorney with a master's degree in Law and Ethics, Ms. Hammatt has served on the faculty at the University of Hawaii medical and law schools and has taught courses in biomedical ethics, regulatory compliance, human subjects' protection, and responsible conduct of research. She has also served as Legal and Regulatory Specialist and Chair of the Ethics and Regulatory Subcommittee for the Research Centers in Minority Institutions (RCMI) Translational Research Network (RTRN), funded by the National Institutes of Health. The RTRN is a national consortium of 18 RCMI institutions dedicated to reducing health disparities through collaborative basic, clinical, and translational research. Among her many accomplishments, she led the harmonization of the Institutional Review Board process across all 18 RCMI. Ms. Hammatt has been a Fellow with the St. Francis International Center for Healthcare Ethics in Honolulu since 1997. Since 1995, she has been involved in international projects to empower women in Central and Eastern Europe as they develop initiatives that support their communities.

## Good Mentors *(from page 2)*

budget was then $1.16 billion. Twenty-seven years later, in constant dollars, it has almost tripled. If $1 billion in 1986 created a big science unable to provide adequate supervision of trainees, what then was the effect of the $3 billion awarded in 2013? He also noted the pernicious effect of competition for funding. In 1986, the percentage of approved applications for funding was 33 percent; in 2013, it was 17 percent! Competition indeed.

In addition, we cannot ignore the fact that today's trainees have acquired their prior education in an academic environment in which cheating has become prevalent.[7,8] It is quite likely that for some trainees, this experience has lowered the bar for what is considered acceptable behavior.

Petersdorf was also rightly concerned about inadequate supervision of trainees.[6] They made up approximately one third of the 149 individuals found guilty of misconduct in the reports I reviewed. Their misconduct was typically motivated not only by fear of failure, but also, less commonly, by the direct, indirect, or inadequate action of a mentor. Here are some examples:

- A trainee was convinced that her future in science was totally dependent on the quality and quantity of her published work. She therefore betrayed a personal honor code and falsified data in order to acquire one more publication.
- A brilliant trainee, a perfectionist, with prior publications in *Science* and *Nature*, stated he felt self-imposed pressure to replicate those earlier successes and therefore manipulated data.
- A trainee reported that she was pressured by a mentor to obtain "useful data." She complied.
- A trainee had observed a mentor "clean up data" to confirm a hypothesis and therefore felt he could do the same.

Not one of the trainees in the entire sample claimed they were unaware that what they had done was an act of misconduct.

What might have averted these violations of the ethical code of science? In my opinion, the interventions of a mentor might have averted them. A mentor could have provided the needed emotional support, guidance, and supervision.

ORI documented the inadequacy of mentoring in today's training programs in a similar study of trainees found guilty of misconduct. Sixty-two percent of their mentors had not established such basic procedural standards as the need to maintain a laboratory notebook, and 73 percent had not reviewed their trainees' raw data.[9] Another study of 98 medical schools found that only 23.5 percent had published guidelines on mentorship.[10]

Therefore, I believe it is possible to significantly reduce research misconduct in trainees by providing them with high-quality mentors who have the time, talent, and motivation to play that role. A good job description is provided in the title of a guidebook for mentors, *Adviser, Teacher, Role Model, and Friend*, published by the National Academies Press.[11] Note that *Advisor* is only one of a mentor's roles.[11,12] As the authors state, "*An advisor might or might not be a mentor… Mentoring is a personal, as well as a professional relationship... a relationship which develops over an extended period of time, during which a student's needs and the nature of the relationship tend to change.*"

What might a good mentor have done to reduce the likelihood of the trainees' research misconduct in the examples provided above? In the first case, a good mentor could have sensed the trainee's heightening fear of the impact of a failed experiment and reassured her that one failed experiment does not destroy a potential career, as the mentor would know from personal experience. A good mentor might have suggested that the perfectionist get professional counseling to relieve him of what would be a lifetime burden, and good mentors would have addressed the unethical behavior of their colleagues reported by the trainees.

Most faculty mentors would benefit from a clear understanding of what is expected of them and how best to provide that efficiently and effectively. A recent study found that one third of research faculty could not recall whether they had received guidelines related to their

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## Good Mentors *(from page 3)*

responsibilities to Ph.D. students, and less than a quarter had the opportunity to participate in training to be a better mentor.[13] The establishment of training programs for mentors is a recent development and should prove helpful.[14,15]

What can be done to assure that trainees are adequately mentored? One would expect that the quality of mentoring would be a criterion assessed when training grants are evaluated for funding. What criteria should be applied? One significant criterion should be the ratio of trainees to mentor, which may vary by discipline. When assigned an unrealistic number of trainees, the most well-intentioned, talented faculty cannot be the mentors they would hope to be.

In addition, where ORI has established that a mentor played a significant direct or indirect role in a trainee's misconduct, NIH should expect a full report on what action has been taken by the responsible institution when it applies for the renewal of its training grant. Training grant renewal applications could also include the results of anonymous surveys of trainees that would permit the evaluation of the strengths and weaknesses of a program and, in particular, the effectiveness of personal mentors. Some institutions demonstrate the importance they place upon this role by providing annual awards to outstanding mentors.

In summary, the time has come for the research community itself, ORI, and NIH to acknowledge what they already know: The most effective means of minimizing research misconduct in trainees is not in the classroom but at their elbow in the laboratory.

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# A Stage Model to Help Promote Mentoring for Responsible Research Conduct

*Catherine Woodstock Striley, Ph.D., M.S.W., M.P.E., College of Medicine, University of Florida*

*Hoc speculum cottidie intuere*
*(Look into this mirror every day)*
–St. Clare of Assisi, 1253

The outcome of good mentoring is judged by the mentee's successful publication and funding record. Whether or not mentees are responsible in their research conduct is neither measured nor, in many cases, questioned. The process of mentoring is still seldom explored; much less so is the process of mentoring for the responsible conduct of research (RCR).

The process of mentoring—and being mentored—fits well with the Conscious Competence Learning Model (variously attributed to M. Broadwell, 1969, W. Lewis Robinson, 1974, and others).[1] In this model, learners proceed through four stages:

1. unconscious incompetence,
2. conscious incompetence,
3. conscious competence, and
4. unconscious competence.

The model has since been adapted to include a fifth stage: reflective or enlightened competence.[1]

In the stage of unconscious incompetence, mentees don't realize they need mentoring. To mentors, it can look as if the student doesn't really care about particular topics, like RCR, because the mentee doesn't know enough to recognize what he or she doesn't know or its importance. In this stage, it is the mentor's role to help the student realize what they don't know, and how important that knowledge is.

Once aware of their need for training and mentoring, mentees move into the consciously incompetent stage. With students now open to instruction, mentors need to be available to provide guidance and instruction to move their mentees into competence.

Mentors themselves are likely to be at one of three stages in this model: consciously competent, unconsciously competent, or reflectively competent. If they are at a stage in their career in which they are mentoring graduate students, they are likely to be consciously competent. But they may have moved past that stage into the unconsciously competent stage. The downside to this stage is that they may be so competent it is hard to break down what they do into steps to teach others. Mentors' difficulty in breaking down what they do may give their mentees the message that science is more magic than method.

> *"I never teach my pupils, I only attempt to provide the conditions in which they can learn."*
>
> **Albert Einstein**
> (1879-1955)

Thus, mentees may not be able to follow the scientific process one step at a time.

Mentors who are able to consciously monitor and reflect on their own processes and behavior are at the stage of reflective competence. Their process of self-reflection provides a model for mentees to emulate. Such reflection may be especially critical for teaching responsible research conduct.

In a short survey conducted using an online survey tool, 81 graduate students at a southeastern university who had submitted an abstract for their college research day were asked about their mentors and mentoring. Twenty-one anonymously participated in the study approved by the Institutional Review Board (IRB): 14 female, 9 first members of their family to go to graduate school, and 5 minority members. Most were Ph.D. students and met with their mentor an average of 1 hour per week.

Although no statement or question tapped the unconscious competence stage directly, we did ask students about their comfort discussing personal, professional, and ethical concerns with their mentor. The high comfort expressed might indicate that students were conscious of the need to address these topics with their mentors. On a scale from very comfortable (1) to very uncomfortable (5), their highest-rated comfort was with discussing

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## Stage Model *(from page 5)*

ethical concerns with their mentor (1.95 where 1 is very comfortable), whereas personal concerns had the closest to neutral (3) answers, and professional concerns rated 2.29 on comfort.

Some questions addressed whether the mentees felt confident in their research and whether their mentor was involved enough in research activities to provide them with guidance and instruction. Student confidence was endorsed at a mean level of 2.29; however, the actual range for these scores was from 5 (not confident at all) to 1, with six students choosing a score that showed a lack of confidence in their results (4 or 5). Most endorsed a collaborative process in planning, conducting, and preparing their research for presentation, with scores from 2.5 to 2.48. However, five students (24 percent) chose a 4 or 5 for one of the questions on whether their research had been a collaborative process with their mentor.

Confidence and competence come with instruction and experience. One mentee said "I'm supposed to figure it out (analysis) and bring them something to review…sometimes, it takes a while for me to figure out how to do it." Another said, "I am not as confident as I would like to be regarding the use of some methods and interpreting the results…" Becoming competent is not automatic. The process of getting results is at least as important as the findings: Incorrect and improper methodology can lead to questionable findings or even falsified results.

Mentoring to encourage competence requires regular contact of sufficient duration and content. One student said, "He's not involved in the day-to-day activities of our lab, so I don't feel as though he is aware of any challenges unless they get brought to him directly." Another said, "Students need feedback on how they performed more frequently in order to take the next steps with more confidence and…knowledge." About responsible conduct and mentoring, one student said:

> "My mentor has a thorough understanding of the responsible conduct of research. This is demonstrated through adherence to proper protocols during study design, as well as a strict observation of training and approval requirement (e.g., IRB, Institutional Animal Care and Use Committee, etc.)."

Students were asked to reflect on the mentoring relationship and, on a scale from strongly agree (1) to strongly disagree (5), to answer the question: "How accurate is this statement in describing the nature of your relationship with your mentor? 'Mentoring relationships are dynamic, reciprocal, personal relationships in which a more experienced person (mentor) acts as a guide, role model, teacher, and sponsor of a less experienced person (protégé). Mentors provide protégés with knowledge, advice, counsel, support, and opportunity in the protégé's pursuit of full membership in a particular profession'."[2(pxv)] Scores averaged 2.1, showing that students agreed with this characterization of their mentoring relationship. One mentee said her mentor "is truly a mentor in every sense of the word…She always has my best interests in mind, and I know that I can count on her." In the words of another: "While he does not micromanage, giving enough space to foster independence, he is still able to provide necessary guidance and direction as needed."

The ideal mentoring relationship may also be characterized by the fifth stage, reflective competence. This is similar to notions of reflective and critical practice[3-5] as well as concepts of mindfulness.[6] It combines "looking deeply into oneself in the spirit of self-inquiry and self-understanding"[6(plxii)] with a "participatory, dialogical approach" paying attention to the "wider discursive, social and political context."[7(p7)] In the survey, we asked what the

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*"We make a living by what we get, we make a life by what we give."*

**Winston Churchill**
(1874-1965)

## Research Is a Team Sport

*Ted Usdin, Ph.D., Fundamental Neuroscience, National Institute of Mental Health*

I was pleased to see the Feb. 9 article in the Washington Post "Simulating blindness may boost hearing," which described elegant and important scientific work carried out by investigators at Johns Hopkins University and the University of Maryland. The first author of the study, published in the prestigious journal *Neuron*, is my former student Emily Petrus. It was appropriate that the article named the senior authors of the study because they conceived it, obtained funding to carry it out and closely supervised the work. But an opportunity to illustrate an important aspect of scientific research was missed.

Scientific research is a team sport. Studies like this would not be possible without hardworking postdoctoral fellows or graduate students such as Petrus. To partially compensate for financial and personal sacrifices, these trainees look forward to the attention and help in their careers that comes from publication in high-profile journals.

This particular advance was picked up by *The Post*, in part, because of efforts by PR teams at the universities intended to bring attention, and ultimately benefit in the form of continued support, to their universities and senior researchers. The rest of the research team also deserved a "Post Bump."

(Dr. Usdin's "Letter to the Editor" was published in *The Washington Post* on February 21, 2014.)

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students wanted their mentors to know, but thought they didn't. One student said, "As an international student, I continue to have some interpersonal problems in the lab due to fellow lab members treating me differently." Mentors must peer into the mirror daily and "see" what is happening in their own labs and around them. This competence may help them be more responsible in their research conduct. Then they can hold up the mirror for their mentees to help them develop their own reflective ability.

We conducted this small survey among graduate students who were conducting mentored research and who turned in an abstract for a college research day presentation. These students may differ from those who were being mentored but did not turn in an abstract; those who completed the survey may differ from the 74 percent who did not. Students were comfortable with sharing ethical concerns; most seemed conscious of what they needed to learn, although a minority seemed to feel they had to learn on their own.

Mentoring in science is important for preparing the next generation of responsible, competent scientists. The Conscious Competence Learning Model may provide a helpful framework for mentors to use to understand the process of mentoring and the need for reflective competence in research conduct. The model may also provide a fruitful research framework for studying mentor and mentee descriptions of mentoring behavior.

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# Mentoring Senior Scientists: The Impact Factor

*Wendy J. Fibison, Ph.D., Associate Director, Office of Training and Diversity, National Institute of Allergy and Infectious Diseases, National Institutes of Health*

Mentoring the young, those preparing for biomedical research careers, is frequently spoken about in educational settings. At the National Institutes of Health (NIH), the concept of mentoring trainees at different developmental stages has broadened, and expectations have risen to a new level in recent years. Trainees are encouraged to be proactive in seeking mentors who will be supportive of their career endeavors and will provide guidance and insightful feedback. "Peer mentoring," "Multiple Mentor Model," and "speed mentoring" are commonly heard terms on NIH campuses. Mentoring awards have been created to recognize outstanding mentors. Along with the increased visibility of mentoring as a critical component of training, services and programs have expanded to promote the growth of trainees as future mentors.

What is spoken of far less is mentoring for the senior scientist. In this instance, "senior" refers to anyone in a tenure-track or tenured position, whether this is a recent or longstanding accomplishment. A short time ago, a renowned researcher, Dr. Albert Z. Kapikian, well into his years, yet young at heart and still a presence in the research community, passed away. Many senior scientists paid tribute to this beloved man, acknowledging how much his mentoring would be missed. It reminded me again of the enormous value of having a mentor at all stages of one's career.

Yet mentoring is not universally regarded as vital for those beyond their postdoctoral years. This article briefly explores the role of a mentor. It then considers some of the specific challenges you, as a senior scientist, may face and how a mentor might enrich every stage of your professional life.

A mentor aspires to support your success. This aspiration involves active listening, observing, understanding what motivates you, and giving you candid feedback. Being adept at solving problems and being knowledgeable about resources will further enhance your mentor's value. Establishing a good mentoring relationship requires investment from you, as well. Most important, you must be able to articulate your needs. And if you embrace the concept of being a "lifelong learner" in the broadest sense, you will be more open to your mentor's guidance. As you transition through the different stages of your career, you may seek a variety of mentors with diverse talents, from within or outside your institution.

If you are a recent postdoc assuming a tenure-track position, you are suddenly in a new space; that is, you are no longer "one of the postdocs." Rather, now you are responsible for helping your postdocs be successful, both scientifically while in your lab and professionally in reaching their career goals. This new role will compel you to re-examine how you relate to those in "your" lab. How directive or non-directive will you be with respect to their scientific projects? How will you ensure that their science meets high standards? How will you identify the individual mentoring needs of your trainees? How will you approach conflict resolution? How do you want authorship to work in your lab?

With respect to your trainees' career goals, realistically few new fellows will know exactly which path they want to take. Or their goals will change. Or there may be significant changes in workforce opportunities. Your postdocs will rely on your mentoring skills to help them as they decide their next step. This decision might be less daunting for you if they, too, aim to be a principal investigator; although with the level of competitiveness for these positions in the current environment, this may not hold true. Many may end up pursuing a career track quite different from yours, one unfamiliar to you.

For all of these issues, having your own mentor can ease the stress as you step into your new role and can add breadth to your thinking about strategies and solutions. Your mentor may be adept at communication skills, or the mentor's strength may be knowledge of trends in non-bench careers and resources. He or she may have a broad network of colleagues in science careers who can also be a resource for you. Having a mentor as you begin your

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career may be particularly important if you do not have a wide, informal professional network.

As a tenured researcher, you face shrinking research budgets, a greater spectrum of available new technologies, ever-evolving publication demands, cross-cultural collaborations, and an increased need to articulate the significance of your research to those making funding decisions, as well as increased administrative responsibilities. With these divergent demands, mentors with specific talents and expertise may prove critical. For example, a business-savvy mentor may help you make the most of resources. A separate mentor may teach you how to leverage new opportunities or devise a research plan that considers cost-benefit analyses effectively. As another example, there might be an approach that does not require animal experiments but gets you very close to the results needed for the next big advance at far less cost.

> *"I think a mentor gets a lot of satisfaction in a couple of ways. They're doing something constructive, so they feel good about that. And when they see the results of this, with the young people they're working with, it's very, very rewarding."*
>
> **John Glenn**
> (1921- )

Researchers who have been in the field for many years may find themselves puzzled by the incoming trainees. These young scientists, often described as Generation X or Generation Y/Millennials, may be a "new breed" to them, with a very different work focus, ethos, set of expectations, and sense of loyalty. They may be motivated by different factors. Their values may be more focused on "individuality and time," rather than "family and community" that typifies the "traditionalists" era, those born before 1945. Generational diversity in the workplace calls for new strategies to instill high standards, foster good lab citizenship, and motivate fellows to reach their maximum potential. Your mentor may be a specialist in the field of generational diversity. Or you might consider enlisting as your mentor a knowledgeable, articulate member of Gen X or Gen Y. This person could help you explore approaches to issues that arise in your lab with trainees from Gen X or Gen Y.

In the past decade, global research has been added to many research portfolios. Research collaborations, as well as clinical research projects that are multinational, have resulted in a greater need for a global perspective on bioethics. Consideration of cultural and ethical pluralism is critical to the success of these projects. This consideration is particularly germane to clinical protocols.

If you are setting up an international clinical protocol, understanding the cultural basis of potential subjects' beliefs can effectively inform your recruitment plans. For example, you are already familiar with the Western culture's concept of autonomy. It underscores the importance of individual decision making, especially when those decisions relate to health and illness. What may be unfamiliar to you is how decision making works in another culture. Family and community may play a much greater role in this process. A cross-cultural mentor could provide insight into participants' reasons for volunteering for a clinical protocol. Incorporating this understanding into recruitment strategies at the earliest stages of planning would be beneficial to the research and to the community.

Transitioning out of the scientific workforce may be the most challenging transition of all. Science has been described by some as "addictive." As a successful scientist, you've devoted much energy and countless hours to your research over many years. Doing anything else might be unimaginable. You may ask yourself: *When should I retire? When should I tell people that I'm going to retire? How can I leave without compromising the careers of those in my lab? How can I stay involved in the science I love?*

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# Evaluation: A Vehicle to Empower Mentor-Mentee Relationships

*Lauren M. Anderson, M.Ed., Department of Family and Community Medicine, Northwestern University Feinberg School of Medicine*

Although mentoring relationships are known to be pivotal in the development of researchers, very little attention has been given to systematically promoting and evaluating the quality of those relationships. However, in the past five years, there has been a dramatic upswing in attention to the quality of mentoring relationships, including how to evaluate them.

The purpose of this commentary is to highlight a component of new theoretical framework[1] on how to more successfully structure a mentoring relationship. This model was created after a series of interviews and focus groups with mentees, mentors, and program directors.

From the research, we deduced that there are four essential steps that help to optimize the mentoring relationship:

1. mentor development,
2. mentee empowerment,
3. mentoring agreements, and
4. formal evaluation process.

A safe environment in which evaluation is valued is critical to the entire process.

### *Mentor Development*

It is important for mentors to receive training in best practices. As lifelong learners, when we wish to acquire a new skill or gain new knowledge we read about it. Study it. Talk to colleagues about it. Talk with an expert about it. Why should mentoring be any different? Mentoring is a skill. We propose three components of mentor development: (1) structured competency-based training, (2) informal peer learning, and (3) self-reflection.

The first element of mentor training is providing mentors with initial formal competency-based development. This training should be engaging and meaningful. The structure of the training can follow the mentoring competencies outlined in Fleming et al. 2013. Workshop topics can include: maintaining effective communication, aligning expectations, assessing understanding, fostering independence, addressing diversity, and promoting professional development.[2]

The second component is peer learning. New *and* experienced mentors would come together and share what has worked well and where they have encountered struggles. The experienced mentors share valuable lessons learned with new mentors. These informal "booster-like" sessions are meant to reinvigorate mentors with ideas on how to build their relationship or improve it.

> *"Tell me and I forget, teach me and I may remember, involve me and I learn."*
>
> **Benjamin Franklin**
> (1706-1790)

The final element is mentor self-reflection. Between the formal and informal training sessions, it is important for mentors to be encouraged to continually self-reflect on their own mentoring practices. To frame this self-assessment, the following domains (or areas) of mentoring can be used (depending on the purpose of the relationship): meetings and communication, expectations and feedback, career development, research support, and psychosocial support. These domains were created by reviewing mentoring evaluation instruments and have been used in several mentoring articles.[1] An example of a self-reflection template can be found in the Anderson et al. 2012 article.

### *Mentee Empowerment*

One of the most vital components for an effective relationship is for mentees to feel empowered. The power differential often makes mentees feel incapable of giving feedback to their mentor.[2] There are also those mentees who are unclear on what they can expect from their mentor; they don't know what a good mentoring relationship could look like. Mentees need to become as highly skilled in guiding their own mentored relationship as their mentors.

**(See Evaluation, page 11)**

## Evaluation *(from page 10)*

Mentee sessions can mirror those of the mentors. It is important that mentees understand elements of a relationship, communication strategies, and mentoring agreements. Mentee training can also include having more "senior mentees" come and give best practices, useful tips, and other pertinent information to the newbies.

### *Mentoring Agreement*

A very crucial step is to formalize the mentoring relationship by using a mentoring agreement document. It is important that expectations be aligned from day one. Alignment of mentee and mentor expectations on how the relationship will function is key.[3,4] Essential components of this agreement could include the following domains and example subcategories:

- Detailed Timeline for Components Expected for Both
- Communication (How often will you meet? Will you meet in person?)
- Expectations and Feedback (How often will you receive feedback on your project?)
- Career Development
- Research Support
- Psychosocial Support

This document is crucial but should not be set in stone, but rather thought of as a living document that needs to be updated and changed as the relationship matures. This agreement also can be helpful as a prompt during meetings with the mentee to aid in reviewing relevant areas.

### *A Formal Evaluation Process*

Although mentees are often evaluated, mentors are often not. Once both mentees and mentors are trained and following the establishment of the agreement, it becomes easier to implement a more formal evaluation process for both the mentee and the mentor. The mentoring agreement will provide a roadmap for evaluation and will hold both the mentor and the mentee accountable.

**(See Evaluation, page 12)**

## Impact Factor *(from page 9)*

Having a wise mentor can make these questions more approachable.

Although many might benefit from having an astute mentor, preferably one with a great sense of humor, realistically not everyone embraces a "mentoring across the years" model. Some may value independent decision making. Others may be reluctant to ask for help with an issue, feeling they should be able to manage it on their own. Still others may protest and say, "I'm too old to change." In these instances, "stealth mentoring" might be considered if there is a common issue that requires new approaches. Case study discussions can be made part of a routinely scheduled meeting. This approach may make it easier for shared insights, resources, and ideas for creative solutions to be considered by those reluctant to engage a mentor.

The National Institute of Allergy and Infectious Diseases (NIAID) provides senior scientists opportunities to enhance their mentoring skills and to identify mentors for their own career development. Leadership workshops with the opportunity for ongoing mentorship have been provided for many years. New tenure-track scientists are matched to a mentor to help them with this transition. In the near future, incoming tenure-track scientists will also have a mentoring committee. This committee will meet regularly with the new researcher to provide guidance on scientific progress, as well as lab management, training, and personnel issues. NIAID Office of Training and Diversity provides services, resources, and programs for trainees and investigators. An annual NIAID Outstanding Mentor Award recognizes contributions of scientists to the postdoctoral community. A new program will create a bank of newly retired scientists, who will be available to researchers who seek mentoring.

Whether you take advantage of what your institution provides, seek your own mentors, or both, integrating this relationship into your experience will enrich your professional life. Being open to the "Mentor Impact Factor" can be very rewarding. More time for reflecting on your science may be the best reward of all!

# How Does Your Research Mentoring Program for Ph.D.'s Stack Up?

*Sandra Titus, Ph.D., Office of Research Integrity*

We know several important things about mentoring Ph.D. candidates that succinctly describe why evaluating institutional and programmatic issues on mentoring is a critical issue:

- The intervention most likely to reduce research misconduct in trainees is a good mentor. Such fortunate trainees are more likely, in all fields of research, to publish research papers before graduation and to make presentations at scientific meetings.[1] The less fortunate trainees are likely to have a mentor in name only, that is, an "absentee mentor."
- The absence of a true mentor can be career ending for students. Specifically, 73 percent of a sample of graduate students and postdocs, who were found guilty of research misconduct, had the misfortune to have an "absentee mentor," who failed to review their source data; and 62 percent failed to set standards such as using laboratory notebooks and rules for data analysis.[2]
- A mentored student has fewer opportunities to cheat. In addition to their own work with students, effective mentors are more likely to schedule research group meetings. These can be a very useful method by which to review their laboratory's current findings and can also serve as a deterrent to misconduct by limiting the students' isolation and the opportunity to cheat.[3]
- We cannot naïvely assume that if you have been mentored you will know what is expected of a mentor. Graduate and postgraduate education focuses on preparing scientists; thus, most faculty members have not received any formal training on how to be an effective mentor. Yet, in a study with 3,500 RO1 faculty, 30 percent reported they had no written guidelines from their institution on their role with their graduate students, and over half of those with guidelines felt the guidelines they had were not useful because they were too generic and vague.[4]

### *Institutional Assessment Questions:*

**1. Are the faculty's responsibilities with Ph.D. candidates clearly defined?** There are members of any faculty who self-identify as *mentors* but, perhaps, unknowingly, are not truly fulfilling that role. There are others who consider themselves to

**(See Program for Ph.D.'s, page 13)**

## Evaluation *(from page 11)*

Mentees can evaluate their mentors annually or biannually if needed. It is still important for the mentees to be able to give feedback. Evaluations can be collected by the program director, who can collate them to be shared with all mentors as de-identified comments, or they can be used in the mentor training process. Any "red flags" picked up by the program director can be dealt with on the individual level. There may be instances when a meeting between the program director, the mentee, and mentor may be appropriate. It is important for the mentee to feel empowered to give feedback even if it is critical. However, by following the other steps (e.g., agreement, mentor self-reflection, and trainings), we hope that disagreements on the functionality of the relationship would be minimized.

### *Conclusion*

All of these steps can assist in creating stronger, more effective mentoring relationships. It may not be feasible to implement every component at once, so implementing piece by piece may be the best option. I hope that you will consider trying out some of these processes in your own institution.

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## Program for Ph.D.'s *(from page 12)*

be *advisors*. However, to serve as an advisor is only one function of a mentor.[5-7] Advisors do not invest in their student's development to the same degree as mentors. Therefore, the mentor's responsibilities to the trainee should be explicitly stated and made known to both parties. Doing so would lessen the possibility of the development of "absentee" or lax mentors. For example, students need to be able to receive direction on the selection of appropriate research questions, practice in presenting data, coaching on preparing a paper for publication, working on a grant, discussing analysis, and participating with others in conducting responsible and ethical research. Unfortunately for many students, the requirements and expectations of the faculty are poorly described and minimally evaluated by administration.

It is essential that the faculty understand that these responsibilities should be required of any graduate teaching program which prides itself on its quality and integrity. Policies that address the removal of deficient mentors should also be established.

> *"The mind is not a vessel to be filled, but a fire to be kindled."*
>
> **Plutarch**
> (45-120 A.D.)

**2. What are the responsibilities of faculty members to teach responsible conduct of research (RCR) in the training program classes and in the lab?** RCR is not only a training program required of trainees by the National Institutes of Health and the National Science Foundation, but is an essential component of a mentor's job. A mentor is automatically, for better or worse, a role model illustrating his or her own RCR behaviors. In addition, a mentor applies and teaches those principles of data integrity, appropriate analysis, and honesty in presenting and publishing findings. When the RCR training program was created, it was not intended to remove a primary responsibility of mentors to promote integrity and prevent research misconduct. Yet over half of the 3,500 faculty members reported that they thought the institution was primarily responsible for RCR.[8] It is a shared responsibility, and RCR is not merely the formal training component.

**3. What are you doing to develop programs that teach and discuss how to have more effective mentoring relationships?** Less than 28 percent of over 3,500 faculty reported that they had the opportunity to be involved in a training program focused on how to be a research mentor.[9] Training programs aid faculty in considering new skills and new ways to interact with their Ph.D. candidates. Faculty, in turn, should have the opportunity to define what they believe is needed to create stronger research mentors. For example, the University of California created a program based on planning with its faculties.[10]

An important component in building such a program would include discussions on how to develop relationships with graduate students, beyond advising. Such bonding can occur only when one invests in the relationship. The psychiatrist Eric Ericson has coined the term "generativity" to describe this bonding behavior of adults.[11] He defined it as the emergence in adulthood of the concern for establishing and guiding the next generation. This is often an unspoken but essential quality of a good mentor. Training program leaders need to consider ways to awaken the "generativity" function of their faculty.

**4. How do you recognize the outstanding mentor?** Many graduate programs demonstrate the value they place on such training by providing annual awards for outstanding mentors. These awards are presented to faculty members who go the extra mile to nurture the development of young scientists. Such awards not only acknowledge the faculty member, but also call public attention to what the institution and its students value in its faculty.

**5. Are you listening to the students?** The voice of students is often neglected in planning and enhancing mentoring efforts. The following is a list of attributes cited by students in nominating their mentor of the year for a *Nature* award.[12]

**(See Program for Ph.D.'s, page 14)**

## Program for Ph.D.'s *(from page 13)*

- **Enthusiasm:** "First and foremost, M is incredibly passionate about science. She eats, sleeps, and breathes science. Her enthusiasm is absolutely infectious, and it creates a wonderful atmosphere in her laboratory."
- **Sensitivity:** "When things go wrong, it is important to find out why things happened the way they did. There could be personal factors (sickness, relationship break-ups) that contribute to unhappy decisions or results. Although I may not be able to provide the solution to personal problems, I can provide a sympathetic ear as well as advice or direction to support services."
- **Appreciating individual differences:** "Again it is important to cater for personal traits. Some of my student colleagues need to dot every i and cross every t as they design a set of critical experiments that we have all agreed are important. Others, with, I suspect, an equal success rate, need to jump in, risk making a mess of a few highly critical experiments but gain an instant understanding of either what not or what to try. Allowing both approaches is sometimes difficult, but necessary."
- **Respect:** "She treats her colleagues, regardless of whether they are doing a Ph.D. or if they are a fellow professor, with the same high regard. In doing so, M inspires confidence in her collaborators."
- **Unselfishness:** "His magnanimity in sharing his own ideas and delight in seeing others succeed has also been an inspiration, not just for myself but for a whole generation of younger scientists."
- **Support for other than one's own:** "M is just as diligent in fostering careers of people who he thinks can advance science as he is at fostering his own students. This action is consistent with a motive that goes beyond mere ego and represents service to the advancement of science."
- **Teaching and communication:** "M's enthusiasm was infectious for many undergraduate students, and I have no doubt in saying that her delivery of the subject matter was instrumental in fueling my interest in X as a subject."
- **Activities that made a difference:** "First, her door is always open, even now in her retirement she can never say 'come back later.' I now greatly admire this skill, for I find myself struggling with administration and feeling guilty in making appointments to see students. M always put scientific discussion first."
- **Inspiration, optimism:** "Going to M's office with your head down, armed with a plot or calculation showing that the project seemed to be going nowhere, you will leave believing that you've solved the mysteries of the Universe."
- **Balancing direction and self-direction:** "M displays the right balance of direction in a project and letting someone discover and develop insights for themselves. Supervisors who micromanage their students or have very specific ideas of how the science in a lab should be done can stifle the student."

This brief summary is intended to spark institutional discussion on ways to enhance mentoring at your institution. The work of high-quality mentors will not only reduce the likelihood of research misconduct, but will enhance the value of the training and development of its graduate students and postdoctoral trainees. It will also demonstrate the significance an institution places on its own basic integrity.

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## Case Summaries

**Li Chen, Ph.D.**
**Mount Sinai School of Medicine**

Based on evidence and findings of an investigation report by Mount Sinai School of Medicine (MSSM) transmitted to the United States Department of Health and Human Services (HHS), Office of Research Integrity (ORI), in April 2010 and additional analysis conducted by ORI in its oversight review, ORI found that Dr. Li Chen, former Postdoctoral Fellow, Department of Gene and Cell Medicine, MSSM, engaged in research misconduct in research that was supported by National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), National Institutes of Health (NIH), grant R01 DK062972 and National Institute of General Medical Sciences (NIGMS), NIH, grant P20 GM075019 and was submitted in grant applications R01 DK074695 and R01 DK083286 to NIDDK, NIH, P20 GM075019 to NIGMS, NIH, and R01 NS062054 to the National Institute of Neurological Disorders and Stroke (NINDS), NIH.

ORI found that the Respondent intentionally, knowingly, and recklessly fabricated and falsified data reported in four (4) publications, one (1) submitted manuscript, and four (4) grant applications:

- Chen, L., & Woo, S.L.C. "Complete and persistent phenotypic correction of phenylketonuria in mice by site-specific genome integration of murine phenylalanine hydroxylase cDNA." *Proc. Natl. Acad. Sci. U.S.A.* 102(43):15581-15586, October 2005 (hereafter referred to as "*PNAS* 2005")
- Chen, L., Thung, S.N., & Woo, S.L.C. "Metabolic Basis of Sexual Dimorphism in PKU Mice After Genome-targeted PAH Gene Therapy." *Mol. Ther.* 15:1079-1085, June 2007; Retracted in December 2010 (hereafter referred to as "*Mol. Ther.* June 2007")
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- Chen, L., Roy, I., Prasad, P.N., & Woo, S.L.C. "Nanoparticle-Based Gene Therapy for Metabolic Disorders: Hepatic Delivery of

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## Case Summaries *(continued)*

Minicircle DNA for Complete Correction of Phenylketonuria." Submitted for publication in *Proc. Natl. Acad. Sci. U.S.A.* (hereafter referred to as the "*PNAS* 2008 manuscript")

- R01 DK074695, "Genome-targeted PAH Gene Integration in PKU Mice and Sexual Dimorphism," Savio L.C. Wood, Ph.D., Principal Investigator (P.I.) (hereafter referred to as "R01 DK074695")
- P20 GM075019, "Growth, Differentiation & Genetic Alteration of Human ES Cells," Gordon M. Keller, Ph.D., P.I. (hereafter referred to as "P20 GM075019")
- R01 NS062054, "Nanoparticle-medicated Gene Therapy for PKU," Savio L. Woo, Ph.D., P.I. (hereafter referred to as "R01 NS062054")
- R01 DK083285, "Nanoparticle-Mediated Gene Therapy PKU," Savio L. Woo, Ph.D., P.I. (hereafter referred to as "R01 DK083285")

*"What is a teacher? I'll tell you: it isn't someone who teaches something, but someone who inspires the student to give of her best in order to discover what she already knows."*

**Paulo Coelho**
(1947- )

The Respondent fabricated figures reporting the chromosomal locations of integration sites, fabricated data reporting the use of polymerase chain reaction (PCR) to determine integration frequencies, falsified data representing the detection of chromosomal translocations in human cells, and fabricated figures by falsely reporting the results of High-Performance Liquid Chromatography (HPLC) assays. The Respondent also falsified experimental data for LacZ stained liver sections and for hematoxylin and eosin (H&E) stained liver sections.

Specifically, ORI finds by a preponderance of the evidence that the Respondent engaged in misconduct in science and research misconduct by intentionally, knowingly, and recklessly:

1. fabricating and/or falsifying nineteen (19) figures by falsely reporting that phenylketonuria (PKU) gene therapy experiments were successfully completed, when the available evidence shows the experiments were not performed; specifically, the Respondent:

   (a) fabricated figures where DNA sequencing was purportedly used to identify the chromosomal locations of integration sites for the PAH gene in mouse and human cells, reported in seven (7) figures:

   - *PNAS* 2005, Figure 2A
   - *HGT* 2008, Figures 3b and 3c
   - R01 NS062054, Figures 3 and 20
   - R01 DK074695, Figure 6
   - R01 DK083286, Figure 17
   - P20 GM075019, Figure 4

   (b) fabricated data purportedly representing the use of PCR to determine integration frequencies for the phenylalanine hydroxylase (PAH) gene and the secreted embryonic alkaline phosphatase (SEAP) reporter gene, in mouse and human cells, reported in eleven (11) figures:

   - *PNAS* 2005, Figures 2C and 3B
   - *Mol. Ther.* June 2007, Figures 2a and 5a
   - *Mol. Ther.* Oct. 2007, Figures 2d and 5a
   - *HGT* 2008, Figure 4
   - R01 NS062054, Figures 4b and 10a
   - R01 DK074695, Figure 7b
   - R01 DK083286, Figure 2b

   (c) falsified figures representing the detection of chromosomal

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tranlocations in human cells, purportedly determined by PCR in two (2) figures:

- *HGT* 2008, Figure 5a
- R01 NS062054, Figure 21a

2. fabricating the results of HPLC assays to show generally lowered blood levels of phenylalanine after PKU gene therapy and to show liver levels of $BH_4$ when the Respondent did not have the HPLC data needed to support those claims; specifically, the Respondent:

   (a) fabricated serum phenylalanine graphs in:

   - *PNAS* 2005, Figure 4B; this false data also is presented in R01 DK074695, Figure 10b
   - *Mol. Ther.* June 2007, Figure 1a; this false data also is presented in R01 DK074695, Figure 11
   - R01 DK083286, Figure 3; this false data also is presented in *Mol. Ther.* June 2007, Figure 3, and R01 NS062054, Figure 7
   - *Mol. Ther.* Oct. 2007, Figure 4a; this false data also is presented in R01 NS062054, Figure 9a
   - *PNAS* 2008 manuscript, Figure 4

   (b) fabricated graphs for $BH_4$ levels in:

   - *Mol. Ther.* June 2007, Figure 5c; this false data also is presented in R01 NS062054, Figure 8c

3. falsely reporting the results of LacZ stained liver sections by reusing and relabeling an image and claiming that it represents different experiments; specifically, the same image was used to represent mice treated with a nanoplex gene delivery system in R01 NS062054, Figure 14b (right panel), and also to represent a wholly different experiment for mice treated with 10 injections of the phiBT1 integrase system alone in R01 NS062054, Figure 4c (right panel), and *Mol. Ther.* Oct. 2007, Figure 2b (D panel)

4. falsely reporting the results of H&E stained liver sections in R01 NS062054, Figure 6, by using the identical image to represent four (4) different experimental treatments of H&E stained liver sections; specifically, the Respondent reused and relabeled one image to represent liver sections from mice that received either 1 or 10 injections, with or without the phiBT1 integrase plasmid.

The Respondent failed to take responsibility for the fabrication and falsification described in ORI's findings.

The following administrative actions have been implemented for a period of three (3) years, beginning on April 11, 2014:

(1) Respondent is debarred from any contracting or subcontracting with any agency of the United States Government and from

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## Case Summaries *(continued)*

eligibility for, or involvement in, nonprocurement programs of the United States Government referred to as "covered transactions" pursuant to HHS' Implementation (2 C.F.R. Part 376 *et seq.*) of Office of Management and Budget (OMB) Guidelines to Agencies on Governmentwide Debarment and Suspension, 2 C.F.R. Part 180 (collectively the "Debarment Regulations"); and

(2) Respondent is prohibited from serving in any advisory capacity to PHS, including but not limited to, service on any PHS advisory committee, board, and/or peer review committee, or as a consultant.

**Office of Research Integrity**
**1101 Wootton Parkway, Suite 750**
**Rockville, Maryland 20852**
Office of the Director... (240) 453-8200
Fax ..... (240) 276-9574
Division of Education
and Integrity..... (240) 453-8400
Fax ..... (240) 276-9574
Assurances Program .... (240) 453-8400
Fax ..... (301) 594-0042
Division of Investigative
Oversight..... (240) 453-8800
Fax ..... (301) 594-0043
Research Integrity
Branch/OGC ..... (301) 443-3466
Fax ..... (301) 594-0041
**http://ori.hhs.gov**