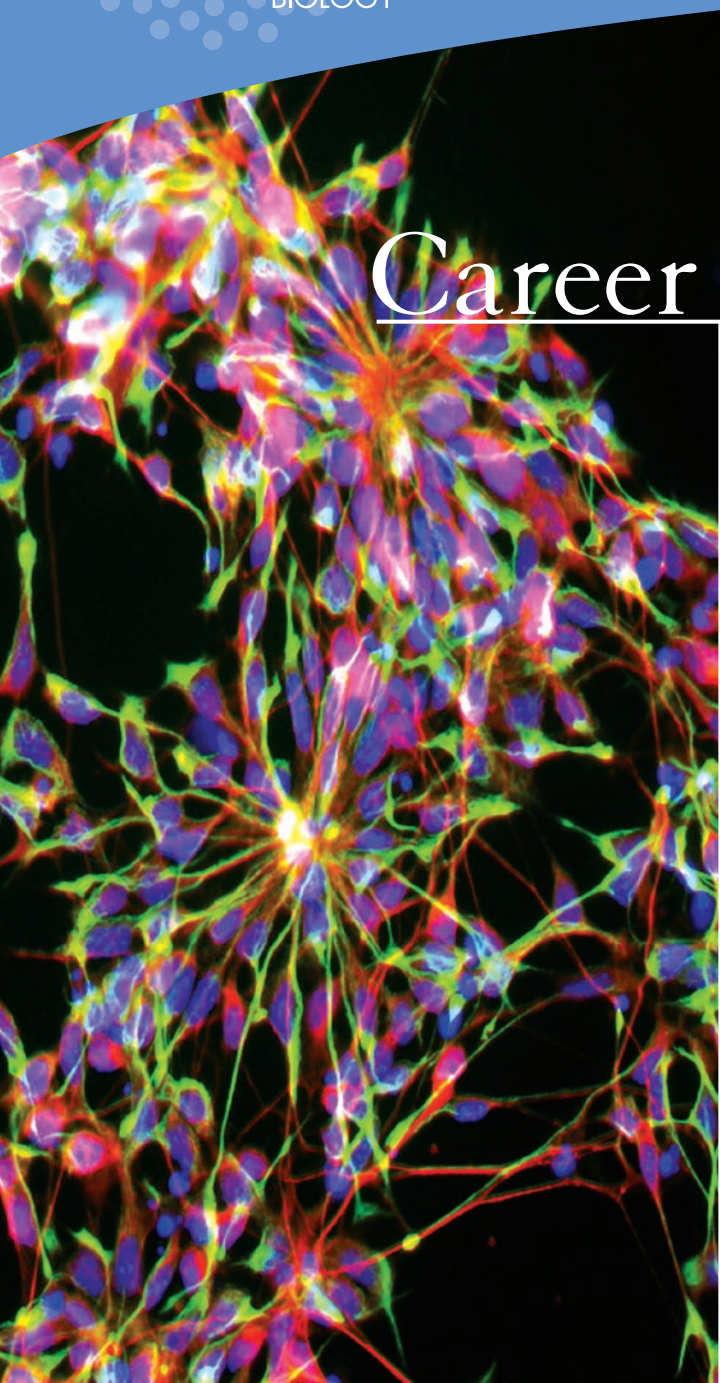


THE AMERICAN
SOCIETY FOR
CELL
BIOLOGY



Career Advice

for
Life
Scientists
Volume III

*Women in
Cell Biology*



THE AMERICAN SOCIETY FOR CELL BIOLOGY

Career Advice for Life Scientists III





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Career Advice for Life Scientists III



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Introduction to Career Advice for Life Scientists III



Ursula W. Goodenough
Chair
ASCB Women in
Cell Biology Committee



Elizabeth Marincola
President
Society for Science & the Public
Publisher
Science News

The Women in Cell Biology (WICB) Committee traces its origins to 1971, when a small assembly of Yale colleagues determined to organize a gathering of the few women attending the 11th Annual Meeting of the American Society for Cell Biology (ASCB) in New Orleans that year. They posted flyers on the back of bathroom stalls and 30 women showed up.

The first sustained effort of this pick-up group was a “newsletter”—a bimonthly mimeographed job—addressing topics as diverse and important as sexist advertisements in scientific journals, job opportunities (though the jobs had not been advertised), and American Civil Liberties Union rulings that women should not be required to use their husband’s names and that single women should qualify to receive loans and hold mortgages.

In the subsequent almost four decades, the WICB Committee has, in its way, become the heart and soul of the cell biology community. Women in cell biology and the WICB Committee have achieved sufficient progress to make the early concerns seem almost quaint. But the challenges faced by women in science today are, while more subtle, still real and still attracting the commitment of dedicated cell biologists. We are proud of contributing to that history.

One of the keys to the success of the ASCB WICB Committee is that its activities and services have served the many male members of the ASCB and the scientific community as well as its women. This has never been so true as in recent years, when students and postdocs face acute challenges in establishing satisfying careers in the life sciences. In response, the WICB Committee has given high priority to programs, events, publications, and awards that support the career aspirations of scientists. *The Career Advice for Life Scientists* series is offered in that spirit.

This is the third volume of selected articles from the acclaimed WICB column of the award-winning *ASCB Newsletter*, those ranked by WICB Committee members as providing the most helpful career advice for life scientists. The first volume was published in 2002 while Zena Werb served as WICB chair (1997–2001), following the leadership of W. Sue Shafer (1994–1997). The second volume was published while Ursula Goodenough was chair (2001–present). Based on the success of the monthly *ASCB Newsletter* columns and the overwhelming popularity of *Career Advice for Life Scientists* Volumes I and II, we trust that this compilation will prove even more helpful than the sum of its parts.

At the risk of inadvertently excluding deserving colleagues, we acknowledge proudly some of the many people who together have conspired to make the ASCB WICB Committee and its column widely imitated and praised: Virginia Walbot, Mary Clutter, and Mary Lake Polan made up that small critical mass from Yale that lit the spark in 1971; Susan Goldhor and Elizabeth Harris were early editors of *The Women in Cell Biology*

Newsletter, and their job included gathering \$1 and \$5 contributions from colleagues to keep it going; chairs before the WICB Committee became an official ASCB committee were Ellen Dirksen, Nina Allen, Kathryn Vogel, Patricia Calarco, Mina Bissell, Jane Peterson, Susan Gerbi, Mary Lou King, and Ursula Goodenough (33% of whom—Gerbi, Goodenough, and Bissell—were later elected President of the ASCB, as was Zena Werb); Dorothy Skinner served as the conscience of the ASCB Council in the early years; Laura Williams and Maureen Brandon were dedicated editors of the *ASCB Newsletter* WICB column (Laura did much of the research that contributed to this history); and Emma Shelton, Dorothea Wilson, Rosemary Simpson, Elizabeth Marincola, and Joan Goldberg, as ASCB executives, have helped nurture women’s activities through the Society. Finally, but not least, we thank the National Institutes of Health Office of Research on Women’s Health and the Burroughs Wellcome Fund, without the support of which we could not offer this resource. ■



1. ACADEMIC CAREERS

Succeeding in Science at
a Liberal Arts College

How to Ask Your Chair for a Raise

Sustaining Women through
Critical Career Transitions

Late Career Opportunities and
Challenges for Cell Biologists

Succeeding in Science at a Liberal Arts College



Jennifer Roecklein-Canfield
Simmons College

I'm dragging because I was up until 2:00 am on eBay. It was worth it, though; I won the used Afga X-ray developer for only \$1,200. I spent the first part of the morning trying to order lab supplies. I just got off the phone with Fisher, trying to order pipette tips and microcentrifuge tubes. I had to scrounge up a P.O. for them and couldn't find the paper with my account number on it. I struggled to figure out whether I have money in my jumbled grant budget to pay for the supplies. I think I've done some math incorrectly and may have found an extra \$200 (or maybe I've done the math correctly and am \$200 short, not sure...). I've now got 15 minutes left of the hour before my biochemistry lecture to set up a restriction digest and load a gel. Alas, it's not to be, for as soon as I step outside my office I spot two students from my immunology class approaching me. Those precious 15 minutes are disappearing....

Where else could I collaborate with some great researchers in my field, without the fear of losing my funding and the pressure to churn out publication after publication?

Dictionaries define fragmented as broken into pieces. There is no better adjective to describe what it is like to be a scientist at an undergraduate liberal arts college, in my case at Simmons College, where the undergraduates are women. On any given day, I am called upon to be a PI, a lab manager, a lab technician, a grants administrator, a teacher, a career advisor, and sometimes a soft place to land for an unhappy 18-year-old. Imagine for a moment, your



lab with no technician, no postdocs, and no grad students. Who's available to do the experiments? YOU. You would be making the plates, purifying the plasmids, lysing the cells, running the gels, washing the blots, and so on. Calculate the number of productive hours your postdocs, techs, and graduate students spend at the bench performing experiments. Now imagine that it is only you and maybe a few junior undergraduates. It's a frightening thought.

Collaboration and Fragmentation

At the moment, my lab is working on three very different projects. I'm collaborating with one colleague who is characterizing an *Escherichia coli* protein possibly involved in transcriptional silencing. I'm collaborating with another colleague who is exploring the evolution of a murine mutation involved in patterning in the mouse. And finally, my lab's own project is characterizing the functional relevance of a mammalian B cell receptor protein and its downstream protein partner. This means that I'm a molecular, developmental, and cellular biologist, with a dash of biochemistry and immunology thrown in. Talk about "fragmented"! I am truly never bored, but I face a Sisyphean task trying to keep up with all the literature.

By definition, liberal arts colleges, and hence their departments, are small. Consequently, I am the sole representative of several fields in my department. I am the only biochemist in the chemistry department and the only immunologist in the biology department. My office sits between those of an inorganic chemist and a physical chemist. They have become versed at determining if there really is a band on the Western blot I just ran, and I have become an expert at analyzing their MALDI-TOF mass spectra. Hence, collaboration is essential; it is impossible to do research in a vacuum.

Teacher-Scientist or Scientist-Teacher

I teach three courses in an average semester. I have about 30 advisees each semester, and there are usually two to three students doing independent research in my laboratory each year.

This translates into about 15–20 student contact hours per week. My students have constant access to me, and my door is always open for conversation and a cup of tea. I mentor these students, and counsel them, and, hopefully, serve as a role model so that they will go on to become scientists themselves. But first I have to teach them biochemistry and immunology—without a teaching assistant to run the labs, go over homework problems, or grade the 10-page take-home exams I'm fond of giving.

So, am I a teacher-scientist or scientist-teacher? Does it matter? Does the fact that I'm a teacher-scholar make me less of a "real scientist" in the perception of the larger research community? Will researchers at major research institutions take me seriously?

If you can imagine funding your entire laboratory on a \$2,000 research grant, you will begin to comprehend my joy at finding used lab equipment for sale on eBay.

Will major grant programs consider me "worthy" of receiving funding? If you can imagine funding your entire laboratory on a \$2,000 research grant, you will begin to comprehend my joy at finding used lab equipment for sale on eBay.

Why would I choose this path? I get to dabble in many scientific disciplines daily.

Where else could I apply my training in molecular biology to learning how to run a MALDI-TOF mass spec? Where else could I watch the epiphany of understanding dawn on the face of a junior when she finally appreciates that cell biology and biochemistry are actually related? Where else could I write, be awarded, and control my own grants, and still manage to wield a pipette? Where else could I collaborate with some great researchers in my field, without the fear of losing my funding and the pressure to churn out publication after publication?

Am I exhausted at the end of the day? Without question, but so is anyone who is

passionate about his or her work. I am excited when a manuscript is accepted for publication, but I am equally excited when my students are accepted into graduate school.

My very first student will shortly defend her Ph.D. thesis at the Massachusetts Institute of Technology. So the next time you have particularly skilled graduate students join your lab, think about where they came from. Think about the scientists who trained them at the undergraduate level and inspired them to continue. I am a scientist and I am a teacher.

It doesn't matter in which order you write the words, because on any given day I am equally both. And I would not have it any other way. ■

How to Ask Your Chair for a Raise



Victor L. Schuster
Albert Einstein College of
Medicine



Sandra K. Masur
Mount Sinai School of Medicine

If you are at an institution with fairly fixed salaries tied to teaching, administration, and your step on the academic ladder, this article may be somewhat irrelevant; move up the ladder and you get the raise. In contrast, in many medical schools, one's primary responsibilities are either research supported by extramural grants or patient care supported by practice fees. This results in a range of compensation at each rank, meaning that one's salary is often negotiable.

[C]onfrontational negotiation has many pitfalls. While it may be effective in the short run, it often damages your long-term relationship with the chair.

Confrontational Negotiation

Your initial inclination may be to take an aggressive stance with the chair and stake out a "position." Although some chairs are clueless and will require such hardball tactics, confrontational negotiation has many pitfalls. While it may be effective in the short run, it often damages your long-term relationship with the chair. Here are some examples, taken from real life, of various confrontational approaches and a chair's response.

1. "I've been looking at other jobs. If I leave, you'll be in trouble. To stay, I'll need a raise." This is very risky. Be prepared to have your offer to leave accepted. The chair may be thinking: "I'd really like to keep you, but no job has been offered to you yet, and maybe none will be. I have a file of applicants wanting your position, many of whom appear 'hungrier' than you to succeed. And I've weathered defections before."

-
2. “I’ve been offered a terrific position elsewhere, and unless I get a raise, I’m leaving.” Although a stronger position than #1, it is still extremely confrontational (indeed, many chairs call this the “terrorist” approach). Besides, the chair may think: “If it’s such a great position, why aren’t you simply leaving?” or “I don’t believe you; show me the written offer.” As with #1, you must be prepared to have your bluff called.
 3. “I work like a dog, 60–70 hours a week, I need a raise.” Without productivity data relative to your peers, this argument will likely fall on deaf ears. The chair may think: “I’m delighted you’re so dedicated to us, but for all those hours, what are your grant dollars? Your productivity? Your clinical billings? Maybe you’re just very inefficient, or have no life outside the lab or hospital. Maybe you work on things that don’t generate revenue or are not aligned with our goals for the department.”
 4. “As you know from my evaluations, I’m a great teacher. I’m planning new courses and lectures and I’ll need a raise to support these new activities.” The sad truth is that medical schools often pay little for teaching, and teaching budgets are often fixed. The chair may think: “We have plenty of teaching already; what I really need is to decrease the waiting time for new patients,” or “What we really need is for you to fund more of your salary on a grant.”
 5. “My children are starting college,” or “We have new home renovations”—demands related to new personal expenses—are generally not effective. It could be argued that you should have planned ahead. Importantly, the chair will be fearful of setting a precedent for every special case.
 6. “I want parity.” You might take the approach that a fellow faculty member at your rank earns more, and that you want parity. Before taking such a “comparative” approach, know your facts. For example, your colleague may not really make the salary you assert. Or the faculty at higher-paid institutions may be required to bring in a higher percentage of salary than you. A more useful approach might be “According to the AAMC 75th percentile salaries for our region, I am underpaid for my academic field and rank.” Introducing an external benchmark into the discussion may engender a healthier salary analysis that might even benefit your whole department.
 7. Equity arguments such as “I’m underpaid because I’m a woman” (or “a minority”). These may have been true in the past, but because of Equal Employment Opportunity Plan and Affirmative Action, most institutions currently review salaries annually with precisely this thought in mind.
-
- You have to find sources for your raise that generate revenue and align your activities with the needs of your department.*
-
- ### Looking for Common Interests
- This alternative approach builds on two principles: (1) Your chair doesn’t have an unlimited bank account to draw on, and (2) You have to find sources for your raise that generate revenue and align your activities with the needs of your department. For a basic scientist, this often means generating more grant dollars that include sufficient funds to cover the increased salary. If you have clinical responsibilities, learn about “work relative



value units (wRVUs) and wRVU benchmarks for your specialty, since a salary increase may require you to generate billings above that benchmark.

The “Ask” Meeting

1. Do your homework first. Ensure that you are meeting or exceeding the chair’s expectations for your present role. Calculate how much salary you generate in grants and/or how much you bill clinically (wRVUs generated). Find out comparable salaries for your peers from guidelines on departmental and institutional websites or from Association of American Medical Colleges data. Visit <https://services.aamc.org/Publications/index.cfm>.
2. Assuming you are productive, look for additional unmet needs, important to your chair or institution, that you might fulfill. If you meet these needs well and efficiently, will that generate new revenue? If so, will you be rewarded appropriately? If the answers are “yes,” you have a good chance of working with your chair to fund your own raise.
3. Schedule the meeting with your chair. Avoid the mistake of saying the meeting is “personal.” Instead, explicitly tell the secretary it’s about “compensation” so the chair can be prepared with data about your salary and its sources.
4. Be on time, come prepared, make your case calmly, and, above all, “no whining.”
5. If you are rebuffed (which is likely on the first meeting), ask specifically why. Write down the answer and try to flesh it out more fully with the chair at the meeting. Ask: “What specific goals of the department could I fill that, in your opinion, might get me the raise I seek?” This is also an opportunity to explore creative solutions, such as a bonus from a new grant rather than a base salary increase, or a trial increase tied to targets. Ask the chair to identify mentors (research, clinical) who can help you achieve your identified goals in these new areas.
6. Re-examine whether your needs can be satisfied only by a salary increase. It might be equally helpful to get the chair’s support for flexible time, training in new skills, or day care.

The bottom line is that confrontational approaches are a last resort. To be successful, you must above all understand how your chair thinks about salaries. In the film *Being John Malkovich*, various strangers get inside the actor’s head and see the world as he does. Get inside your chair’s head before you ask for a raise. You’ll be glad you did. ■

Sustaining Women through Critical Career Transitions



Joan R. Goldberg
American Society for Cell Biology

With fascinating data and inspirational personal stories, a recent meeting held by the National Academies examined women's careers in science, technology, engineering, and medicine (STEM). The National Academies Committee on Women in Science, Engineering, and Medicine organized the September 18–19, 2008, meeting in Washington, DC, to spotlight obstacles and solutions to smooth career transitions in these fields. A variety of compelling career challenges—many faced by both women and men—are longstanding. Many strategies to address them aren't new either. However, some lessons were apparent and worth examining.

Understanding the Data

An overview of a National Science Foundation (NSF)-funded study, five years in the making, assessing gender differences in academic careers was presented by Claude Canizares.¹ The population studied included tenure-track and tenured faculty at research-intensive institutions. Six disciplines, including biology, were targeted in the 1,800 faculty at 89 institutions studied. By examining hiring, promotion, tenure, and resources (including lab space and start-up funds), the investigators sought to understand where institutions tried to intervene and where they were successful.

The bottom line according to Canizares: "I believe we've made the academic research career unattractive to men and women and particularly for minorities." The age at first assistant professor position has climbed from 34 in 1980 to 38 in 2006, he noted. In addition, the age of receiving one's first NIH R01 grant, as widely noted, is now 43, vs. 37 in 1980.

Kathleen Christensen of the Alfred P. Sloan Foundation cited a recent study at the University of California system finding that women were significantly less likely to want to pursue academic careers than men before starting graduate work: 35% vs. 45%.



The gap persisted after they started graduate school (27% vs. 36%). Women apply for fewer academic positions, submit fewer grants, and express a greater desire for career flexibility, she noted. “What we have is a structural mismatch,” according to Christensen. “What’s needed is...career flexibility...a way of structurally realigning the career path.”

Now for the Good News

Recognizing that there was a problem, nine research university presidents began meeting annually in 2001, at the urging of the Massachusetts Institute of Technology, reported Joan Girgus of Princeton University. The university presidents agreed to:

- Analyze the salaries and proportion of other university resources provided to women faculty
- Work toward a faculty reflective of the diversity of the students
- Share initiatives undertaken to achieve objectives

What’s needed? An institutionally supported mix of programs and services characterized by variety and flexibility.

About three years ago the presidents’ focus shifted to the work and family life “juggle,” Girgus explained. And the focus expanded from faculty to include postdocs and graduate students. What’s needed? An institutionally supported mix of programs and services characterized by variety and flexibility, Girgus said. Given the need to relocate for many opportunities, partner placement assistance is important. (Girgus has written about the “two-body” program for the ASCB Newsletter. See www.ascb.org/files/0510wicb.pdf.)

At Princeton, the mix includes programs for graduate students (GS) and postdocs (P):

- Maternity leave (GS, P)
- Automatic one additional term of financial support for the primary caretaker of each child (GS)
- Workload relief for the primary caretaker (an additional term of financial support for the primary caretaker of each child for GS)
- Back-up care program (GS, P)
- Dependent care travel fund (GS, P)
- Employee and student childcare assistance program (GS, P)
- Expanded on-campus childcare (GS, P)
- Employee assistance provider work/life program (GS, P)

In addition, Princeton and other institutions provide for faculty an automatic one-year extension of the tenure clock for each child.

Encouraging Cultural Change

To recognize the institutions that seek to transform their culture and policies to provide more support to women, the Alfred P. Sloan Foundation initiated the Alfred P. Sloan Awards for Faculty Career Flexibility. The awards consider policies such as extended time to tenure (including modified duties and tenure clock stoppage, “on and off ramps” through leave policies, delayed entry—to foster late career starts, and phased retirement). The Sloan awards addressed these issues in a first round of foundation awards targeted at research-intensive institutions. The second round focused on master’s granting institutions. The third and current round addresses liberal arts institutions (www.acenet.edu/AM/Template.cfm?Section=sloan_awards).

The awards look at cultural and programmatic changes. Assessments evaluate the engagement of leadership, the training of chairs, communications, transparency,

and use of funds. To further foster change, each entrant receives benchmarking reports to make clear how comparable institutions address similar problems. Carrying \$200,000 to \$250,000 each, the awards aim to accelerate efforts as well as recognize leadership and innovation in career flexibility programs.

All the speakers acknowledged the importance of mentors and colleagues, willingness to make geographic and institutional moves, and making choices in building their own career paths.

Inspirational Stories Shared

A diverse group of women speakers described their career paths and spotlighted their transitions: from postdoc to assistant professor, from assistant professor to associate and full professor, into upper administration, and to industry. All the speakers acknowledged the importance of mentors and colleagues, willingness to make geographic and institutional moves, and making choices in building their own career paths.

A participant noted that grants and fellowships can assist with these transitions. For example, the National Institutes of Health has a variety of portable awards to fund individuals at the end of postdoctoral fellowships. These include K, or career development, awards, including the New Investigators Program Pathway to Independence Award (K99/R00). This award is portable to junior faculty positions.

Nontraditional pathways and interdisciplinary fields can offer special rewards. Stacey Gabriel of the Broad Institute described how she rejected pursuing a postdoc in favor of a

staff position. She now runs large-scale multidisciplinary teams in genetics and genomics. Collaboration is a hallmark, and consensus-building rather than competition is critical to her success, Gabriel observed. She also found flexibility and recognition in her career. In fact, it may present a new model, critical for large projects to succeed, and an alternative to the two-class system (of faculty and not faculty).

ASCB Minorities Affairs Committee Vice-Chair Lydia Villa-Komaroff and several other speakers described their two-way paths from, between, and to academic and industry positions. Villa-Komaroff also pointed to the critical role played by mentors and champions.

For students and postdocs looking ahead, Susan Wessler of the University of Georgia argued that being a professor “is a great job if you want to be a mom.” Why? She named flexible hours, good pay, the ability to take long vacations to “cool” places, a diverse career (research, teaching, administration, writing), and fairly reasonable colleagues. She recommended “making smart choices about partners,” and advised asking:

- Is this someone who is supportive of your career?
- Is he or she prepared to contribute equally to parenting if you have children?

In terms of choosing where to live and work, Wessler also advised comparing possible jobs in terms of the availability of:

- Affordable housing
- Affordable childcare
- Minimal commute
- A family-friendly department/workplace

Next Steps

The meeting included invited oral testimony by professional societies—including that by ASCB Council member and Women in Cell Biology (WICB) member Sandra Masur—



offering new directions and highlighting society programs. Masur addressed how the skills of midlife women scientists who have successfully juggled career and family may be overlooked in recruitment for dean and director positions. She called for a new model for identifying candidates for management training.

Many society representatives cited their own programs—including the many ASCB WICB programs at the ASCB Annual Meeting and the Career Advice for Life Scientists series. I urged that:

- Professional societies should work together in program development rather than waste time “reinventing the wheel.”
- A shared space for data from evaluated programs that work in providing career flexibility, mentorship, etc., should be developed.
- What works in smoothing career transitions should be better disseminated as well.

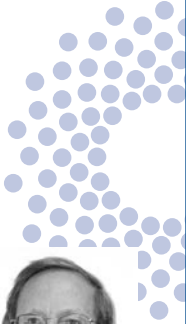
One resource now available is provided by the NSF Advance (Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers) program grantees. A portal to their individual websites, which include survey instruments and evaluations, can be found at www.nsf.gov/crssprogm/advance/itwebsites.jsp.

While the road ahead may be rocky, institutional support may be increasing. The bottom line: Seek the support you need, from peers, mentors, institutions, and professional societies... and don't give up your goals! ■

REFERENCE

1. National Research Council. (forthcoming 2009). *Assessing Gender Differences in Careers of Science, Engineering and Mathematics Faculty*. Washington, DC: National Academy Press.

Late Career Opportunities and Challenges for Cell Biologists



J. Richard McIntosh
University of Colorado

Conversation with any group of cell biologists 55–65 years old will elicit a range of opinions about their ideas for the years ahead. Some are committed to ever more research and/or teaching, essentially a continuation of mid-career activities. Others are looking forward with enthusiasm to the prospect of doing something different, perhaps doing nothing at all, while many fall in between.

There is no general solution to optimizing late career options, because the pertinent issues are so complex and personal that each individual must think things through for him/herself. There are, however, a number of processes that seem generally important for the personal decisions that must be made.

Some older scientists are still full of energy but bored with the problems they have studied for a significant time.

Some people think of retirement as an event that will occur at a specific date, a Rubicon to be crossed that all too much resembles the River Styx. One can, however, approach one's late career with more personal control, organizing a gradual change. Many employers will permit and even encourage a phased retirement in which duties diminish over some years, either through part-time work or a negotiated agreement.¹ If one is enjoying most of professional life but finding that the pace has become too demanding, a gradual retirement probably makes sense. This course may also be advantageous for one's department, allowing several older scientists to wind down and release their positions, while the department initiates hirings that will bring in new blood.



Some older scientists are still full of energy but bored with the problems they have studied for a significant time. Unfortunately, most funding agencies are conservative about new endeavors, so a change of field is not easy at any career stage (new grants are harder to get than renewals for everyone). Late career does, however, offer opportunities for change that are less obvious. Seniority can allow you to reduce the stresses of running a lab, providing a welcome splash of freedom. If, for example, you enjoy lab work but not the struggle for resources, you can probably find a congenial younger colleague who would welcome you into the lab as an associate to work on scientific problems of common interest. This would give chances both to train students in techniques and thought processes that you know well and to pursue your own research. Similarly, many institutions have budgets for lab instruction that can help to pay the expenses of independent study students (undergraduates, summer visitors, even medical students); these young people could come to your own lab and help with research questions of your choosing.

[T]here are ways to continue research, albeit at a slower pace, without the pressure of competing for major research grants.

The point is that there are ways to continue research, albeit at a slower pace, without the pressure of competing for major research grants. Such changes can readily be initiated, given the independence that accompanies outgrowing the need for further professional advancement.

Some older scientists find that a new perspective on teaching can provide a change

of pace and an exciting challenge, as well as significant personal reward. Recent research on interactive learning suggests ways to engage students, even in large lecture courses, helping them learn more effectively.² Modern information technology can provide instructors with immediate feedback on the success or failure of their exposition, allowing lecture modification on the fly and a significant increase in the efficacy of information transfer.³ Computers can serve as teaching machines or as surrogates for hands-on laboratory work. While such ideas are not necessarily new, one can find rewarding and effective ways to use a professional lifetime of teaching and learning experience to enrich the pedagogic process. As a senior scientist, one has the opportunity to revisit teaching with creativity rather than regarding it as a chore.

Helping younger people understand the craft of science can also be highly rewarding. Time spent mentoring younger colleagues one-on-one, or in a workshop setting, can make a significant contribution. One can also teach as far afield as pre-college, even elementary school. Big cities have benefited tremendously from the work of senior scientists who have worked with teachers to effect curriculum change or subject innovation.⁴ Such efforts can be a big commitment, but even occasional volunteer work as a tutor in a school can make a significant difference to a few students and provide a valuable alternative to continuing your customary work.

The issue of volunteering brings up two complicated subjects. One is finances, since working without compensation is a luxury that not everyone can afford. Universities, the Teacher's Insurance and Annuity Association,⁵ and many investment companies offer information and guidance about financial planning for retirement. Attending seminars or workshops by several such organizations is sensible, since it provides multiple view-

points and demystifies this planning process. Such interactions may reduce one's sense of dependency and can provide assurance that resources in retirement will be sufficient. One's retirement package can stretch even further if one undertakes something adventurous, like working as a volunteer teacher in a poor country. Living costs in the developing world are so low that a retired American can live very graciously on modest resources. It is rare that a school or university in such a country can pay a salary, but a volunteer is almost certain to be welcomed with gratitude and enthusiasm. Such opportunities can be organized independently, through Internet and email, but Fulbright,⁶ the Peace Corps,⁷ and several nongovernment organizations⁸ can also help.

The second issue related to volunteering is freedom. It is easy to view the winding down of professional activities as a loss of privilege and power. Certainly some valuable things will go, but constructive additions can compensate. A reduced professional load can provide freedom that is simply not available under the pressure of competitive paper- and grant-writing. This suggests that an important part of late career thinking should be identifying the things that you would like to initiate.

*Emerging from a total focus
on a specific field of science
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metamorphosis and ecdysis
that will allow the spreading of
new-found wings.*

Some people think of new activities in terms of hobbies while others think of new academic projects. The point is that one of

the greatest opportunities offered by late career flexibility is the chance to explore activities, fields, and ideas for which there has previously been no time. Retired people often talk about their opportunities for travel, reading, attending lectures, music, and sociability. For someone who has led an intensely focused life in science, such "opportunity" may sound foreign, even terrifying. This is why a gradual transition may be important for capitalizing on the opportunities of late career development. As one ages, life will change, of this there is no question. With luck, the changes will not be crippling ill health but instead the chance to explore and enjoy things one cares about and finds worthwhile. Emerging from a total focus on a specific field of science can include elements of metamorphosis and ecdysis that will allow the spreading of new-found wings.

Underlying the issue of late career transition is the fact that although our country's investment in science is large, it is not infinite. A grant to a senior scientist is money not given to someone younger; a position occupied by an old-timer is one not filled by a beginner. Some senior scientists claim that they have always been underpaid, and if they are now earning more for less work, it's about time and they deserve it. Frankly, I disagree. Most of us have done science because we wanted to. Earning a good, middle-class wage for following one's own interests is an appropriate reward. At some point it makes sense to bow out and give someone else a chance.

The above generalities hardly constitute a plan, but they do contain a message: If you build upon your career in science to identify and/or generate opportunities for exploration, it is possible to make and use freedoms that will enrich the latter part of your career, potentially making it one of the best stages of your life. ■



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2. Handelsman J. et al. (2004). Scientific Teaching. *Science* 304, 521–522.
3. See, for example, <http://srri.umass.edu/perg>.
4. See, for example, www.nas.edu/rise.
5. www.tiaa-cref.org.
6. www.iie.org.
7. www.peacecorps.gov.
8. www.crossculturalsolutions.org or www.iearn.org.



2. ALTERNATIVE SCIENCE CAREERS

From Lab to Law

Science through Words

Science Libraries Want You!

Exploring a Career at the
NIH Center for Scientific Review

From Lab to Law



Amanda T. Barry
The Proctor & Gamble Company

What comes after the laboratory work, the experiment design and redesign, and months and years of bench work? For many inventions, the completion of work in the laboratory marks the beginning of another stage in development: patent protection and possible commercialization.

In many cases, the value of a particular product, or even an entire company, is defined primarily by the strength of the patents covering the product or owned by the company.

A patent is a written document that gives legal rights to an invention. It is valuable because it allows the patent-holder to exclude others from making, using, selling, offering for sale, or importing the patented invention for a period of 20 years from the date the patent is filed. In many cases, the value of a particular product, or even an entire company, is defined primarily by the strength of the patents covering the product or owned by the company. Some patents, such as those protecting blockbuster pharmaceuticals, are valued in the billions of dollars.

Because patents, especially those in chemistry and biotechnology, can cover complicated scientific discoveries and principles, a patent practitioner may need specialized skills, and sometimes hold a master's degree or doctorate in the field of their practice. In addition to lawyers with a specialized background, many law firms, corporations, universities, and the government employ scientists with chemical and biotechnological experience to work on patent matters as technical advisors and patent examiners. Both lawyers and non-lawyers are eligible to take the patent bar



exam for admission to practice before the United States Patent and Trademark Office (the “PTO”).

A patent practitioner can provide services including identifying patentable inventions and preparing and obtaining the patents, providing legal advice, and litigating issues related to patents. In order to prosecute a patent application, a scientist or lawyer needs only to pass the patent bar exam and be admitted to practice before the PTO. On the other hand, only attorneys licensed to practice law may provide legal advice and litigate patent issues; non-lawyers can assist attorneys in these areas.

Patent applications usually include detailed explanations of the relevant science and specific experimental protocols and data and an explanation of how the invention is novel and unobvious compared with prior inventions and publications in the field.

The bedrock of patent law is the drafting and procurement of patents, termed “patent prosecution.” Many patent attorneys prosecute patents, as do most, if not all, technical advisors. Patent prosecution involves learning about the invention and the related technology, usually from the inventor, and writing the patent application, which may be 50 pages or more. Patent applications usually include detailed explanations of the relevant science and specific experimental protocols and data and an explanation of how the invention is novel and unobvious compared with prior inventions and publications in the field. After the application is prepared and filed with the PTO, the patent attorney or technical advisor

negotiates with the PTO, ideally to obtain a patent that covers the intended invention. Patent prosecutors learn and write about cutting-edge science in a variety of areas, often long before public disclosure or publication, and they reap the rewards of working with inventors and companies to see ideas transformed into valuable assets.

Patent attorneys work with clients to develop a strategy for protecting new and existing products; to evaluate publications and patent filings in a certain area of science; [and] to prevent accidental loss of rights....

Patent attorneys also provide legal advice related to patents. This advice can include analysis of a patent to determine if it covers a certain product, if the patent is likely to be upheld if challenged in a lawsuit, and/or whether or not a particular product or method can be used without infringing on patents held by a third party. Patent attorneys work with clients to develop a strategy for protecting new and existing products; to evaluate publications and patent filings in a certain area of science; to prevent accidental loss of rights, such as where details of an invention are inadvertently presented or published prior to the filing of a patent application; and to develop internal procedures for memorializing inventive data and documents in case of future patent challenges. When a company or invention is bought or sold, or an invention is licensed, patent attorneys research and analyze the strength of existing patents or pending patent applications. Patent attorneys can also be instrumental in preparing and negotiating license agreements.

Patent attorneys often work on litigation concerning patent issues. Examples of such litigation may include a patent holder suing an alleged infringer who is unlawfully making, using, or selling the patented invention; a dispute between two scientists who both believe they are inventors of a particular invention; or a controversy over alleged theft of an idea. In addition to courtroom-related activities, litigation work often involves analyzing documents and working with scientists and other witnesses to piece together the history of an invention or idea.

Thus, once an invention is defined by scientists in the laboratory, the invention can enter the legal arena, beginning with the filing of a patent application and potentially involving licensing, commercialization, and even litigation. ■

RESOURCES

www.ipcounsel.com.

www.mayerbrownrowe.com/biotech.

www.uspto.gov.

Science through Words



Pamela J. Hines
*American Association for the
Advancement of Science*

So you want to be in science writing. How do you get started? The good news is that you already have: Writing and critical thinking are integral to the effective scientist, so you are already no doubt honing the necessary skills to be a science writer. The transition from doing research to writing about research can be as easy or as complicated as you like, whether you just launch into it, or prefer to try an internship, or assemble more official credentials.

Writing and critical thinking are integral to the effective scientist, so you are already no doubt honing the necessary skills to be a science writer.

You may not initially have a fluid writing style or even, perhaps, fluent English. But your writing will improve with practice and in response to continued critique: Take every opportunity to write, and be receptive to critiques of your writing. And, if English is not your most fluent language, consider that there are opportunities for science writing in other languages, as well as a particular niche for writers who understand technical topics and can bridge linguistic and cultural complexities.

Take every opportunity to write, and be receptive to critiques of your writing.

A good way to develop your skills is to offer short articles for the general public to your local newspaper or your university's alumni magazine. Small projects fit in around your research and might help you get a feel for whether or not you enjoy science writing.

There are also organized opportunities to enter the field. The American Association for the Advancement of Science (AAAS) offers a summer fellowship suitable for graduate students or postdocs to immerse themselves at places such as *The Chicago Tribune* or National Public Radio. The week-long Santa Fe science writing workshop brings aspiring and actual science writers together, so that prospective writers can enjoy expert critiques of their writing as well as get to know some leading science writers. The year-long science writing program at the University of California, Santa Cruz, takes those with a science background and develops their skills in writing and editing through coursework and internships.

A switch from bench research to science journalism may result in changes in the way you feel about ownership of your work. You will now be talking not about your own research results, but rather about results that other scientists have produced. However, it will be up to you to identify a topic that might be worth watching and to develop your informational resources, whether through a first-hand experience with a dive in a deep-sea submersible or with a world-wide network of reliable scientific contacts. Ultimately, your output will be how you bring the story together, from background research to the final text.

A sense of how science works and what it is like to be a scientist will give a solid foundation to your articles. You will likely address a much broader variety of topics than you would have as a researcher, so unbridled curiosity and being able to get up to speed quickly on a new topic will serve you well.

Writers might pitch, develop, and write stories for newspapers, radio, television, for a university press office, or for the newsy sections at the front of various scientific research journals. Editors might edit others' writing, applying red pen (or more likely these days,

"track changes" on the computer file) to text. These edits might concern word usage, but are also likely to address organization, missing arguments, hyperbolic statements, or other issues of quality, content, and style. Copyeditors may tend to focus more on grammar, spelling, punctuation, and sentence structure. And there are those who research how science communication happens, in departments of technical communication or schools of information science.

Editors decide what content pieces are chosen to make up the whole website, or magazine, or newspaper section. Thus "editor" means much more than marking up others' work—it also includes filtering an onslaught of information (or submitted articles, or story proposals) to decide what pieces together make an effective publication. If the parent organization has unique goals for its publication, as an advocacy group might have for its website, the editor is key to accomplishing these goals.

Science writing may be a less predictable career than is academic science. This does not suggest absence of employment, but rather that the road map can be nonlinear.

Science writing may be a less predictable career than is academic science. This does not suggest absence of employment, but rather that the road map can be nonlinear. Science writers or editors have gone on to positions as diverse as executive director for a nonprofit scientific association, or organizer of scientific meetings and workshop programs. Science writing itself may include cultures as different as book publishing, working for a zoo or aquarium, or working freelance from home.



What exciting new research is just around the corner? What is the nitty gritty of how it works? How does it fit into the larger context of policy and societal implications? And how can I possibly explain all of that to a non-expert audience in 800 words or less, due tomorrow? Such is the challenge for the science writer. ■

Organizations for Science Writers and Editors

- National Association of Science Writers
www.nasw.org
- Council of Science Editors
www.councilscienceeditors.org
- Society for Scholarly Publishing
www.sspnet.org
- European Association of Science Editors
www.ease.org.uk
- Society for Technical Communication
<http://stc.org>

Workshops, Classes, Programs in Science Writing

- PSP Journals Boot Camp
www.pspcentral.org
- Stanford Professional Publishing Course
<http://publishingcourses.stanford.edu>
- AAAS Mass Media Fellowships
www.aaas.org/programs/education/MassMedia
- UC-Santa Cruz Science Writing
<http://scicom.ucsc.edu/SciWriting>
- Santa Fe Science-Writing Workshop
<http://sciwrite.org>

Resource for Science Writers

- AAAS Press Room
www.aaas.org/news/press_room

Science Libraries Want You!



Cindy Boeke

Southern Methodist University

Are you looking for a career change? Would you like to explore a field that needs people with your background, provides room for advancement, has openings across the world, and allows you to combine cell biology with new skills? If so, you might be interested in learning more about science librarianship.

There is a growing need for librarians who have subject specialties in science. In fact, libraries often find hiring librarians with strong science backgrounds difficult. With a Ph.D. and/or research background in cell biology, you will stand out when applying for jobs in academic, corporate, and government libraries whose patrons have scientific information needs.

The Science Librarian's Role

"I do believe science backgrounds will be very valuable, especially for librarians who work closely with researchers," says Jean Shipman, Associate University Librarian, VCU Libraries, Virginia Commonwealth University, and President of the Medical Library Association (MLA). "As more and more data is produced by research, the need for organizing this massive volume of data can be met by the skills offered by a librarian. Having the science knowledge base to be able to understand the data will be critical in order to properly organize it."

In a university setting, science librarians often serve as liaisons with science departments. Take the example of Michele Tennant, Bioinformatics Librarian with the University of Florida's (UF) Health Science Center Libraries and the UF Genetics Institute. Tennant received her Ph.D. in Biology and then earned a Master of Library Science (MLS) degree from the library school at the University of California, Los Angeles. She is a liaison to the most "genetic" of the College of Medicine's (COM) basic science departments (Molecular Genetics and Microbiology, Physiology and Functional



Genomics, Biochemistry and Molecular Biology, and Anatomy and Cell Biology), as well as the COM's Interdisciplinary (Ph.D.) Program in Biomedical Sciences.

"Much of my time is spent teaching the libraries' clients how to use genetics and molecular biology fact-based databases, such as GenBank and BLAST," she explains. "I teach in the first-year medical student curriculum, a Ph.D.-level bioinformatics course, and undergraduate classes in biophysical chemistry and general genetics. I am responsible for collection development and determine which new resources to purchase in the basic sciences. I provide in-person, phone, and email reference and consultation services related to genetics/bioinformatics resources, serve on the UF Genetics Institute's Executive Committee, run its seminar series and lead its Web page development team, and serve on the curriculum committee for the university's fledgling genetics Ph.D. program."

Accelerated Need, Good Opportunity

Informatics—the organization, analysis, management, and use of information in health care—is a growing area of information science as well. "The need [for librarians with science backgrounds] is accelerating with bioinformatics and biocomputational efforts. The need is also prevalent within the pharmaceutical research and development areas," says MLA's Shipman. "The combination of a science background and information discovery and retrieval skills constitutes the skill set of a research 'informationist.'"

Often, library jobs provide long-term security, potential for promotion, and excellent benefits. Academic librarians typically are placed on a tenure track, and are expected to conduct research, teach, and provide community service. Salaries are typically at least as much as or higher than postdoc stipends. The number of job opportunities in the field is growing.

If you've read this far and are still interested in starting a career as a science librarian, it is likely that the only thing standing between you and your dream library job is the MLS degree that many (but not all) library jobs require. There are 56 American Library Association-accredited library schools in the U.S. Several of them offer the degree online. Many programs have jobs for graduate assistants that pay a stipend and cover tuition costs. You can finish your degree in as little as a year, although two years is the norm.

The library field needs people like you to provide high-quality services to its science communities. "The knowledge I gained through my biology Ph.D. program, coupled with the MLS degree, has allowed me to develop fruitful collaborations with research faculty, postdocs, and graduate and undergraduate students," Tennant emphasizes. If you pursue a career in science librarianship, your background in science will be highly valued by your employer, and you will use your science background and knowledge to help others find the information they need to succeed. ■

NOTE

Boeke is the former Assistant Director of Digital Resources, ASCB.

RESOURCES

American Library Association: <http://ala.org>. Click on Education and Careers to access job boards for ALA as well as the Association of College and Research Libraries.

ALA List of Accredited MLS programs: www.ala.org/ala/educationcareers/education/accreditedprograms/directory/list/index.cfm.

Association of Research Libraries Annual Salary Survey: www.arl.org/bm~doc/ss07.pdf.

American Medical Informatics Society: www.amia.org; For jobs: www.amia.org/inside/jobex/joblist.asp.

Biofeedback. Newsletter from Biomedical and Life Sciences Division, Special Libraries Association: <http://units.sla.org/division/dbio/publications/pubs/biofeedback/index.html>.

Biomedical and Life Sciences Division,
Special Libraries Association:
<http://units.sla.org/division/dbio>.

Gilman, Todd: columns in the Chronicle.com
(document the transition of an English Ph.D. into
the realm of academic librarianship).

Informationist/Information Specialist in Context
Concept: www.mlanet.org/research/informationist.

Journal of the Medical Library Association focus
issue on building the role of medical libraries in
bioinformatics: [www.pubmedcentral.nih.gov/
tocrender.fcgi?iid=133339](http://www.pubmedcentral.nih.gov/tocrender.fcgi?iid=133339).

Medical Library Association: <http://mlanet.org>.
For jobs: www.mlanet.org/jobs/jobs.html.

Medical Library Association: Medical Informatics
Section: www.medinfo.mlanet.org.

Medical Library Association: Section websites:
www.mlanet.org/sections/sections.html.

Special Libraries Association: www.sla.org. Click
on Career Centers to view jobs at corporate,
government, and other special libraries.

Exploring a Career at the NIH Center for Scientific Review



Charles Dearolf
National Institutes of Health

For a variety of reasons, scientists at all career levels may want to look into alternative career choices. The National Institutes of Health (NIH) offer a range of positions in which a scientist can contribute to the mission of advancing science through an administrative role. This article will discuss some of my experiences as a Science Review Officer (SRO) at the NIH Center for Scientific Review (CSR). My colleagues include scientists and clinicians with a range of experience, including individuals who left the lab bench after finishing postdoctoral research, former faculty who ran an academic lab (like me), and a former director of an entire research institute.

The primary function of an SRA is to ensure fair, expert, and timely reviews—so that NIH can fund the most promising research.

What We Do

No surprise here, we organize the review of grant applications, although we do not make funding decisions. The NIH review process is two-tiered. One group (most often CSR) handles the review to determine scientific and technical merit. Afterwards, the specific Institute or Center determines whether to fund, based on the review score, overall priorities, and public health needs. The primary function of an SRO is to ensure fair, expert, and timely reviews—so that NIH can fund the most promising research. To demonstrate how this is accomplished, I'll describe the duties involved for a "typical" R01 research application review panel, which meets three times each year.

First, we attempt to make sure that each application is assigned appropriately to the study section. For

some applications, the study section choice is fairly obvious. Other applications could be reviewed by any one of several panels. We read through and consider the applications, and, when necessary, interact with other SROs and the Receipt and Referral Office to find the most appropriate home. In addition, some investigators contact us to discuss their assignment, either in advance of submission or after notification of assignment.

... some investigators contact us to discuss their assignment, either in advance of submission or after notification of assignment.

We next need to obtain the appropriate reviewers for the upcoming meeting. This will be a combination of regular members and newly recruited ad hoc members. The panel covers certain areas of science every round, so the SRO assembles a roster of regular members to provide this expertise. These hardy scientists agree to a four-year hitch on the panel, and the SRO updates the panel every year. Each review round, the SRO also recruits ad hoc members to provide additional areas of expertise, and to substitute for the regular members who cannot attend that round. Recruiting involves a combination of persistence, networking, and sometimes plain old good luck.

Having recruited the panel members, the SRO then assigns applications to each reviewer, and sends the applications and supporting materials approximately four to six weeks before the meeting. From this time until the actual meeting, the SRO carries out activities to ensure that the meeting and review run smoothly. We orient new reviewers to the

process, communicate with the applicants about supplemental materials, and make sure the reviewers complete their initial critiques and scores before the meeting. We also deal with issues that may arise, such as the occasional reviewer who withdraws from the panel and must be replaced, or the hotel that “lost” reviewer room reservations and now has no rooms available.

At the study section meeting, the SRO serves as the NIH representative and “Designated Federal Official,” while the panel chairperson manages the reviews. The SRO ensures that the review runs according to appropriate procedures, and provides administrative guidance when necessary. Much of our efforts at the meeting are spent taking notes on the discussions, as these will be used in writing the summary statements. Many SROs also organize and attend a dinner (or some other social function) with the review scientists.

After the meeting, SROs complete a number of administrative tasks. For example, they calculate and disseminate the final scores to the applicants. The summary statements need to be compiled and released within 30 days of the meeting.

Things can get busy. SROs usually handle multiple panels each cycle. Also, the cycles overlap, so that the time for summary statement preparation coincides with the arrival of the next round’s applications. We have additional duties and opportunities, such as attending scientific meetings, recruiting for and preparing the regular roster, and internal meetings/training sessions within CSR.

Life at CSR vs. Life in the Lab

There are many similarities in CSR and lab work. SROs work relatively independently, within the overall constraints of their responsibilities. We keep up with the progress of science, though on a broader scale, attend scientific meetings, and interact with scientists. (As a representative of NIH, I find that scientists



invariably return my emails and messages!) Writing skills are necessary for the compilation of summary statements, which could be described as a combination of original text and abstracting.

We keep up with the progress of science, though on a broader scale, attend scientific meetings, and interact with scientists.

There are differences and trade-offs too. While there are deadlines, the pace of work is overall more relaxed, and SROs have the time and energy to get involved in activities outside of work. There is financial security that comes from being a government employee,

although we are subject to the vicissitudes of government. We are out of the lab and not following up on our own ideas, but we do get a first look at future research in multiple areas. And we get to learn lots of government acronyms!

Obtaining a Job at CSR

Successful applicants for an open position usually have faculty-level experience, either as an independently funded academic researcher or as an industrial researcher. The strongest candidates also have reviewing experience, either for NIH or for alternate funding agencies. SRO positions are advertised as they become available.

Information about current job openings is available through the CSR website, <http://cms.csr.nih.gov/AboutCSR/Employment>. ■



3. THE HEAD GAME

Strategies for the Shy

Becoming Visible:
Effective Self-Promotion

Strategies for the Shy



Vivian Siegel
Vanderbilt University

Most people feel anxious in at least some social situations, and as many as 50% of people surveyed will describe themselves as shy.¹ And, let's face it, science has the reputation of a solitary field, and attracts more introverts than, say, social work. (In fact, many girls, when asked why they choose not to go into math or science, say these fields

Let's face it, science has the reputation of a solitary field, and attracts more introverts than, say, social work.

are not social enough²). Yet there is a social fabric to science, and the ability to interact with others, both casually and professionally, is critical to the work of a scientist and her enjoyment of it. This is true throughout one's career: It is as important for the head of a lab to step out of her office and interact with her students as it is for the student to approach and interact with her colleagues and potential mentors.

Even though a large fraction of people self-identify as shy, most are not obviously shy to others. Only extreme cases of shyness are visible as such, like in the unusual situation of someone who bows her head and

The reticence that shy people feel is often misinterpreted as disinterest or arrogance.

avoids eye contact in conversation. The reticence that shy people feel is often misinterpreted as disinterest or arrogance.

Even for the shy, not every social interaction leads to anxiety. One can be perfectly comfortable giving semi-



nars and speaking with people one-on-one, but feel awkward at a dinner party or other social engagement in group conversation. It is important to identify which situations make you anxious and to work out ways in which you can navigate those situations as comfortably as possible. Here are some approaches that can help the shy feel more comfortable and get more out of daily social interactions.

- **Set achievable goals.** If you are going to a meeting, it may be too much to ask yourself to meet everyone, but you can set yourself the goal of meeting two people a day. Knowing how you will enter and end the conversation will make this task even easier. Ask if this is their first time at the meeting or how the meeting has changed since they first attended it. End by introducing your companion to someone else, or by excusing yourself to meet others, while voicing your interest in staying in touch (make sure to note their contact information). During the conversation, aim to learn something personal about them, so that the next time you meet them, you have a starting point for conversation. It helps to keep a list of meeting participants to jog your memory at some future occasion.
- **Come prepared.** Have you ever noticed how much easier it is to give a seminar once you have made the PowerPoint presentation? While PowerPoint may be overkill for personal interactions, there is nothing wrong with deciding in advance what to talk about, what questions you want to ask, and so on. Attending a seminar with questions already in mind is a lot easier than figuring out what you want to ask during the seminar itself. Similarly, if you are on a job interview, think about possible points of mutual interest before arriving. The more you do your homework, the less spontaneous you have to be, and the more

spontaneous you seem. This is true for interactions with students at all levels.

The more you do your homework, the less spontaneous you have to be, and the more spontaneous you seem.

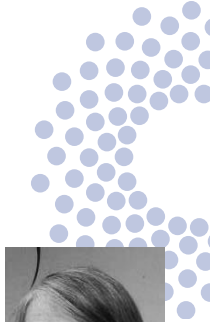
- **Get practice.** There are numerous options for learning and practicing social skills. The career counseling office at your university may offer sessions on successful networking. Take advantage of courses that offer the opportunity to be videotaped giving seminars. Or join Toastmasters,³ a nonprofit organization that teaches public speaking and leadership skills.
- **Take advantage of friends and mentors.** Ask them to critique mock interviews, listen to practice talks, and introduce you to someone you want to meet. The best friends and mentors are those who offer constructive comments and not just reassure you. Help your mentor be forthcoming by inviting critical comments.
- **Act the part.** When people spend time in a foreign country, they can find that speaking a new language and being surrounded by people who don't know them allow them to take on a new, more gregarious persona. The brain is plastic, and the more you act a part, the more it will become a part of you.
- **Schedule time to speak with others.** If it is hard to just introduce yourself to other people at a meeting, arrange in advance to meet with them at specified times. This is a good strategy even for the extrovert.

-
- **Volunteer to lead.** It's common to feel like you have nothing to say at a large table of scientists. If you come to that table with an agenda (leading a group discussion, finding out about the goals of the students at the table), you will surprise yourself with your ability to carry the conversation forward. For those who have career experiences to share, the WICB networking lunch is a wonderful place to practice being a "table leader."
 - **Take time for yourself.** When you are self-conscious, interactions can be exhausting. Reward yourself with needed alone time, whether to curl up with a good book or to spend several hours at the microscope.
 - **Smile.** It will help you relax and signal to others that you value the time they are spending with you. ■
- **It's not all about you.** If about half of the world describes itself as shy, then it is as likely as not that the person you are trying to talk to is having an equally hard time talking to you. Just as you are wondering what this person thinks of you, so too is she wondering what you think of her. If you can do something to make the other person feel at ease, you will feel easier, too.

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Becoming Visible: Effective Self-Promotion



Caroline Kane
University of California,
Berkeley

Being a young scientist yourself, you observe other young scientists and wonder how they were selected as the award winners, the symposium speakers, the review writers, the committee members, and Councilors of the ASCB. How did they become visible enough to be acknowledged and invited?

The answer has many different parts, but you can be sure that one aspect has been effective self-promotion.

The term self-promotion may evoke images of boorish, boastful, bombastic behaviors by scientists “more skilled in public relations than in research.”¹ However, self-promotion can simply entail effective networking to introduce oneself, and one’s work, to other scientists by a variety of means. After all, communication is the engine of scientific discovery. Peer-reviewed publication provides the credibility for the description of the science, but there are myriad other ways for communicating one’s work, ideas, and relationship to the scientific community as well.

Peer recognition ... is also noticed by others who might be in charge of your next promotion, or on the panel reviewing your next grant, or chairing a symposium organizing committee.

One way to become better known is by receiving an award. Peer recognition for achievements and discoveries is not only gratifying, it is also noticed by others who might be in charge of your next promotion, or on the panel reviewing your next grant, or chairing a symposium organizing committee. Nominations for awards are often done with the goal of surprising the recipient, but far more often, the nominee is asked

for materials in support of the nomination. “Given the unsupervised nature of much of what we do...I am really in the best position to describe... my work most effectively.”²

Invite Champions, Ask Questions

In some cases, a young scientist may learn about an award and ask a more senior scientist to champion her or his nomination, in which case putting together a package of materials facilitates the process for the nominator. Indeed, many award selection committees actively recruit nominations from their colleagues to maximize consideration of all worthy candidates. It is a fact that if one is not nominated, one certainly will not be considered.

... good relationships, along with good science, provide the networks for sustained career development.

Although awards represent a good, if narrow, opportunity for effective self-promotion, good relationships, along with good science, provide the networks for sustained career development. In many training programs, students and postdoctoral fellows are provided the opportunity to meet with seminar speakers or even organize seminar series. Be active in these events so that you meet these invited scientists.

Simply Asking

One of the most difficult actions for a young scientist is simply asking a question in a department seminar or at a scientific meeting. Hearing one’s voice in a public forum can be terrifying at first. Candid senior scientists will note that if you missed a point, you can be sure that others did too. Nonetheless, if the forum

context is initially too intimidating, speaking one-on-one with the speaker after the talk is a fine alternative. There will be interest in your question, in your ideas, and this positive reception may provide confidence for asking group questions in the next forum.

There is also a way for speakers to help. The seminar speaker can specifically call on people she or he does not know, or can encourage questions from the younger voices in the audience. Such graciousness from a more senior scientist can have a large impact.

Understand Scientific Connection

No matter how good one’s science may be, there is always science that is better. Keeping in mind how one’s own science connects to the science of others and adds value to the field can provide confidence at meetings. That confidence is enough to start a conversation with a more senior or even a “famous” scientist. If others join in, all the better, not only for your visibility but also for sharing and critiquing ideas. Everyone benefits. Being loud and obnoxious works against anyone. Communicating clearly and interacting personally are key.

Poster sessions also are an excellent venue for becoming visible. Presenting posters provides the opportunity to give interactive “miniseminars.” Senior scientists can again be positive participants here by listening to the description of the work and asking questions. The poster presenter will deeply appreciate this opportunity to interact and will also remember that visit. Going to the posters of other scientists is equally important since it provides practice in asking questions.

Participate in Institutions, Societies

All of these actions are suitable for anyone developing a career, including those in their first independent positions. In addition, scientists should seek opportunities to participate on committees, not only in their place



of employment, but also in their scientific societies. Such committee service provides an excellent opportunity for meeting others and for sharing ideas and work habits. This “self-promotion” works best if not premeditated. Communication and developing relationships naturally provide visibility, and that visibility provides valuable networking just as the networking provides valuable visibility.

Effective self-promotion starts early and locally. The friends made in graduate school, both students and faculty, form the first network. These scientists can provide a valuable core of contacts throughout one’s career. Staying in touch with friends comes naturally, and science provides many opportunities for intersecting paths. Graduate school friends will distribute into multiple areas of science, and in future years they will be providers of the names of scientists they know for awards, symposium speakers, review writers, and society officers. Their networks and yours

*From visibility comes influence,
a voice in the science, and a
platform for encouraging the
visibility of the next generations
of scientists ...*

will intersect. From visibility comes influence, a voice in the science, and a platform for encouraging the visibility of the next generations of scientists who also will be wondering how people become known scientifically. ■

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4. COMMUNICATION

How to Write an Effective
Letter of Recommendation

How to Read a
Letter of Recommendation

Delivering an Effective Scientific Lecture

Email Etiquette

How to Write an Effective Letter of Recommendation



Ira Mellman
Genentech, Inc.

The letter of recommendation is a ubiquitous feature of that quaint custom of academic life and death known as “appointments and promotions.” In principle, letters of recommendation should provide important insights into a candidate’s character, scientific accomplishments, potential, personality, and general abilities.

A successful letter imparts the writer’s enthusiasm for an individual, but does so realistically, sympathetically, and with actual data to support the writer’s contentions.

However well-intentioned, too many letters fall short of this goal. All too often letters are nearly useless. It is regrettable both for the candidates and for institutional committees when letters fail to provide accurate, fair, or transparently honest assessments or fail to place the candidate in proper perspective relative to his/her place in the field. Although many of us have come to understand this, committee group dynamic all too often results in letters being used as de facto decision-making tools: candidates are dismissed if a letter is deemed to contain coded negatives, dangerous since not all letter writers or nationalities use the same code. Alternatively, candidates can be elevated by unexplained laudatory comments from well-known luminaries. This, too, is dangerous, since not all letters are thoughtful, and many writers are afraid to say anything that it is at all negative. It is also easier and less time consuming to be positive than to provide thoughtful criticisms, especially for busy luminaries.

A successful letter imparts the writer’s enthusiasm for an individual, but does so realistically, sympa-



thetically, and with actual data to support the writer's contentions. It also gives the reader what he/she needs to make a wise decision, and tries to convince the reader that you, the writer, know what you are talking about. Also, remember your own credibility and judgment are at stake.

The principle that guides nearly every aspect of this approach is also the simplest: write what you know. The better a writer knows the work of the candidate, the better the resulting letter. That does not mean that the letter will be more "positive," but rather that it will be more honest and transparent, describing and balancing the various attributes and limitations of the candidate. As such, it will provide more useful information to the committee.

Everyone has good points and not-so-good points, and unless the writer acknowledges and describes these clearly and fairly, the resulting letter is less likely to have an impact. The letter will also be best received if it is written in an engaging fashion. This helps distinguish your letter and candidate, and also keeps the reviewers from falling asleep. An enthusiastically positive letter that is uncritical may have less influence than a more balanced letter that is thoughtful and personal. Ironically, being fully honest about strengths and weaknesses allows the writer to be positive about everybody, but in a way that allows you to demonstrate clearly why you are positive. To paraphrase my first creative writing teacher: never tell what you can show.

Here are the general rules of constructing almost any letter of recommendation:

- **Only write about people you know.** A senior investigator has an obligation of course to write for any former student, fellow, or staff member. On the other hand, one should be selective about writing on behalf of colleagues who may be in one's field but whose work is not well known to the writer. If a potential writer has to read

the CV to find out who someone is and what they have done, then the writer may not be qualified. This is also the message that should be communicated back to the originator of the request. It is often useful, however, to review the CV and interests of even the closest colleague. Before beginning to write, reflect a bit on the individual, his/her history and contributions, and your relationship with the person (wine or something even stronger often helps at this stage of the process).

[N]ot everyone can be the best postdoc or student you have ever had. Committees know this, so such statements can appear gratuitous: They should be stated only if they are literally true.

- **Summarize what you know about the candidate and why.** Begin with a paragraph introducing the candidate, how you know them, their influence on the field, and their most important scientific and personal characteristics. Remember, not everyone can be the best postdoc or student you have ever had. Committees know this, so such statements can appear gratuitous: They should be stated only if they are literally true. If you do make a comment like, "Clio is one of the best students ever to have walked the face of the earth," the rest of the letter must provide credible supporting evidence for this claim. The goal is to demonstrate that the writer knows the candidate well enough to make an informed judgment, and that the judgment is objective. You want readers to take your opinion seriously. If not, why waste time writing in the first place?

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- **Summarize the candidate's work and its context.** Write one, two, or sometimes even several paragraphs about the subject's work. One hopes that the committee already knows what the candidate does, but this is not always the case (even if no one admits it). Moreover, and more importantly, it helps to define the person in the

Do not enumerate facts and specifics, individual papers (pointing out the number of Science papers published is obnoxious), or describe every last discovery this person has made.

eyes of the readers. Do not enumerate facts and specifics, individual papers (pointing out the number of *Science* papers published is obnoxious), or describe every last discovery this person has made. Present the big picture, but without being superficial. This does a great service for your candidate: Having a knowledgeable "expert" place the candidate's work in the context of the field is something a candidate can never do him/herself without appearing obsequious, self-serving, or unctuous. Clearly discuss how the candidate has advanced understanding and in what areas. By far the most important piece of information to provide is the extent to which someone's work has influenced the field or the work of others—even unknowingly. If you can say that a person has done this at every stage of their career (student, postdoc, junior faculty member), that is the single most important piece of information you can relay to a committee. Therefore spend most of your time and care supporting your contention that the candidate can walk on water (or at least wade

through it). This is also a chance to present the candidate's supporters on a committee with pre-packaged evidence (yes, academics like sound bites) to support their views in discussion. Be as laudatory and enthusiastic as possible in this section, since enthusiasm will always be self-limited by the stark reality of an individual's accomplishments.

- **Summarize the candidate's personality.** Does he/she play well with others? Have they been an important member of the laboratory or scientific community? Are they generous with time and effort? Give examples. Saying someone is a wonderful person is not enough since without evidence, you are almost telegraphing that they are anything but wonderful. If the individual in question is a bit shy, cantankerous, argumentative, or tells bad jokes—features that will come out soon enough in an interview—always reveal this in writing, to help mitigate the problem beforehand... that is, assuming the problem can be mitigated.
- **Discuss extenuating circumstances.** If a candidate has had personal difficulties to overcome that had an effect on his/her career progress (children, illness, or family issues), or illustrates an aspect of personal motivation, bring it up. It can be difficult for the candidate to do so, and readers like some personal insights. Obviously, do not reveal details that might be of too personal a nature, or have nothing to do with the professional considerations at hand.
- **Evaluate the candidate's potential.** Also critical is how the writer feels the candidate will do in the future, as an independent investigator, postdoc, or recipient of a grant or award. Here again, it is possible to discuss this topic logically and with objective support: How does the picture painted lead to this conclusion?



- **Evaluate the candidate's "suitability."**

Consider the place the candidate wishes to go, or the objective of the grant/fellowship program to which he/she has applied. Leverage that knowledge to explain why the candidate is a good match for the job and institution. As always, it is much more effective to "show" this, rather than simply to state it. If the factual information does not sufficiently support the suitability argument, or if the writer cannot logically indicate good reasons for why the person is a good match, the committee does not have to read between the lines, since the lines will simply be missing. Of course, to ensure this, a future essay will consider, "how to read a letter of recommendation." (See p. 46) ■

How to Read a Letter of Recommendation



Ira Mellman
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If everyone exercised rigorous thought in writing letters of recommendation,¹ then it would be happily unnecessary to offer advice on how to read them. In this perfect world, all letters would be transparent, they would contain all of the information we need, and therefore they would not require interpretation. Unfortunately, we are not quite there yet. So, here is some humble advice on how to read recommendation letters in the real world.

As a mature evaluator, it is your obligation to independently and intellectually assess the quality of a candidate—not relinquish this solemn responsibility to unseen others.

Most importantly, always keep letters in perspective. Although some will provide honest, accurate, and useful assessments of a candidate, other letters will fall well short of the mark. The challenge for the reader is to distinguish one from the other. The best training for reading a letter is knowing how to write one, but even this wisdom is not foolproof. Therefore, letters must never be used as a substitute for one's own assessment of a candidate based on his/her accomplishments and ideas, or the impression he/she makes when interviewed.

All too often, particularly when considering promotions, letters are taken as a substitute for a faculty's collective judgment, with committees tending to use a stack of glowing letters as a crutch to support a positive decision rather than relying on their own, often more direct, observations. Conversely, if one or two letters in a pile are deemed "negative" (or anything less than embarrassingly enthusiastic), one or more committee members typically get spooked, losing



confidence in their own assessments; or they will use such letters as an excuse to derail a candidate they do not like but against whom they could not otherwise make a persuasive argument. Even when well written, one must remember the obvious: Letters of recommendation are inherently subjective. Unless an opinion of a candidate can be supported by convincing, objective, and factual arguments, be wary of placing too much emphasis on what any writer has to say.

If letters are potentially so flawed, what use are they? Why do we even bother? In actual fact, letters can be extremely important, but only as one component of the evaluation process. Letters have two purposes; neither of them is to on their own predominantly determine the fate of the candidate.

First, when written by a close colleague or mentor, a letter can provide helpful insight into a candidate's motivation, thought processes, personality, creativity, potential, independence, and ability to work with others. At the very least, this assessment should be used to sensitize a committee to look for certain qualities in an interview: i.e., give committee members a chance to obtain primary data to test every aspect of the accuracy of the letter's assessment.

Second, when written by a more "impartial" expert (thesis committee member, outside referee), a letter can provide a highly useful opinion into the importance of a candidate's work in advancing knowledge and understanding in a given field. This is especially helpful when the committee does not contain experts in the candidate's area. A mentor can provide this information as well, but readers must beware that a mentor's assessment may be biased by the mentor's interest in advancing (even unintentionally) the perception of his or her own legacy and accomplishments. With that disclaimer, a mentor's evaluation of a candidate's place in the scientific universe can be valuable, as the mentor can probably

assess this better than anyone else. Obviously, if the candidate is already an independent investigator, the longer he or she has been on their own, the less the committee need consider the mentor's assessment of the importance of the candidate's contributions.

Deconstructing the process of letter writing provides a blueprint for reading a letter. Although subjective, effective letters are supported by actual evidence. If a candidate is deemed to be brilliant and creative, does the letter make a convincing case based on the candidate's record or specific personal observations? The extent to which this is or is not the case should be in direct proportion to the weight you place on the letter.

The number and prestige of awards held by the letter writer is almost always irrelevant.

The number and prestige of awards held by the letter writer is almost always irrelevant. A thoughtless and dismissive letter by a famous scientist ("since I do not have time to write, suffice it to say that I am wonderful and I believe the candidate is wonderful, therefore the candidate is wonderful") is just as useless as a similarly thoughtless letter from an unknown scientist. However, a thoughtful letter from a respected colleague who has a sense of perspective can be incredibly valuable.

What else should one look for, or not look for? Here is a partial list:

Code words. Many of us engage in an almost semiotic analysis of precise words used, or not used, to describe a candidate. Is "outstanding" better than "excellent"? Is being "the best" in the field better than being merely "one of the top three"? Does that mean the candidate is #3 and therefore not as good as #1? Are his/her contributions "solid,"

meaning boring and inconsequential? If we all used the same codebook, this exercise would be useful, but we do not. Therefore do not place much faith in this exercise. Even using language and word choice to gauge overall enthusiasm is dangerous, as different individuals exude enthusiasm in radically different ways. The guiding principle is to look for the evidence that substantiates the platitudes.

Comparisons. Another common technique that should be read with skepticism is the comparison: the candidate is as good as Drs. X and Y, but not as good as Dr. Z. This type of information simply compounds the subjectivity problem: Unless it is explicitly stated why the contributions or other qualities of the individuals mentioned distinguishes them from each other, you are just getting someone's opinion, one which may or may not be better than your own. Some institutions even ask for such comparisons in their requests for letters; these requests should be ignored. A statement from an expert naming other players in an area can be extremely useful, so you (or an expert on the committee) can explore whether your candidate's contributions are as exciting or high quality as those of his/her peers or colleagues.

“The CNS Syndrome:” a condition in which letter writers (and committee members) pay morbid attention to how many papers were published in Cell, Nature, or Science.

Paper counting and the “CNS Syndrome.” The number of papers matters less than their quality. Further, the journal that publishes a paper is not a guarantee of quality. Believing

otherwise is the product of what I call “The CNS Syndrome”: a condition in which letter writers (and committee members) pay morbid attention to how many papers were published in *Cell*, *Nature*, or *Science*. CNS Syndrome bequeaths to unknown reviewers and editors a disproportionate influence on the appointments and promotion process. As a mature evaluator, it is your obligation to independently and intellectually assess the quality of a candidate—not relinquish this solemn responsibility to unseen others. When faced with a letter that goes out of its way to extol the number of papers a candidate has published in *Cell*, *Nature*, or *Science* (or even worse, in their F1 spawn), let the reader beware. This can be an indication that the writer is overly influenced by superficial rather than substantial considerations. On the other hand, if extolling CNS publications is in the context of a thoughtful description of why the work is important, then it should be considered seriously. The guiding principle here parallels the discussion above: The journal in which a paper is published is only significant in the context of a substantive description of why the work is important.

Time is precious. Some people are called upon to write a disproportionate share of letters, as well as to perform a variety of other community and professional responsibilities. As a group, these individuals may not have as much time as they—or you as a reader—would like them to have to prepare their letters. Make allowances for this as you read.

Dealing with negativity. It is rare that one receives a truly “negative” letter; more common, we sometimes interpret as negative letters that merely include mention of a candidate's shortcomings. There is a general phobia about being too honest; writers often fall victim to another disorder, The Mr. Rogers Syndrome: “Everyone is special.” Thus, a negative letter should be evaluated carefully and in the same way as one evaluates a posi-



tive letter: Does the writer support his/her contentions with facts and objective observations? Does the writer have professional or

A believable and influential letter is one that gives an honest opinion based on demonstrable fact.

personal biases, even inadvertent ones? This writer may be doing a difficult but honest and helpful thing by alerting the reader to problems with a candidate, but he/she may also just be expressing an opinion, however deeply and honestly held, that may not coincide with your own. Do not let even a truly negative letter kill a candidate unless you can

independently verify what it contains, and you agree that the negative features should affect your decision.

Reading letters is the same as writing them: A believable and influential letter is one that gives an honest opinion based on demonstrable fact. The closer a given letter comes to reaching this goal, the more influential it should be. At the same time, an evaluator must never ever allow a letter—or even a set of letters—to substitute entirely for her or his own judgment. Doing so is intellectually lazy and a recipe for making wrong decisions. ■

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Delivering an Effective Scientific Lecture



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Oral presentation of research is one of the most important and sometimes feared aspects of a scientific life. Most young scholars have ample opportunity to make presentations in small or private settings, such as at group meetings and department retreats. As one builds a career, the occasions for such presentations in seminars and national meetings become even more important. Although many mentors stress the principles of an effective presentation, it remains a mystery why so many prominent investigators perform poorly in this regard. Unfortunately, it is quite rare for a one-hour lecture to hold the attention of an audience and to impart a limited and memorable

The job of a public speaker, at least in science, is to inform interested people from other fields and not simply to impress competitors.

conclusion. One principle that many speakers fail to embrace is the importance of empathy for the audience. The job of a public speaker, at least in science, is to inform interested people from other fields and not simply to impress competitors. The few real experts in any given audience are not the ones to address; the target should be those who come to learn something new and not those who have heard the subject over and over.

An effective presentation begins in the planning stages. Many speakers attempt to stuff far too much into a seminar. Even an hour seminar should focus on one theme or perhaps two closely related ideas. The presentation should begin with a simple introduction for the uninitiated. Be sure to acknowledge the contributions of others in the field, and not only



if they happen to be in the room. Follow with a brief summary of the results to be presented and then build in layers until the heart of a topic and the data are ready to be explained. Most speakers present far too many slides and an excessive amount of material, much more than any but the few

An effective presentation begins in the planning stages.

experts can comprehend. Slides should be limited in number; one every two minutes of a presentation is a good place to start. The slides should be designed for simplicity. Every data point should be described and each slide should not develop more than one experimental result. Figures from publications often do not make effective slides. Color can be an effective tool, but certain schemes are distracting and some combinations provide poor contrast. A colorful presentation from a colorful personality may be entertaining, but the final impact may be amnesia-inducing. Successful presentations follow an arc progressing from the historical origin of an idea through the critical tests and the logical conclusion.

Use a pointer with some precision to highlight a data point but not as a magic wand to bless the slide.

During the presentation itself, address the audience and not the screen. Speak slowly and clearly, again assuming most people do not know the jargon of the field. Look for facial cues from the audience indicating comprehension and attention. Effective speakers

develop a rapport with the audience and can judge the level of interest from nods and smiles or yawns and distracted daydreaming. A friendly face in the audience can often dispel the anxiety that is quite natural in most, even experienced, public speakers. Use a pointer with some precision to highlight a data point but not as a magic wand to bless the slide. Many speakers use humor or personal anecdotes to lighten a presentation. Of course, such asides can become excessive and distracting (mea culpa!). Here again, it helps to develop a personal bond with the audience. Take note of the techniques and style of the best lecturers. Mention the names of co-workers throughout a presentation and use anecdotes to personalize the impact of their contributions. Where appropriate, practice a presentation in front of friendly but critical peers.

Clear and succinct responses [to questions] reinforce the good impression left from a well-paced and modest presentation.

Stick to a prescribed time limit. An excellent seminar spoils quickly when the speaker goes more than a few minutes over time. A well-paced seminar will conclude near the time limit with final results that round out the theme, a restatement of the conclusions, and an indication of future directions. Although it is typical to conclude with a list or picture of collaborators, the role of a student, postdoc, or colleague will be lost if he or she is not highlighted during the presentation. If time and format permit, the post-seminar question period presents another opportunity to explain and highlight results and new directions. Questions from the audience must be treated with respect and patience. Clear and

succinct responses reinforce the good impression left from a well-paced and modest presentation. Arrogance pays no dividends.

Finally, enjoy the experience. An effective presentation and an appreciative audience can be one of the great pleasures of a life in science. ■

Email Etiquette



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Why do we welcome email from some and not others? Which habits are endearing, and which annoying? What opportunities and pitfalls does email offer that paper letters and telephone conversations do not? What can we do to make our own correspondence easy to read and tempting to respond to? Following is a modest primer on email etiquette.

Do Not Send Gratuitous Messages

Jokes can be a welcome break if they are received at just the right time and if they're just the right jokes. But the confluence of these factors is rare. Don't undermine your reputation as a credible correspondent by circulating unnecessary messages. You want your correspondents to know that when they receive a message from you, it's substantive.

Don't exploit your address book to sell things. You do not want to develop a reputation for using the addresses of acquaintances for fundraisers or to sell commercial merchandise, no matter how special you think your friend's homemade jewelry is.

[E]ven well-intentioned warnings or petitions should be circulated only with caution and if you can personally attest to their authenticity, or they come from an impeccable source known to the forwarder.

More seriously, even well-intentioned warnings or petitions should be circulated only with caution and if you can personally attest to their authenticity, or they come from an impeccable source known to the

forwarder. For example, missing children notices, stock tips, and political rumors are often misleading. It can be better to let an opportunity go by than to inadvertently perpetuate inaccuracies.

Hold Yourself to a Reasonable Writing Standard

Email provides the opportunity to send messages fast. But sometimes messages are sent too fast. It is not necessary to write the Great American Novel, nor even to choose words and phrases as precisely as one would when writing a paper letter. On the other hand, if the message is important enough to consume the reading time of the recipient, then a courtesy incumbent upon the writer is to at minimum read over the message to make sure that the spelling, grammar, and punctuation are, if not perfect, at least decent. Long communications are best broken into multiple paragraphs. Similarly, multiple subjects are best sent in separate emails.

Do Not Include Others Carelessly

There are two categories of inappropriately copying people on email messages. One is when doing so may be indiscreet or impolitic. The other is when it is unnecessary and a waste of time.

With regard to the former, before copying others on correspondence, ask yourself the following questions: Will doing so embarrass or compromise the primary recipient, or others? Is my motivation to seize credit or display my cleverness, without a substantive reason? Might third persons interpret the message in a way that is unintended? If the answer to any of these questions is “yes,” think carefully before copying your correspondence.

Email is considered *ipso facto* confidential. If there is any question that you should forward an email, check with the originator first.

With regard to the latter, just apply the simple test: Does everyone need to know this? All of us have been on an email distribution list, for example, for a child’s soccer team. The manager circulates a message that says, “Don’t forget that practice is today at 3:00 pm.” Fifty parents do not need to receive a message back from you that says, “Sorry, Bobby can’t make it today.” If this is information that the manager needs to know, respond

[L]arge distributions go to committees to schedule meetings, department faculty to remind members of a deadline, etc. Do not waste the time of your colleagues by telling the whole distribution, “I can attend on March 21 but not on October 11....”

to the manager. Do not reply-to-all. Similarly, large distributions go to committees to schedule meetings, department faculty to remind members of a deadline, etc. Do not waste the time of your colleagues by telling the whole distribution, “I can attend on March 21 but not on October 11,” or “Thanks for letting me know!” All correspondence should be on a “need-to-know” basis.

As a writer, you can prevent either of these outcomes by using the blind field when corresponding with multiple recipients for standard messages. In this way, responders cannot reply to everyone.

Do Include Others When Appropriate

The flip side to the overcopying problem is of course undercopying. If you write an email that directly impacts the work of or refers to



a third person, copy that person on the correspondence. Forwarding the message separately without a reason suggests to the person who should have been copied that you have changed the original language (the implication being that you said something that would have been displeasing in the original correspondence). It may also leave the primary recipient the impression that you are careless and/or inconsiderate.

[C]aveat scriptor (*let the writer beware*). The conventional (if cynical) wisdom is, “don’t write anything in an email you’re not willing to see attributed to you in the *New York Times*.”

Do Not Use Email Every Time It Occurs to You

If you are angry or emotional or just feeling loose, it is often best to wait to express yourself. And it is very often best to wait to express yourself by email. Even more than a hand-written or printed letter, a record of your words can be preserved for all time and forwarded forever, so *caveat scriptor* (let the writer beware).

The conventional (if cynical) wisdom is, “don’t write anything in an email you’re not willing to see attributed to you in the *New York Times*.” Also, bear in mind that standard employment law gives the employer the right to view the work-based email of employees without consent or notification. While spying on students, staff, postdocs, or faculty is not the usual practice of universities, remember that it is at least a theoretical possibility before shooting off that angry, passionate, critical, or slanderous email.

[A]n email sent to dozens of people that says, “can someone please review this paper?” is easy to ignore. Instead, an email that says, “Dear Carol, you are an expert in this field so I hope you would be willing to review this paper” is much harder to dismiss.

Be Personal

In contrast to group notices about meeting times, some communications are most effective one-to-one. The more an email is or appears to be directed exclusively to one recipient, the more likely it is to be read and to receive a response. This is particularly important when you are asking the recipient to do something or otherwise imposing on him or her. Thus, an email sent to dozens of people that says, “can someone please review this paper?” is easy to ignore. Instead, an email that says, “Dear Carol, you are an expert in this field so I hope you would be willing to review this paper” is much harder to dismiss.

[M]any spam filters are programmed to eliminate emails that contain specified words in the subject line. This is a particular danger for biologists who routinely use “prohibited” words like “sex” and “sperm.”

Make Subject Lines Relevant and “Clean”

Always create a subject line and make sure that it addresses the topic of the email. This may seem unimportant when considering the message in isolation, but the practice facilitates the filing and retrieving of email for both the sender and the recipient. Also, many spam filters are programmed to eliminate emails that contain specified words in the subject line. This is a particular danger for biologists who routinely use “prohibited” words like “sex” and “sperm.” Be aware of these filters and limit the detailed discussion of mating systems to the text of the message.

Be Aware of Technical Limitations

Not everyone reads their email on DSL/T1 lines, especially not all the time. This is especially true with the increased use of hand-held devices, which sometimes cannot handle attachments at all. Do not send simple brief text messages as attachments. If you must include an attachment, make sure that it is in a format that can be read by commonly used software programs (e.g., Word, Adobe Acrobat, .gif, .jpg.)

When writing, one “hears” or envisions the intended tone, but this is often lost in email translation, particularly with persons you don’t know well.

Use Humor Carefully

Humor, especially sarcasm and other subtleties, often relies on tone and/or facial expression to come off. When writing, one “hears” or envisions the intended tone, but this is

often lost in email translation, particularly with persons you don’t know well. When in doubt, either skip the humor or set it off explicitly with signaling language, e.g., “my colleagues often tease me that I’d rather work out at the gym than work in my lab.” The alternative, “I’d rather work out at the gym than work in my lab” could be taken literally by someone who does not know you well.

Respect the confidentiality entrusted to you, even if it is not clear to you why you were blind copied instead of just copied. If you do otherwise, you will establish yourself as careless at best and untrustworthy at worst.

Never Expose a Blind Copy

If you are a “blind” recipient of correspondence, this means that the writer wants you to see the message but does not want those who are the primary recipients or cc’s of the message to know that you received it. Respect the confidentiality entrusted to you, even if it is not clear to you why you were blind copied instead of just copied. If you do otherwise, you will establish yourself as careless at best and untrustworthy at worst.

As a writer, use bcc’s cautiously (except for standard group communication as noted above). You can avoid blind-copying altogether by instead sending the message separately to the intended blind recipient, with a note that it is being sent in confidence. This decreases the possibility that the blind recipient will thoughtlessly embarrass all concerned.



Be Calm!!!!!!!!!!!!

Exclamation points (!!), emoticons (:-) , colored, large or animated fonts, and CAPITAL LETTERS FOR EMPHASIS are routinely over-used in email. Use them sparingly, if at all. Your message will be heard better if it is understated and straightforward.

Check Before You Click

Many email programs have helpful features that populate the “To” fields with a name as soon as unique keystrokes are recognized. But a typo can result in embarrassing misdirection. Before you press “send,” look again at all the send-fields (primary recipient[s],

cc’s, bcc’s). Are they the intended recipients? Similarly, when forwarding an email, be sure you have scrolled down to the bottom of the message so you are aware of everything being forwarded. Last paragraphs or post-scripts have been known to be non sequiturs. Depending on what they are, you may regret having forwarded them, even if the rest of the correspondence is relevant. ■

NOTE

The author acknowledges with gratitude Ray Everngam, Ursula Goodenough, and H. Robert Horvitz for helpful review and critique of this article.



5. SCIENTIFIC CITIZENSHIP

Approaching the
Critical Task of Peer Review

Revising Your NIH Grant Application

Approaching the Critical Task of Peer Review



Sandra Schmid
The Scripps Research Institute

The Value of High-Quality Peer Review

Virtually every published paper has benefited from, and been improved by, peer review. Reviewers help clarify and tighten my arguments. They catch large and small errors that would otherwise cause confusion. They point out worthwhile controls, or suggest new experiments that strengthen, and sometimes correct, initial interpretations. Thus, from my experience, as both author and editor, high-quality peer review is beneficial to the authors.

Objective and scholarly peer review ensures that the conclusions reported are fully justified by the data.

The greatest value of good peer review is, however, to the journal's readers. Objective and scholarly peer review ensures that the conclusions reported are fully justified by the data. On a more subjective level, well-informed reviewers help editors prioritize and categorize papers, so that published manuscripts match the journal's scope and objectives. Although the standards for objective peer review should be the same for all journals—specifically, referees should insist that the experiments be rigorously performed, and that the presented evidence is of sufficient quality and quantity to justify the paper's conclusions—each journal has different goals that referees need to consider when they make their subjective recommendations.

Some journals present scientific vignettes to communicate with interdisciplinary audiences. Others, like *Molecular Biology of the Cell (MBC)*, publish complete and significant advances within a broad discipline. Still others are more focused on subdisciplines.



Others function as archives for communicating important stepwise advances.

The subjective nature of peer review helps match the scientific and conceptual advances reported in each paper with the appropriate audience. This is a valuable task that helps readers sift through the plethora of resources listed on PubMed for the kind of information they seek.

How to Review a Paper

The following is a step-by-step guide to reviewing papers, written from the perspectives of an author, who will hopefully benefit from your efforts, and an editor, who is seeking your advice before making a publication decision. With regard to the former beneficiary, my advice is to follow the Golden Rule: Treat others as you want to be treated, and keep in mind that you are communicating with both your peers and their younger students and postdocs.

Step 1: Accept the Assignment

Before you agree to review a manuscript ask yourself the following questions: Are you knowledgeable in this area of research? Do you have the expertise to assess the methodology and results? Can you be objective in your criticism? Is there a conflict of interest? Lastly, can you meet your commitment to review the manuscript within the allotted time, usually one to two weeks? If you answer “no” to any of these questions, then decline and recommend someone you think might be more appropriate.

Step 2: Consider the Journal

If you are not already familiar with the journal’s scope and philosophy, you can find these on each journal’s home page. Many journals will include specific instructions to the referees regarding the criteria by which they prioritize manuscripts for publication.

Step 3: Read the Paper

As you do, try to take two views: Look for the big picture but also pay close attention to the details. The big picture view should form the basis of your subjective opinion. Ask yourself the following questions. Has this paper taught me something useful and/or interesting? Would my students, postdocs, and colleagues find this information helpful? If the journal is interdisciplinary, then ask, would researchers outside this field benefit from reading these findings?

At *MBC* we ask our referees to help us prioritize papers by considering the following big questions:

- 1) Does this study significantly advance our knowledge, and/or provide new concepts or approaches that extend our understanding?
- 2) Are the advances presented of broad interest and significance to cell biologists?

In general, papers must satisfy both these criteria to meet *MBC* standards.

As for the details, look carefully at all of the data presented, including the supplemental material and any movies, and at how the experiments were performed. Is the approach or procedure appropriate? Are all the necessary controls in place? Is the quality of the data sufficient? Pay attention to the axes of graphs; is the scale chosen to make small differences look large? This is one of my pet peeves. Does the written description of the results match the data presented in the figures? Close inspection of these details will allow you to determine if the conclusions and interpretations are supported by the data.

As you read, you should also assess how effectively the authors have communicated their findings. Again, at *MBC*, we ask referees to assess whether the title and abstract

accurately reflect the content and conclusions of the paper. This is critical given that the title and abstracts available from a PubMed search direct readers to important papers and help them to prioritize their reading. Does the introduction provide sufficient background to understand the significance of the findings that follow? Is it concise and relevant to the subject at hand? Are the results presented in a logical order? Are the experimental rationales established? Are the important conclusions and their significance stated clearly and concisely in the discussion? Are the findings placed in a larger context? Is the work of others considered and incorporated or inappropriately ignored? Is there unnecessary repetition; can the author be more succinct?

... Avoid inflammatory language; remember the Golden Rule!

Step 4: Write Your Review

Adopt a professional and scholarly tone, and avoid inflammatory language; remember the Golden Rule! In an opening paragraph, make a general statement describing the major conclusions of the paper and your overall assessment of their validity and significance. This opening statement should reflect your “big picture” view of the paper. These comments help the editor decide whether the paper’s findings match her or his journal’s scope and objectives—and thus whether to reject a paper

or to invite resubmission. Importantly, you should not make a recommendation regarding publication in your comments to the authors; instead reserve this opinion for your confidential remarks to the editor.

Subsequent paragraphs should focus on the details. Generate a list of specific criticisms and concerns (preferably numbered and subdivided into major and minor concerns) that justify your overall assessment of the paper and provide constructive feedback to the authors. If possible, be specific about suggested additional controls or experiments needed to justify the conclusions. Is the suggested experiment doable and, if so, is it worth doing, or will it only add incrementally to the take-home message while unnecessarily delaying publication? If you disagree with an interpretation, be specific about alternatives. Check your work, as mistakes diminish your credibility to the author.

Step 5: Make Confidential Remarks to the Editor

Many journals have check boxes for prioritizing publication. Any recommendations regarding publication should be communicated confidentially to the editor and not to the authors. You might also indicate which of your concerns are more or less critical for the authors to address.

Peer review is our most important responsibility. It epitomizes the scholarship and collegiality that attract us to this profession. Although anonymous, it is often the most valuable form of communication. As a frequent beneficiary of peer review, I thank my colleagues for sharing their efforts and advice. ■

Revising Your NIH Grant Application



Lakshmi A. Devi
Mount Sinai School of Medicine



Lloyd D. Fricker
Albert Einstein College of Medicine

As most everyone knows, the success rate for National Institutes of Health (NIH) funding is low for just about everybody right now. In this article, we focus on the key points to consider when you receive a score that is not in the “absolutely amazing” range, indicating that a revised application is needed. Since it is impossible to cover the subject in sufficient detail in a short article, we also refer you to several helpful books on grant writing (see Resources).

So what to do when your wonderfully crafted, scientifically exciting application doesn’t get a fundable score from the study section?

Don’t take a nonfundable score personally. Keep in mind that most applications are not funded the first time through study section.

What to Do

1. Calm down. Don’t take a nonfundable score personally. Keep in mind that most applications are not funded the first time through study section.
2. Once you have read the summary statement and recovered from the shock, contact your program officer. Do not berate him or her with a tirade against the insane reviewers who didn’t understand your application. Instead, ask for helpful advice about what your next steps can be.

A grant application that narrowly missed the payline is, on occasion, still funded if the NIH Institute staff feel that it provides a unique and important direction that will have a large impact on the field. Disease relevance helps but isn’t

essential. Some Institutes have bridging funds if the score was within 10 points of the current funding percentile. Even if your score is well outside the likely fundable range, it helps to contact the program officer to ask advice. There is a chance that your program officer attended the study section meeting when your grant was discussed and took notes. If so, these will be extremely valuable in rewriting your application. Not all of the discussion that occurs during the review process makes its way into the summary statement; often there are one or two problems that the review committee deems fundamental, but which appear in the summary statement as a single sentence.

3. Get advice from several colleagues. Do not be embarrassed by your score. Chances are they have also received a similar score at some point in their careers (or will in the future). Ask people whom you trust to give you an honest opinion, even if they are not experts in your field. You don't want advice from people who will just agree with your assessment that the reviewers are brainless nematodes. You want to ask people who can gently point out that even though the reviewers may be nematodes, they may have picked up on areas that need to be revised.
4. Plan a strategy. Do you need more preliminary data to make a convincing argument? Or can you address the points just by adding a few more references, mentioning some solutions to potential problems, or other minor writing changes? Do you think the study section that reviewed your application will ever be enthusiastic enough to give your application an outstanding score, or do you need another study section? It is possible to have your revised grant application reviewed by a

different study section if you can make a convincing argument about why the previous one is not appropriate. Be careful in changing study sections, though: A totally new group of reviewers may find 30 additional problems not mentioned by the first group, or otherwise be less enthusiastic about your overall research area. The phrase "out of the frying pan, into the fire" may apply.

Be appreciative of the constructive advice offered, but don't automatically make all of the changes suggested by the reviewers.

5. Write a draft of the Introduction section. Then, tear this up and write another draft that does not attack the reviewers for their failure to recognize the brilliance of your previous application. Be appreciative of the constructive advice offered, but don't automatically make all of the changes suggested by the reviewers. If they really said something stupid (and your colleagues agree with you), then nicely point out why you are not heeding a piece of sage advice (references to published papers help). The reason to start with the Introduction first, and not the actual application, is that reviewers usually focus on the Introduction. Also, this will provide a blueprint of the changes you need to make in the application.
6. Rewrite your application. Be sure to indicate all changes that you make. Bold or italic text is OK for short passages, but entire paragraphs of bold/italics can be difficult to read, and a line in the margin is



easier for the reviewers. Even if the same people are not reviewing your application, the new reviewers will want to see what you changed. After rewriting your application, go back to the draft of your Introduction and make sure you changed everything you said you would.

7. Seek advice again from your trusted colleagues. In particular, ask them to suggest changes in your Introduction to make it stronger and not offensive to the reviewers.
8. Now, think about the advice of your colleagues, and make additional revisions to address their concerns.
9. Submit the application.
10. Pray to every deity you have ever heard of, and even those you haven't, just in case. Take the evening off and go home early. Spend a quiet evening with your family or friends, whom you haven't seen in the past months while working on your application. Then, get back to work on your next application! ■

RESOURCES

The first resource is a humorous look at the grant writing and reviewing process that includes serious advice. The others are serious advice books.

Fricker LD. (2004). *How to Write a Really Bad Grant Application (and Other Helpful Advice for Scientists)*. Bloomington, IN: AuthorHouse.

Friedland AJ, Folt CL. (2000). *Writing Successful Science Proposals*. New Haven: Yale University Press.

Gerin W. (2006). *Writing the NIH Grant Proposal: A Step-by-Step Guide*. Thousand Oaks, CA: Sage Publications.

Reif-Lehrer L. (2004). *Grant Application Writers Handbook, Fourth Edition*. London: Jones and Bartlett Publishers.

Yang OO. (2005). *Guide to Effective Grant Writing: How to Write a Successful NIH Grant Application*. New York: Springer.



6. GRADUATE AND POSTDOC ISSUES

Advice on Choosing a Successful Postdoctoral Position

How to Apply for a Postdoctoral Position

How to Have a Successful Postdoc Experience and Get a Good Job

Your Career Plan ... Consider the Forest While You're Focused on the Trees

Their Future in Your Hands: Inspiring Undergrads to Pursue Ph.D.s

Advice on Choosing a Successful Postdoctoral Position

Choosing the right postdoctoral position can be one of the most important decisions of a scientist's professional life. But some postdocs are unhappily surprised to discover that their chosen lab seems to be totally different when they arrive than it did the day they interviewed. How can a prospective postdoc make a solid choice that is good for her or him and good for the lab?



**Gráinne Whitman,
Brian Guzik,
and Larry Goldstein**
*University of California,
San Diego
School of Medicine/HHMI*

The way that the PI deals with challenges and opportunities will influence enormously the traits and style that the postdoc internalizes and employs when it becomes his or her turn to lead.

This is a vital question, as the choice will dictate a good part of the rest of the postdoc's professional (and personal) life—not just the four years or so during which s/he will be in the lab. The way that the PI deals with challenges and opportunities will influence enormously the traits and style that the postdoc internalizes and employs when it becomes his or her turn to lead. It is best to aim for both a role model whose style one can respect and wish to emulate, and a situation that combines good leadership with good science.

Many graduate students are so influenced by the stress and excitement of interviewing for a position that they forget that an interview works both ways. Not only is it an opportunity for the student to shine, but it is also an opportunity for the student to gain an understanding of how other labs operate.

Here are a few things to do and not to do, and some signals and qualities to watch out for:



Make sure that the walk fits the talk. The “talk” is the lab group mythology, which is what the PI and lab members in groups say. What actually goes on, the “walk,” will most likely only be disclosed in one-on-one sessions with individual lab members, either directly or subtly. Remember that if they hesitate in answering a question, there is a good chance that they are trying to remember the party-line (mythology) or they are trying to be a diplomat (spin doctor).

Look for how group members relate to each other. One can tell a lot about the PI’s leadership style by the way lab members carry themselves and how they treat each other, you, and especially people with little power or status.

Tune into warning signs. If you sense that something is not right, it may be an important indication that it isn’t. Red flags may include things like:

- No one-on-one time with lab members
- People in the lab are cynical, sullen, and/or depressed.
- Lab members don’t personally respect their PI.
- The science doesn’t suit you, or, more ominously, you have the feeling that people are not being straight in discussing and/or publishing their results.
- You are promised your own project on the condition that you take on another project first.
- Feeling like you are on a honeymoon, or seeing an exuberance that doesn’t feel natural.
- You find yourself “talking yourself into” working there.
- You can’t quite put your finger on it, but something just doesn’t feel right.

Insist on a feeling of trust and community. Look for clarity, understanding, and openness to everyone inside and outside the lab. The opposite of these qualities are secrecy within the lab and to outsiders, lab members who are confused and don’t seem to “get it” themselves, and a certain rigidity that should be palpable even with one visit.

Consider the scientific track record of the lab. While history doesn’t always repeat itself, it can be a good place to learn about how a lab is run. Does the lab publish frequently in reputable journals? Publication is the metric by which academics are measured, and is a measure of productivity that is critical for getting almost any type of job. Is the number of publications representative of the lab size? A lab with 30 postdocs that publishes three to four high-profile papers a year is probably not as organized and efficient as a lab with six postdocs that publishes one to two high-impact papers per year.

Value a focused research program. Look for a logical coherence in research topics. Do current research questions relate reasonably to each other? Has the lab changed focus frequently and significantly over time? Research on a fertile topic, which has been built on a solid foundation of findings, thrives in a lab. However, research based on a few sensational findings or a few chance observations may disappear when the primary author leaves the lab, and may not be a productive area in which to invest time and hard work.

Be cautious about excessive overlap between projects. Within the lab, look for enough similarity between the lines of research to provide synergy, while maintaining enough distance between them to prevent conflicts. This is not always an easy balance to create or maintain, but in a good area of

research, there are far more important questions than there are people to do the work.

Look up the history of alumni. Look at the PI's list of publications and learn where former lab members are now. Are they successful? Do they have careers that would make you happy?

Careful attention to these details while interviewing, and to your impressions afterwards, will help you identify the PI and lab that is the best fit for you both personally and scientifically. This in turn will create the best opportunity for your success and, most importantly, your lifelong enjoyment of a scientific career. ■

How to Apply for a Postdoctoral Position



Suzanne Pfeffer
Stanford University
School of Medicine

Time spent as a postdoctoral fellow can represent among the best times in one's scientific career—no graduate student coursework or exams to worry about, no faculty obligations of teaching or grant writing, no worries about the success of your students or staff. Postdoctoral training is a time to focus on one's own research, unencumbered by most other responsibilities. As a step along the pathway to full independence, it is a time to learn how to choose a good research topic and to gain additional paper and grant writing skills. It can also be a time to learn how to review manuscripts and begin mentorship of more junior colleagues. Of course, the salary increase from student to postdoc is always appreciated. Moreover, the postdoctoral training period will provide a chance to learn a new research area and new techniques in preparation for your next career stage as an independent investigator.

Seek out a mentor who will be a mentor—working with you to train you for independence and the world of science.

How to Pick a Postdoc

First, pick a topic that excites you and has great potential for fundamental discovery. Don't be afraid to pick a question that will enable you to learn a new area or experimental system, so that you will gain valuable new tools and approaches for the future. Fellowship-granting organizations frown upon applicants who continue their postdoc research in an area close to their Ph.D. topic.

Next, consider which lab has the potential to do the most important and best work on your chosen problem—and keep in mind that this is not always the

biggest lab or the lab at the most prestigious institution. Seek out a mentor who will be a mentor—working with you to train you for independence and the world of science. If a lab is large, you won't get the same mentorship as in a smaller lab. You will probably be independent for the rest of your life, so don't deprive yourself of the opportunity to build a supportive mentorship relationship at this stage of your career.

State specifically what it is you hope to learn as a postdoc and why you have chosen that person's lab.

How to Apply

Thanks to the Internet, good labs receive postdoc applications from all over the world every day. Your job is to stand out above the rest. Your application will be taken much more seriously if you can explain to your potential mentor the specific basis for your application to that lab. Have you chosen a specific research area and sought the top labs in that field? Was there a specific paper you read that really excited you? Make this clear in a cover letter. State specifically what it is you hope to learn as a postdoc and why you have chosen that person's lab. For example:

- "I am really interested in understanding asymmetric cell division in stem cells, and your recent paper in Journal X on this topic piqued my interest."
- "I would like to learn to work with zebrafish and was really excited about your recent studies of X in this system."
- "I am also considering two other labs that also work on this question."

Making such statements shows that you have taken time to focus your interests in an area for training. Summarize your accomplishments as a graduate student and be sure to include a list of your publications. These will show your potential postdoc mentor that you have been productive, have learned how to write papers, and are equipped with the goods to succeed in obtaining fellowship support. Because you have already narrowed your search to perhaps three top labs, ask your Ph.D. advisor to send these folks a letter in support of your application at the same time that you apply. Doing so will show that you sought guidance from your Ph.D. mentor and that you are serious about your interest in a particular lab.

If you have not yet published your work, clearly explain why and ask your advisor to do the same. You will be less competitive in obtaining a position, but a thoughtful letter and a strong reference from your advisor can often overcome this limitation. If you still have time to finish papers before applying, by all means do so. Published papers will help you at every stage in your job-hunting process.

Your visit is a mutual learning opportunity that should leave the lab members feeling that they simply have to recruit you.

The Interview Day

You've been invited to the host lab to give a talk on your graduate work. You've practiced and gone through your slides. But have you read all the papers from that lab published in the last five years? Don't show up having read one review article, only to hear that the lab doesn't even work in that area but that lab members just think broadly. If relevant, bring



publications from the lab with you and ask questions about specific experiments.

Consider also asking your potential advisor:

- What do they really want to understand in the next five years and why?
- What are they excited about? (Does this match your own interests?)
- How often do they meet with lab members?
- How backlogged are they in submitting papers?
- Where have recent postdocs gone on to take positions?

Take the opportunity to ask members of the lab about the environment:

- Do lab members compete with each other or help one another?
- Are people happy there and fully engaged in their science?
- Do they have any concerns?

Your visit is a mutual learning opportunity that should leave the lab members feeling that they simply have to recruit you—and, hopefully, you will get a clear sense of whether that lab is a place where you can thrive for the next several years of postdoctoral training. Finally, if a particular lab seems like a perfect match, be sure to let your host know. ■

How to Have a Successful Postdoc Experience and Get a Good Job



Sandra Schmid
The Scripps Research Institute



Sandra Masur
Mount Sinai School of Medicine

Congratulations. You have your Ph.D. and are one of the most highly educated adults in our society. You have proven you are smart, independent, and motivated, and now you're starting the next stage in your career development. Presumably, you have used your skills to research this new position and have some sense of what it is you want to learn and accomplish over the next three to four years. You have made a significant decision in choosing this postdoc position. Your Ph.D. ensures that you will have other opportunities to make significant career

Remember that being a postdoc is not a job—it is a transitional training opportunity en route to independence and, eventually, a “real job.”

choices. Remember that being a postdoc is not a job—it is a transitional training opportunity en route to independence and, eventually, a “real job.” With your advisor, you can determine a path to attain both your research and career goals—but you have the primary responsibility for your success.

There are excellent published and Web resources to guide your career development; some are listed below. Here we consider three well-defined goals that constitute prerequisites for successfully completing postdoctoral training. With hard work, determination, and a little luck, you can accomplish these.

Goal 1: Set a Clear Plan

Decide where you want to be four years from now. If you don't know where you're going, how can you set a straight and efficient course to get there? The sooner you choose a career path (e.g., academic or applied



research, teaching, journalism, science advocacy) the better, so that you can get the training and qualifications and make the contacts you need to get where you want to go. Your objectives may not be the same as your advisor's, but if you want your advisor's help, it's a good idea to make sure that you are both pushing in the same direction. Doing so requires honest self-evaluation (see "Your Career Plan..." on p. 78) and career discussions with your advisor. What aspects of science are you passionate about? Are you creative? Do you like benchwork, or do you prefer reading and assimilating information from the literature? Do you like working as part of a team? Do you want to cure a disease or develop a drug and save the world? Do you like to teach? Are you a risk taker, or are you more comfortable with a clear path? It's okay to learn the answers to some of these questions during your postdoc training, but the sooner you know them, the easier it is to set the best course.

Goal 2: Finish One Significant Project

This is the time to successfully tackle a very difficult, important, and/or novel problem. Determine the single important question you're addressing and how it fits in the context of the field. Then decide what data are needed to tell a compelling but well-defined story. "Finished" means "published." Make good strategic decisions: Home runs are great, but don't pass up the base hits. Also, don't get bogged down for years fighting to try to get your paper into a "sexy" journal. Together with those 12 supplementary figures you might well have material for two or three excellent papers in *Molecular Biology of the Cell*! Learning to write well and communicate your ideas and findings effectively is essential. Writing and publishing papers proves your capabilities and makes you a stronger job candidate for any prospective employer.

Goal 3: Establish Your Identity

In addition to publishing your research, present your work whenever possible at departmental retreats, poster sessions, and minisymposia. At meetings, don't be a wallflower. If you don't say anything, the assumption will be either that (a) you don't understand what's going on or (b) you don't have anything worth saying. Silence is never taken as a sign of wisdom and knowledge. Collaborate with and contribute to other projects. To establish your expertise, others must benefit from it. You will need three to four letters of recommendation for an academic job, so talk to other faculty members and colleagues about their research as well as yours to try to find a connection.

Completing Big and Small Tasks

Achieving these goals and getting a job are the ultimate desired outcomes of your postdoctoral training. Keep them in mind and stay pointed in their direction, but break the journey up into smaller, doable steps. Plan short-term objectives for daily or weekly focus; these may include composing your daily experimental plan and to-do list. Creating a paper outline or plan early on can help you meet intermediate-term objectives of outlining, writing, and submitting your next paper. The intermediate-term objectives will take months to complete. Meanwhile use your group meeting presentations to prepare seminar-quality slides, and compose your job talk month by month as your work progresses. Step back and evaluate your progress regularly. Are you on track?

Attending seminars can play a significant role in achieving each of these goals. Seminars provide an opportunity to expand your knowledge efficiently and effortlessly. At the same time you can learn communication skills from others' successes and mistakes. You might also learn something that could help your research: a new method or

approach, a relevant paradigm. By asking questions, you will be noticed and thereby establish your identity in the research community. You'll also learn good interviewing skills, which involve hearing about others' research and engaging them in meaningful conversation about it. Make sure you meet the famous scientists who give seminars. They will be hiring!

Funding Eases the Way

Independent funding increases your freedom and security. Write a grant proposal, even if your advisor can fund the project. No matter what direction your career takes you, you will always need to plan ahead and justify your experiments—skills that are learned from grant writing. Some grants will ease your transition to an independent faculty position. These include Career Development Awards from the Leukemia and Lymphoma Society, the Department of Defense, or the Burroughs Wellcome Fund. The National Institutes of Health offers the K01 Mentored Research Scientist Development Award, the K08 Mentored Clinical Scientist Development Award, and the new NIH Pathway to Independence (PI) Award (K99/R00); all provide promising postdoctoral scientists mentored and independent research support. Apply for these as you consolidate your future plans and experience success (i.e., have published a paper), typically after two to three years. Make sure that there is good justification for continuing your training, because if your postdoc is not a learning experience, you may be wasting your time.

Don't trust your advisor to keep track of your career. Even the most caring mentor will lose track of time. Besides, given your experience and leadership abilities, mentors like having you around. Go on the job market when you've attained your goals and when you have a clear idea of what you want to do during the next phase of your career. For an

academic job, this means having a clear idea of your independent research program; for a job in biotech, this means knowing your skill set, what you have to offer, and the type of work that interests you. If teaching is your career goal, then teaching experience is more important than a long list of publications.

....working hard doesn't necessarily mean working long: It means working efficiently, intelligently, and with determination.

Finishing a postdoc in three to four years requires commitment, focus, efficiency, and a little luck. You can't do it without working hard, but working hard doesn't necessarily mean working long: It means working efficiently, intelligently, and with determination. Apply the same intensity to your friendships, family, and recreation to stay balanced. But remember, people don't have balanced days, weeks, or months: They have balanced lives. Keep the destination in mind, set your priorities, and prepare to change them as your journey continues. ■

Searchable Resources

Life Sciences Research and Teaching: Strategies for a Successful Job Hunt

www.ascb.org/newsfiles/jobhunt.pdf

www.grantsnet.org

■ extensive, searchable grant database

http://nextwave.sciencemag.org/career_development/

- links to funding opportunities
- great advice on grantsmanship
- career advice



RESOURCES

Feibelman PJ. (1994). *A PhD is Not Enough. A Guide to Survival in Science*. Cambridge, MA: Perseus Publishing.

Austin L. (2000). *What's Holding You Back? Eight Critical Choices for Women's Success*. New York: Basic Books.

Covey SR. (1997). *The Seven Habits of Highly Effective People*. New York: Simon & Schuster Inc.

Holden C. (1999). Eight Attributes of Highly Successful Postdocs. *Science* 285, 1527–1529.

Lindstaedt B. (2007). Your Career Plan... Consider the Forest While You're Focused on the Trees. *ASCB Newsletter* 30, 14–15. (See p. 78)

Your Career Plan . . .

Consider the Forest While You're Focused on the Trees



Bill Lindstaedt
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San Diego

As a young mother and a postdoc, Jane (not her real name) was frustrated. She felt she had just been thrown off her career path, so she made an appointment to consult with me about how to get things back on track. I'm a career counselor, and after investing five years of research in her postdoc lab, with little data and no publications to show for the 60-hour weeks, Jane had learned that her husband Ron, an industry scientist, was being promoted and transferred to his "dream job." Jane would need to leave her lab to move with her family to another city.

Financially, they'd be fine. Ron's salary increase would more than compensate for the loss of Jane's postdoc income. But after two failed postdoctoral projects, her research was just beginning to produce some exciting data. Now what would she do? Would she have to start over with another lab and another postdoctoral position in her new city? If not, was she stepping permanently away from the path originally chosen to lead her into a faculty position? Why didn't her mentor warn her that this path would be so difficult in the first place?

Many scientists in the early stages of their careers ... [focus] ... so intently on the trees right in front of their eyes that they simply miss the forest stretching out for miles in front of them.

Even more frustrating, she had been actively ignoring a nagging feeling that she was losing her passion for the bench. Why hadn't she addressed that issue sooner, before being forced into a career transition? What could she have done to take charge?



Could she have prepared herself better for a transition into something more rewarding? Was it too late?

As a career counselor who works every day with graduate students and postdocs in the life sciences, I have learned to identify this common problem ... Jane was frustrated because she had focused for too long on the “trees.” Now, she desperately needed to shift her focus to the “forest.”

Ignoring the Forest

Many scientists in the early stages of their careers fall into the same trap as Jane, focusing so intently on the trees right in front of their eyes that they simply miss the forest stretching out for miles in front of them. It’s true that training in the life sciences demands a certain focus on the trees. Trainees are rewarded for spending long hours in their corner of the lab, conducting experiments, producing papers, and spending each day—year after year—carefully researching solutions to narrow and specialized problems. Students and postdocs are discouraged from spending “nonproductive” time exploring the forest of their available career opportunities.

... statistics now show that only a small portion of the current trainees in the biomedical sciences will become tenured faculty.

Most people coming up in the life sciences overlook this forest because they presume trainees should take the obvious path to reach the traditional goal—a tenure-track research faculty position. Indeed, for decades, this training process reliably produced that outcome! But statistics now show that only a

small portion of the current trainees in the biomedical sciences will become tenured faculty. So should Jane have presumed that her focus on the trees would lead her so easily to a faculty position? Is a faculty position the outcome that Jane truly desired? What can Jane do now to look past the trees, assess her position, think about her goals and priorities, and then plan her own route through the forest?

Using an Individual Development Plan

In Jane’s case, she answered these questions by creating and following an Individual Development Plan (IDP). This career planning tool helped her to:

- Make an honest assessment of her abilities and passions
- Gain a larger view of available career opportunities
- Consider her life plans in the context of her career plans
- Set short- and long-term goals.

After her move, with the help of many mentors and the use of an IDP, Jane leveraged her experience and skills. Using her past leadership and organizational experiences, and her outstanding writing skills, she obtained a new position: directing a cluster of graduate programs in the sciences at a local campus.

IDPs have long been used by corporations, government agencies, and educational institutions. But the concept appears to be fairly new in the field of biomedical research. In 2002, the Training and Careers Subcommittee of the Federation of American Societies for Experimental Biology’s (FASEB) Science Policy Committee created an IDP template for use by trainees and their mentors.¹ This and other IDP templates do not replace mentoring, but provide a way for trainees to take a proactive role in their own mentoring process. The trainee can initiate

the IDP process.² “Implementation [of the IDP] does not have to be ‘top down,’” said Phillip Clifford, Professor of Anesthesiology and Associate Dean for Postdoctoral Affairs at the Medical College of Wisconsin, and a member of the FASEB subcommittee

In 2005, the use of IDPs in the life sciences got a boost when Sigma Xi reported results of a national postdoc survey. The results show that postdocs who established a written plan with their advisor early in their postdoc period were more likely to report greater productivity, greater satisfaction and better relationships with their advisor.³ Recently, the Graduate Research, Education and Training Committee of the Association of American Medical Colleges (AAMC) released a set of guidelines for postdocs and their mentors, strongly encouraging the use of an IDP tool.⁴

There are many variations of the IDP process, and none is perfect. Jane used the “Annual Individual Development Plan for Life Science Graduate Student and Postdoctoral Trainees,”⁵ incorporating the following five steps:

1. Assess your strengths and weaknesses, your work and life values, and your interests and passions.
2. Carefully consider the assessment items from Step 1 and decide what major changes, if any, need to be made to your current career path.
3. Write out your plan, evaluating past progress along your chosen path, and set detailed goals for the future.
4. Implement your IDP. Share your written plan with a mentor or colleague, who will help you achieve your goals while holding you accountable to working consistently toward them.

5. Most importantly, repeat these steps each year, to help ensure that you progress toward your overall goals.

I encourage you to use an IDP tool in your own career planning! Over time, the annual review of your own IDP will help you to consider your forest while focusing on the trees.

For more information, talk to your mentors and check out the following links. ■

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Their Future in Your Hands: Inspiring Undergrads to Pursue Ph.D.s



Martha J. Grossel
Connecticut College



Jennifer Roecklein-Canfield
Simmons College

You may find it surprising that liberal arts colleges are remarkably adept at training not just future Ph.D.s, but especially successful ones. If institutions are ranked according to the percentage of their graduates who go on to receive Ph.D.s, three of the top six are liberal arts colleges.¹ What are liberal arts colleges doing to put them on equal footing with top research universities such as the California Institute of Technology and the Massachusetts Institute of Technology? The advantage appears to be the close working relationship of students and their professors. The running joke is that the success of these colleges is due to the absence of graduate students. The truth within this witticism may be that all of us are examples that either inspire or discourage undergraduates from pursuing science. What can you do to better motivate undergraduates? We offer here some simple strategies, derived from our experiences at two liberal arts colleges, which can help all of us to guide undergraduates to become successful scientists.

Tell students what great jobs we have. Reflect on what we all take for granted—flexible hours, no boss, no dress code.

Model

Tell students what great jobs we have. Reflect on what we all take for granted—flexible hours, no boss, no dress code. As scientists and professors, we are free to pursue our intellectual interests and are paid to do so! Debunk the myth that we make no money. Not only are most of us well compensated, but the benefits (including college tuition reimbursements) are great. We also enjoy flexibility in scheduling—a perk not shared by industry scientists. Most in academia have stable jobs

and are unlikely to be transferred or laid off, even in troubled economic times. Consider how you demonstrate your job satisfaction to students. Stressed-out, complaining professors do not make attractive role models.

Inform

Inform young students about earning a doctorate in science. Most undergraduates and parents don't realize that a biomedical Ph.D. is often free and that graduate students may be paid to pursue their advanced degree. Staying in school also delays student loan payback, and medical school may be free with an M.D./Ph.D. degree. Emphasize the leadership capacity that a Ph.D. student acquires in making decisions about the direction of research while also working at the bench. Early exposure to this information is crucial because it can spark students' interest and helps them improve performance in their coursework.

Teach what is still to be discovered, understood, or applied so that students don't feel that everything interesting is already done.

Interest

Introduce students to the excitement of exploration and discovery in the first year to encourage students to stay in science and allow for earlier entry into the research lab. Topics that allow students to relate coursework to their own lives can grab their interest. Examples such as prions and mad-cow disease make the study of proteins more pertinent to teenagers. Draw attention to what is not known. Teach what is still to be discovered, understood, or applied so that students don't feel that everything interesting is already done. What is left for them to dream of solving?

Engage

Engage students by undertaking research projects in laboratory courses. Even simple projects allow students to begin to think like scientists. If freshmen tackle simple experimental design and hypothesis formation they will be prepared to pursue more complex independent research in later years. The first year is not too early to begin to look at figures from journal articles. Incorporate these into your courses to allow students to see that class topics encompass a vibrant field of science. If we let students be scientists, they can discover their own passion for discovery.

When students become interested in research, we all know that the best place for them is in our own research labs. Students who have their own project engage in science in a unique way. Intensive research with a mentor, especially during a focused time such as a summer research program, can ignite a student's interest in science. An opportunity for students to share their results in poster sessions creates a special energy and excitement. Finally, bring your research students to meetings where they can participate in science, meet graduate students, and be recruited by professors and programs.

An important component of inspiring students is to have high expectations of them.

Inspire

Share your wonder of science in your class. Tell your students the great stories. Share your own "ah ha" moments, and relay the folklore of science discoveries that happened in the lab down the hall or across campus. Have students read some of the simple articles that appear in great journals (e.g., the



brief communication published in *Nature* that described the use of the polymerase chain reaction to determine that certain types of fish are often mislabeled in the market²). Discuss the Nobel Prizes when they are announced: The website (<http://nobelprize.org>) is comprehensible for undergrads. Relay to students the scientific accomplishments of your alumni. These approaches help students to see a doctoral degree as accessible. An important component of inspiring students is to have high expectations of them. You will be surprised how often they will rise to your expectations.

Advocate

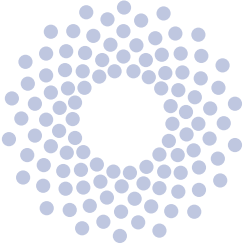
Advocate for a curriculum that requires students to synthesize, solve, and evaluate rather than memorize. Encourage your institution to have a summer research program that includes a poster session. Ask your professional association to sponsor undergraduate events, including a poster session, at annual meetings. Bring underrepresented minority students to meetings (like the ASCB Annual

Meeting) where they can meet minority faculty and students. Lobby for undergraduate travel awards.

With simple adjustments to our own behavior, and simple modifications to our classroom teaching, laboratory practices, and institutional policies, we can better represent to undergraduates the requirements and rewards of a doctoral degree in science. You never know what will resonate. One student recently remarked that she was first inspired while washing glassware in the lab, intrigued while listening to ongoing discussions of research. This experience “sparked in me the idea that I could be part of a team that could uncover something no one had ever found before.” ■

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7. UNDERREPRESENTED MINORITY ISSUES

Diversity in Science:
The Importance of Mentoring

Self-Awareness and Cultural Identity:
A Medical School Course of
Exploration into Personal
Unconscious Bias

Diversity in Science: The Importance of Mentoring



JoAnn Trejo

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A disproportionate number of underrepresented minorities come from low socioeconomic backgrounds and face difficulties in gaining access to quality education and resources. Progress in increasing the number of minorities earning Ph.D.s has been slow. My home institution, the University of California, San Diego (UCSD), does a good job of encouraging minority admissions, but we lose a factor of 2 at each step of the educational ladder: About 20% of undergraduates are minorities; the proportion drops to ~10% in biomedical science Ph.D. programs and to ~5% in the postdoctoral community. Only a fraction of minority postdocs are entering academia. Why is the representation of minorities at the higher levels of academia so dismal? There are many factors that contribute to the failure of academia to recognize, recruit, and retain the most talented minorities in science. Some certainly involve perceptions of inadequacy and cultural bias. Among the solutions is to recognize that all students can benefit from help and guidance. I attribute much of my success in academia to great mentoring.

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Beyond the Bounds of Comfort

I come from a family of migrant farm workers who harbor a strong work ethic. My grandparents were illiterate, and neither of my parents graduated from high school. I am only the second in my family to finish college and the first ever to live away from home. I grew up harvesting produce with my family in the rural outskirts of Stockton, CA. The work was hard and the pay was minimal. As a young child, I accompanied my



mother to a farm worker rally where Cesar Chavez spoke. I remember the sound of feet stomping, the shouts of “Viva la Huelga!” and the feelings of belonging but not really knowing what it all meant. The smell of fertile peat dirt and ripe tomatoes and images of Mexican farm workers are vivid childhood memories.

I liked school from an early age. My early life was good, but I knew money was tight. I was also aware that we often “did without.” My father’s absence made growing up difficult, and adolescence was chaotic, particularly for my older brothers. I sought refuge in school, and I was fortunate to have crossed paths with supportive teachers who kept me on the right track. I also had the great advantage of having an older sister who defied tradition, stayed in school, and graduated from college. I followed in her footsteps.

My transition from home to college 50 miles away at the University of California, Davis, was tough. I was thrust into a world that was wildly different from what I knew. I went home often on weekends to relieve feeling alienated. I eventually adjusted to college life, experienced success in school, gained confidence, and began to excel. I also discovered science, in the person of Antoni Oppenheim, the father of one of my high school teachers. He was an engineer and invited me to visit his lab at the University of California, Berkeley. He also introduced me to an undergraduate research program at Lawrence Berkeley National Laboratory and helped me get an internship, where I worked every summer during college. During these summers, I lived in a small cottage at the Oppenheim’s home in North Berkeley and I learned firsthand what the life of a professor was like. I began to realize that education was a route to a different life. I became passionate about research and decided that I too wanted to be a scientist! Professor Oppenheim was from an educated Polish

family, immigrated to the U.S. after World War II, and was my first scientist-mentor who believed in me and ardently supported my scientific pursuits.

More Mentors Who Believed in Me

After finishing college at the University of California, Davis, I entered the biomedical sciences Ph.D. program at UCSD. Now farther from home than ever, I needed time to adjust to the not entirely comfortable culture of graduate school. I completed my dissertation with Joan Heller Brown, under whose tutelage I learned how to do science and how to think like a scientist. I also began to develop an interest in G protein-coupled receptors (GPCRs). Joan Heller Brown was the kind of mentor I needed. She was friendly, nurturing, and always radiated confidence in my abilities as a scientist. Her belief in my work fueled my desire to succeed in science, and I thrived under her guidance.

I then moved to the University of California, San Francisco (UCSF) to pursue postdoctoral studies with Shaun Coughlin, who had just discovered the thrombin receptor, a unique GPCR activated by proteolysis. At UCSF I was exposed to both the marvelous and the cutthroat sides of academic research. I worked alongside colleagues who came from privileged backgrounds, had trained at the most elite institutions, and were fiercely competitive. We shared the same passion and desire to do great science. This commonality forged many great friendships that endure to this day.

With success in the lab, I began to realize that I was as smart and capable as my peers despite my different upbringing; I felt as though the playing field was now level. Shaun provided phenomenal mentorship by example. He challenged us to do rigorous and creative research: Careless work was unacceptable. My response was to develop

the type of scientific work ethic that enabled me to be an independent and successful investigator. I credit my work ethic to these early training experiences with Shaun. I also realized that my own drive, confidence, and passion for science were necessary to sustain me in this frequently severely competitive, harshly critical, and incredibly satisfying career, and they do.

Despite vastly different backgrounds, I never felt that my mentors had lower expectations for me or treated me differently than any other trainee. In fact, my mentors showed trust and faith in me. Indeed, I was often held to a high standard, since they knew I would get the job done. I now have the same expectations of all of my trainees, regardless of their backgrounds, since rigorous training will only increase their chances of success in science.

The most rigorous scientific training for minority scientists is crucial: When a minority scientist does not meet the highest standard, her/his entire community is often perceived as inadequate.

Rigorous training entails demanding high standards and providing support to achieve these standards. The most rigorous scientific training for minority scientists is crucial: When a minority scientist does not meet the highest standard, her/his entire community is often perceived as inadequate.

Working in the Ivory Tower

After postdoctoral training at UCSF, I accepted my first faculty position at the University

of North Carolina at Chapel Hill (UNC) as a tenure-track assistant professor in 2000. I was promoted to associate professor with tenure in 2005.

UNC was an ideal environment, but as time passed, I desired to be closer to my family and to work in a more diverse academic institution. Hence I jumped at the opportunity to relocate to UCSD and accepted a position in the Department of Pharmacology in 2008. In my view, the excellent scientific environment at UCSD will enhance my research initiatives; the diverse demographics in California will enhance my efforts to recruit more minorities into the professoriate.

I have been a faculty member for eight years and now devote most of my time to research and to interacting with scientists at all levels. I have also served on many graduate admissions committees and faculty search committees. I have experienced firsthand the misconceptions that many academics have of individuals who are simply different than they are. It is difficult to challenge such ideas when the group is largely homogeneous, i.e., typically male and white.

UCSD has made significant progress in bringing a number of outstanding women to the faculty ranks, a step in the right direction. But further work is needed to enrich the faculty of our academic institutions with individuals from diverse backgrounds. We need to attract faculty who more accurately reflect the demographics of the cities and states in which we live. To this end, I am becoming active in the San Diego Institutional Research and Academic Career Development Award program. This postdoctoral training program, sponsored by the National Institute of General Medical Sciences, supports the development of young minority professors. Diversity enriches the educational experience and strengthens communities. It is critical for our economic competitiveness and sustainability.



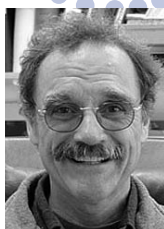
Education and Mentorship Crucial

I remain the only one of my family to live away from Stockton. I currently live with my partner, an elementary school teacher, in an urban community of San Diego. I have dozens of nephews and nieces who mostly live in poverty, and are smart but lack access to quality education. For the most part their lives do not include activities that are compatible with success in school. I talk with them about the importance of education and try to provide them with experiences that go beyond their daily existence. My hope is that they will realize the opportunities that education can offer them.

There is no clear path to follow to rise above poverty, but my experience shows that support in seeking and finding access to education, and crossing paths with the right mentors, can have a profoundly positive effect on the course one follows.

There is no clear path to follow to rise above poverty, but my experience shows that support in seeking and finding access to education, and crossing paths with the right mentors, can have a profoundly positive effect on the course one follows. We all have amazing potential. ■

Self-Awareness and Cultural Identity: A Medical School Course of Exploration into Personal Unconscious Bias



Daniel A. Goodenough
Harvard Medical School

The U.S. continues to struggle with race, and this struggle plays out in our scientific culture as well as in the rest of society. A course offered at Harvard Medical School tries to help participants recognize the manifestations of racism in their own beliefs and behaviors.

Where Are the Minority Job Applicants?

Those of us involved in faculty recruitment are only too aware that although we dutifully add the language to job descriptions urging applications from under-represented minorities, we are often unable to find “qualified” applicants of the same caliber as majority scientists. Why are there no candidates?

[I]t can be hard for white Americans to appreciate how the three levels of racism—internalized, interpersonal, and institutional—continue to deny blacks access to the benefits of society that whites enjoy.

The answer is that the U.S. has a long history of slavery, Jim Crow laws, and anti-miscegenation laws that has shaped our perceptions. And even today there are innumerable institutional structures that continue to offer privilege and advantage to whites. We are bombarded from birth with images and stories depicting black people as criminals, shiftless and lazy, oversexed and dangerous. Most white Americans spend their time in predominantly white contexts and feel uncomfortable when they find themselves in the minority in a black group. Although there are outstanding



resources that debunk race as a biological reality, we have trouble seeing that race is a social construct. And it can be hard for white Americans to appreciate how the three levels of racism—internalized, interpersonal, and institutional—continue to deny blacks access to the benefits of society that whites enjoy.

Learning How We Experience Race

Another manifestation of racism is disparities in health care. Such disparities are so well documented that the Liaison Committee on Medical Education of the Association of American Medical Colleges has added a requirement for “cultural competence training” in medical school curricula. We have developed a course at Harvard Medical School designed to launch participants on a path of self-reflection and exploration of their own unconscious biases. The elective course has 14 sessions, each two hours. It is offered twice a year, once to students in any year of their training and once to faculty. While the study of racism forms a core component of our work, the course also explores gender bias, homophobia, social class, immigration, religion, and body image.

The core tenet of the program is that undoing racism starts with each person understanding what and how s/he was taught to think about and experience race, as a key to unlocking unconscious feelings and biases.

The core tenet of the program is that undoing racism starts with each person understanding what and how s/he was taught to think about and experience race, as a

key to unlocking unconscious feelings and biases. Therefore, the class is structured to allow participants to explore the values they have about human differences and how they acquired those values.

We begin by having the group attempt to define “culture.” We ask each person to identify his or her cultural identity. Participants bring a “cultural object” (photograph, icon, food, book, etc.) to class that has special importance for them. Each person presents the object and its meaning to the group. And as the circle completes, what emerges is a remarkable richness in self-identities. Students often find it hard to select just one object, because we all belong to multiple cultures, and a discussion about which objects were not chosen often brings additional richness to the conversation.

In a subsequent session we each construct our “cultural genogram”: a family tree going back as many generations as desired, using symbols and color coding to denote interracial and interclass marriages; levels of education achieved; immigration patterns; gay and lesbian; disabled and mentally ill; divorce and illegitimacy; and class status.¹ In groups of three we present our genograms to each other, noting areas of pride and shame in the family, unspoken rules, and power dynamics. (What topics were *never* discussed at the dining room table?) As we hear each other’s stories, it becomes clear that we have shared experience with some human differences, while other experiences are totally foreign and unknown to some.

Finding Our Blind Spots

These discussions focus on uncovering our “blind spots,” areas of privilege that each of us has that we don’t have to acknowledge. For example, as a white male, I rarely have to think about my race. Race is something that others have. I am the “norm” in my society, and thus race has very little impact on me on a

daily basis. I was raised in a white community, went to a white school, and had little exposure to blacks. But I find out in this course that my black colleague thinks about race 10–20 times a day and experiences daily “micro-aggressions”: clutching of handbags as he walks by white women, being followed in department stores while he is shopping, experiencing lack of eye contact from whites, hearing comments such as “My, you are so articulate!” or “What do black people think about that?”

Referring to our cultural genograms, in subsequent sessions we explore the communities in which we grew up, our schools, summer vacations, and circles of friends. Again we do this with an eye to understanding how we were taught values about human differences. Who was in our world and who was not? We approach each of the “isms” in the same way, sometimes using trigger videotapes to spark discussion. For example, what would it be like to grow up gay, to have a secret that you could not tell anyone, for fear that he or she would not love you anymore? One rough estimate is that about 10% of us are gay. Yet of the 20 or so people in your genogram, how many did you know were gay? How does that enter into your current comfort zone about being around gay people? Another example: As you move around in your busy day, how often do you notice how difficult it might be to follow you in a wheelchair? What feelings come up for you when you encounter a person in a wheelchair? Do you relate to that individual as you would anyone else?

Which Box Are You In?

Racism is like smog: It is inescapably in the air everywhere. We breathe it from the day we are born, only occasionally noticing it. We may cough from time to time and produce a most ugly excrescence, wondering how something like that could have emerged from such a nice person. We try to hide these contributions, because we fear being called racist.

We want to believe we are not racist. I was given a lovely instrument by Beverly Daniel Tatum that helps get folks thinking about their racism in a constructive way. Consider the following table:

	Active	Passive
Racist		
Anti-racist		

Who would you put in each box? It is usually possible to come up with examples of people who are actively racist, both now and historically. Similarly, it is straightforward to identify active anti-racists, people who devote unusual energy and time to fight racism. With additional thought, you might imagine a passive racist, someone who harbors considerable racist attitudes but who may be relatively unaware of this trait. Where would you be? Most whites would like to be in the lower-right box: passive anti-racist. Here, we can be truly against racism, but we are not prepared to do any hard work.

What Tatum taught me is that in reality the passive anti-racist box does not exist. If you are white, you carry white privilege. If you simply accept that reality without questioning it, then you are part of the problem. You are passively endorsing the continuation of a racist society, enjoying your privilege, seeing it as “normal” or “the way things are,” or even denying that you have any special privilege because you are white. You may believe that we live in a meritocracy and that you have achieved all your successes solely because you are smart and have worked very hard. But white individuals are born on third base, even if we want to believe we hit a triple.

Accepting Reality

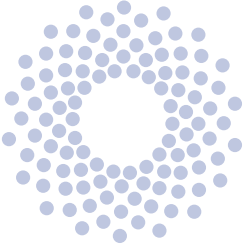
In *The Matrix*, Neo is given the choice of the red or blue pill by Morpheus. Take the blue pill: Go back to the status quo, change noth-



ing, and continue to wonder why there are few competitive black candidates in our job searches. Take the red pill: Accept the reality and unfairness of racism, accept the nonexistence of passive anti-racism, and accept that we are all trained since birth to participate in a society with multiple institutional structures that ensure the preservation of white privilege. Having taken the red pill, there is no going back. ■

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8. WOMEN IN SCIENCE

A Network of Our Own

Improving the Climate for
Women in Academia

The Wisdom of Athena:
A Model Scheme for Achieving
Gender Equity in Science and
Engineering in the UK

A Network of Our Own



Susan L. Forsburg
University of Southern California

Many Women in Cell Biology (WICB) columns have addressed the importance of mentoring relationships between junior and senior scientists. What's missing is the view from our peers who face challenges similar to our own in both time and place. Peer networks not only contribute mutual support but also group intelligence, and are particularly important for scientists who may be isolated or set apart from their colleagues (for example, by being the only woman in a department, or the only single father).

[T]hese two networks... are safe places for their members and maintain confidentiality.... are noncompetitive ... problem-solving groups ...

This column describes two strategies: one, a formal network described by Ellen Daniell in her recent book, *Every Other Thursday*,¹ and the second, an informal network called the X-Gals, authors of a continuing series of columns in *The Chronicle of Higher Education*.² Although very different in structure, these two networks share several features. First, they are safe places for their members and maintain confidentiality. Second, they are noncompetitive: The members aren't trying to establish rank within the network. Third, they are problem-solving groups, with a focus on professional issues. Finally, they are friends, encouraging the members to enjoy the good as well as confront the bad.

A Structured Group

"Group," the network in Daniell's book, was founded by several University of California, San Francisco, faculty over 30 years ago. It was inspired by a psychology movement that promoted a collective approach to



problem-solving. Originally including men and women who were working toward tenure, Group eventually evolved into a group of eight women scientists from different Bay Area institutions. Many of them have now spent over 25 years together. Some readers may recall a presentation from Group members at a WICB event during the 1994 ASCB Annual Meeting.³ Daniell writes:

The objective of Group ... is cooperation in the competitive world. Group members seek both practical solutions for specific problems (such as dealing with a difficult boss or employee) and broader perspective on our lives. Group helps counter the all-too-common experience of professional life as a combat zone in which nobody seems to be on your side Anyone who feels isolated in a professional or competitive setting or who wants honest feedback can benefit from a group, a safe testing ground where everyone is on your side.⁴

“Anyone who feels isolated in a professional or competitive setting or who wants honest feedback can benefit from a group ...”

Group has regular, structured meetings. Each member asks for a certain amount of time to discuss an issue. The members use code-words: a pig is a negative self-perception; a contract is a concise description of goals; a stroke is an encouraging compliment to another member. Members are discouraged from rescues, or taking responsibility for another’s problems.

Daniell’s book is not a how-to manual in setting up a formal network, although it

provides that information.³ Reading the book provides a virtual network itself, with Daniell explaining strategies for common problems and describing “pigs” that many of us harbor. As these high-achieving women describe the challenges they have faced, the reader may feel a jolt of familiarity. The book also describes setbacks in professional careers and real lives, as when Daniell describes her tenure denial, or another member describes the loss of her beloved partner. Thus, it’s a fascinating biography of a cohort of women scientists and what it took for them to survive and thrive.

An Ad Hoc Network

In contrast to the formality and history of Group, the X-Gals are young women beginning their independent careers who have a long-distance, ad hoc network. They are:

nine female biologists who began meeting weekly... over a few beers in 2000, as several of us wrote up our dissertations.... As we graduated and took far-flung jobs and postdocs ... we have continued the dialogue through an e-mail discussion list.... What began as a survival mechanism for a few female graduate students has become an incredible motivational force and a sounding board vital to our lives and careers.²

In their series of columns in *The Chronicle of Higher Education*, they take turns discussing issues of mutual concern. Strikingly, most of their members are not on the “traditional” academic path, and they ask “are women ‘choosing ourselves’ out of an academic career, or is the traditional path of the academic profession so hostile to women that we feel we do not have a choice?”⁵ The series of X-Gals columns⁶ reflects on these and other issues, informed by the views of the network. The *Chronicle* columns do not reflect the support function of the network per se, but evolve into broader reflections about careers

in biological science that come from their network experiences.

We all have searched locally for mentors but found few. Perhaps that is one reason our e-mail group is so important to us: We help one another negotiate the competing demands of our roles, in no particular order, as scientists, partners, and mothers....²

The X-Gals network was begun in proximity but continues, thanks to email, over long distances. Thus, a network need not be formal or local to be functional.

As Daniell reminds us, “intimacy and reliance on others for encouragement and advice is a source of empowerment, not a sign of weakness.”⁷ Both Group and the X-Gals encourage their members to achieve their goals, even though their strategies are different. Their experiences make it clear that all scientists, from junior students to senior professors, can benefit from a peer community. No one needs to do it alone. ■

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Improving the Climate for Women in Academia



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Women's Careers In Science

“At a time when the nation is concerned about training enough health care givers and research scientists for the coming decades, academic science and medicine appear to be in danger of wasting more than half of their capital—their women faculty,” concludes a recent report from the National Academies.^{1,2} But perhaps needed change is coming. Many institutions are seeking ways to promote women’s advancement by creating a more favorable academic climate.

Some important recent efforts to understand and change institutional climates that may impede the careers of women scientists and engineers include:

- Thirty institutions have received National Science Foundation ADVANCE Institutional Transformation Awards, which seek “to develop systemic approaches to increase the representation and advancement of women in academic science and engineering careers.”³
- Five leading medical schools, along with Brandeis University and the American Association of Medical Colleges, have launched a landmark five-year study to explore and address the dramatic underrepresentation of women and minority faculty in leadership and senior positions in academic medicine.² This National Initiative on Gender, Culture, and Leadership in Medicine (also known as “C-Change” for cultural change) is supported by a \$1.4 million grant from the Josiah Macy, Jr., Foundation of New York.
- The University of Southern California received a gift of \$20 million to create the Women in Science and Engineering Program to increase the number of women in tenured and tenure-track faculty positions.⁴

One noteworthy and successful effort to assess and improve the academic climate for women (and for all faculty) is taking place at the University of California, San Francisco (UCSF). The effort began when Chancellor J. Michael Bishop asked his top leadership to develop a Faculty Climate Survey and to include comparisons between women and men. Starting with questions that Nancy Hopkins and her colleagues had used at the Massachusetts Institute of Technology, UCSF officials developed a survey that was refined and administered by a professional polling firm in 2001.⁵ A faculty committee appointed by the chancellor, with representatives from each of the four schools, analyzed the results and forwarded 10 recommendations to the chancellor in 2003.⁶

The chancellor accepted all 10 recommendations.⁷ A Chancellor's Council on Faculty Life was appointed in late 2003. Under the leadership of the vice provost for academic affairs (originally Dorothy Bainton, now Sally Marshall), the council is responsible for implementing the recommendations, thereby ensuring high-level support for these activities.

Some of the positive results so far include a change in tenure policy with respect to maternity, establishment of programs to support new and existing faculty, and institutional recognition of the importance of enhancing diversity.

Some of the positive results so far include a change in tenure policy with respect to maternity, establishment of programs to support new and existing faculty, and institutional

recognition of the importance of enhancing diversity.

One reform was an enhancement to the existing University of California systemwide policy under which the tenure clock automatically stops if a faculty member takes maternity leave. Now at UCSF the chancellor's office compensates departments for the first six weeks of this paid leave. An additional six weeks of leave is available without such compensation.

In keeping with the recommendations of the committee that reviewed the faculty survey, several new programs are in place to support faculty. First, there are now both institution-wide and intradepartmental welcoming activities for all new faculty. A day-long program covers topics as varied as compensation and benefits, childcare, faculty review processes, mentoring, retirement, teaching skills, and managing difficult work situations.⁸

Another new program to support faculty is the UCSF Faculty Mentoring Program, which was established in 2006 with the goals of:

- Supporting the recruitment and retention of the highest-quality faculty
- Increasing faculty diversity through improved mentoring of underrepresented faculty
- Improving faculty career satisfaction and success.

Mitchell D. Feldman was appointed to the half-time position of director of faculty mentoring and is working closely with the Chancellor's Council on Faculty Life to establish and oversee a mentoring program for all UCSF faculty. All assistant professors and new faculty have mentors; more than 800 have been matched to date. Mentors and their protégés meet at least twice a year to review the protégé's updated curriculum vitae and individual development plan. Each department has at least one mentoring facilitator,



with almost 80 such appointments in place. Workshops are being developed to train both mentors and facilitators. Protégés are enthusiastic about the new program, saying, “I applaud the institutionalization of the mentoring program at UCSF,” and “I think that the mentoring program is fabulous.”

A third new program to support and advance faculty careers is a substantive new-faculty leadership development program launched in 2005. Funded by the Chancellor’s Council on Faculty Life, the UCSF Faculty Leadership Collaborative was developed by the Coro Center for Civic Leadership, a nationally recognized leadership training organization. The program is designed for UCSF faculty who want to build community awareness and knowledge as well as their personal and professional leadership skills. More than 60 individuals have already received this training, which will be offered periodically.

Finally, a faculty enrichment pilot program aimed at stress management and reduction has recently been completed, and the initial results are positive. This program supplements the many supportive resources available through the UCSF Work–Life Portal.⁹

Nurturing and enhancing diversity is now recognized as an important component of the UCSF strategic plan.¹⁰ A faculty search ambassador position, initially established two years ago, has been made part of a broader, UCSF-wide diversity initiative. J. Renee Navarro was appointed director of academic diversity in August 2007 to lead UCSF’s efforts to nurture and enhance diversity among faculty and trainees, who include students, residents, and postdoctoral scholars.

To test whether these interventions have improved the climate for all faculty, and especially for women, UCSF plans to repeat the 2001 Faculty Climate Survey in a few years. “I am very pleased with the results of

the programs instituted by the Chancellor’s Council on Faculty Life through the Office of Faculty Development and Advancement,” says Vice Provost Marshall. “It has been a great experience—from the initial support by Chancellor Bishop through the active participation by our faculty and their appreciation of the programs.”

[W]ith efforts like those at UCSF and other institutions, women can be and should be encouraged to pursue careers in all branches of academic science and medicine, without fear of becoming part of the “wasted capital.”

Clearly, to facilitate women’s careers we must reform what the National Academies report calls “gender and racial/ethnic bias and outmoded ‘rules’ governing academic success.” However, with efforts like those at UCSF and other institutions, women can be and should be encouraged to pursue careers in all branches of academic science and medicine, without fear of becoming part of the “wasted capital.” ■

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The Wisdom of Athena: A Model Scheme for Achieving Gender Equity in Science and Engineering in the UK



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The gender distribution in science, engineering, and technology (SET) in both academia and industry is unbalanced in the UK, just as it is in many other countries. This means that the underrepresentation of women increases with increasing seniority. The situation persists even though the business world has openly confirmed what seems obvious: Including all sectors of the population is crucial

[C]hief executives of global corporations have publicly stated that diversity in the workforce at every level is...the best way to develop means to expand into new markets and stimulate new business ideas...

for developing any enterprise to its full potential. In fact, chief executives of global corporations have publicly stated that diversity in the workforce at every level is important. They have identified it as the best way to develop means to expand into new markets and stimulate new business ideas, thus creating a significant competitive advantage. Moreover, a review of corporate performance and gender diversity of 355 U.S. Fortune 500 companies found that “strongest performance correlated strongly with gender diversity in the top management team.”¹

Athena Charts a Course

Such information—together with results of the Athena Survey of Science, Engineering, and Technology (ASSET)—led to a new strategy in the UK: establishment of a charter to recognize excellence in SET employment in higher education. ASSET was conduct-

ed by the Athena Project (www.athenaproject.org.uk) and compared the experiences of more than 6,500 men and women in academia and research council institutes.

To help achieve its goals, Athena works with partner universities to develop, share, encourage, and disseminate good practices to improve career development, recruitment, and participation and, ultimately, to increase the number of women working in SET at all levels.

The idea for a charter emerged from the Scientific Women's Academic Network (SWAN) Conference in October 2002, where 10 founding members committed themselves to "the advancement and promotion of the careers of women in science, engineering, and technology in higher education and research, and to achieve a significant increase in the number of women recruited to top posts." Since then another 16 universities and research institutes have joined the charter. To help achieve its goals, Athena works with partner universities to develop, share, encourage, and disseminate good practices to improve career development, recruitment, and participation and, ultimately, to increase the number of women working in SET at all levels.

What Charter Membership Means

A university that applies to become a member of the Athena SWAN Charter pledges to accept and incorporate the following principles into its action plan:

- To address gender inequalities requires commitment and action from everyone, at all levels of the organization.
- To tackle the unequal representation of women in science requires changing cultures and attitudes across the organization.
- The absence of diversity at management and policy-making levels has broad implications, which the organization will examine.
- The high loss rate of women in science is an urgent concern that the organization will address.
- The system of short-term contracts has particularly negative consequences for the retention and progression of women in science, which the organization recognizes.
- There are both personal and structural obstacles to women making the transition from Ph.D. into a sustainable academic career in science, which require the active consideration of the organization.

The university as a whole, i.e., the top-level administration, must support the charter's intention and thus accept the preceding principles. On a practical level, this commitment involves submitting a report that describes the statistics and self-evaluation of the university with regard to employment practices over time. The report should also include potential areas and procedures for improvement, as well as specific plans for how to implement changes and improvements. Once bronze-level Athena SWAN status is granted, individual departments or colleges can apply for higher-level awards (i.e., silver or gold).

Benefits for All

A report released by Athena summarizes the potential advantages of joining the charter, which include the following:

- To be recognized as an employer of choice, attracting and retaining talent



- To enhance the organization's external reputation, including the public relations and marketing opportunities offered by gaining an award
- To help fulfill statutory equal-opportunity responsibilities
- To identify and publicize initiatives that exist but are not known outside the department concerned
- To stimulate change at organizational and departmental levels
- To receive individual, expert feedback when submitting annual reports and recognition awards
- To have the university's achievements profiled positively on the Athena SWAN website
- To gain access to the charter's network of contacts and events
- To underline the institution's commitment to gender equality to students, funders, research councils, and industry

To find out whether institutions indeed experienced these advantages, I wrote to some of the universities that have held Athena SWAN awards. The response was unanimously positive. For instance, the University of York, whose chemistry department holds a rare gold-level award, confirmed that its expectations—wanting to recruit the best staff and create an environment allowing them to undertake their best research—were met. It confirmed that the Athena SWAN process:

- Is a useful toolkit for identifying weak points in staffing policies
 - Identified good working practices for all (i.e., not just for women)
 - Was a useful and effective recruiting tool
 - Identified areas in which more support was needed and made departments look at their processes and policies to identify gaps
- Raised the profile of the departments involved

“Discussions about the award and the process towards making the application for the silver award led to a structured review of how the school operated, what barriers there were to effective delivery by all staff, and action plans to start to dismantle the barriers.”

The University of Edinburgh similarly confirmed that the important benefit was “for all staff, not just female staff, because any action that is taken affects all staff equally. Discussions about the award and the process towards making the application for the silver award led to a structured review of how the school operated, what barriers there were to effective delivery by all staff, and action plans to start to dismantle the barriers. The award was a good vehicle for organisational development within the school, and a number of very simple actions made a real difference.”

Watch for Progress

The formal process of participating in the charter recognizes the self-reported and externally monitored performance of an institution with regard to gender diversity, the identification of means to change practices that create barriers for the advancement of women in particular, and other cultural changes. Thus, it may be one way of moving forward to address systemic problems that contribute to the disproportionate representation of women in SET.

The charter is only a few years old, and it will take more time to measure how much of a cultural change it can effect. However, I for one will “watch this space” carefully and try to convince my institution to join this scheme. The EU provides clear directives to support principles like Athena’s, but a crucial added value of the Athena SWAN charter is the credibility and visibility provided by external monitoring. Should this scheme prove successful, it might provide an excellent model for other countries to consider. ■

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9. CAREER AND FAMILY

Dual-Career Academic Couples

Postponement of Parenthood—the
Good, the Bad, and the Ugly

Postponement of Parenthood:
Implications for Women Scientists

On Supporting Female Postdoctoral
Fellows with Children

Dual-Career Academic Couples



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I am a hard-working Ph.D. with multiple publications and over 24 independently taught courses,” reports one academic woman. Unlike her husband, she is not on the tenure track. She met her partner in graduate school, where they both completed their Ph.D.s on identical timelines. But when it came time to go on the job market, her husband received the first offer. As a result, she accepted part-time teaching in her husband’s department as part of his hiring package.

“The tiny salary made me wince, but with the ink still wet on my diploma, it didn’t occur to me to negotiate. Never mind that I hadn’t yet tested my Ph.D. on the job market. Never mind that I’d held better and more lucrative teaching posts as a graduate student. My partner and I felt lucky. Unlike so many other academic couples, we would have the privilege of living in the same city.”¹ Several years later, the gap between their careers seems insurmountable. Compared with her husband, she teaches more, earns less, and is nowhere near entering tenure track in his department.

Restructuring university practices will help transform the way universities do business and grow academic cultures where women, too, can flourish.

Dual-Career Problems Common

This story is but one example of the hiring roadblocks encountered by dual-career academics. The phenomenon of dual-career relationships, which accounts for 65% of the U.S. workforce, is even higher inside the “ivory tower.”² Among academics, nearly 80% are coupled with working professionals, over one-third of whom are also academics.³ Both married and domestic partners in dual-career relationships suffer decreased



job mobility and lesser benefits in terms of the opportunities, experience, salary, and working conditions that mobility can bring. This is especially true for women in the sciences, who are more often partnered with other academics. While only 7% of the members of the American Physical Society are women, an astonishing 69% are married to other scientists. A remarkable 80% of women mathematicians and 33% of women chemists are married to men in their own fields.⁴

Although men and women [scientists] might both encounter difficulties as dual-career academics, the survey showed that women face greater barriers to advancement in their fields.

In 1998, two scientists from the College of William and Mary published a detailed survey of dual-career couples in physics. The results were startling and well-publicized. Although men and women might both encounter difficulties as dual-career academics, the survey showed that women face greater barriers to advancement in their fields. More women than men reported that they had taken a lower-level science position, or a job outside science, in their most recent job search. Such partnerships in the sciences are detrimental to women's advancement given the rarity of dual offers.⁵

Dual-Career Responsiveness Lacking

Responsiveness to dual-career issues is perhaps one of the greatest challenges faced by public and private academic institutions. Current institutional policies, which range from formal to ad hoc, rarely create tenure-track positions for accompanying hires.

Spousal employment as part-time, adjunct, or nontenure-track faculty is determined on a case-by-case basis.

More women than men reported that they had taken a lower-level science position, or a job outside science, in their most recent job search.

Research on dual-career academics by Lisa Wolf-Wendel, Susan B. Twombly, and Suzanne Rice found that "dual-career accommodation requests, even at places with formal policies, relies on serendipity, timing, and flexibility."⁶ In many cases, accompanying partners are subject to the personalities and informal practices of various departments. When the accompanying partner is female, potential employers may assume that her ambitions are limited enough to accept a position that is beneath her qualifications (or no position at all).

The 1998 survey documented how hiring committees send mixed messages to academic couples. The hiring committee at one university offered this solution to the female partner: "They suggested that I might consider giving up my career." Another academic partner was told by the department chair "that trying to find two jobs was a bad strategy and that things worked best if one partner took the best job available and the other stopped working." Perhaps the most outlandish recommendation reported by a dual-career academic was a hiring committee professor who "suggested to my husband at his interview that one way to solve the two-body problem was to divorce me."⁷ It is unsettling to think that negative stereotypes about dual-career academic couples still have such traction within the academy.

Dual-Career Hiring, Retention Addressed

How can colleges and universities retain highly qualified academic women in large numbers unless they solve the dual-career issue inside the academy? In November 2006, the Clayman Institute at Stanford University launched the first nationwide faculty survey to address in-depth issues concerning dual-career academic hiring and retention. We are surveying over 30,000 faculty from 13 top research universities across the country. Follow-up interviews and focus groups will commence in the spring of 2007. Persons interested in following the progress of this project are encouraged to visit our website at <http://gender.stanford.edu>.

Policy Recommendations Needed

The Dual-Career Academic Couples study will culminate in policy recommendations aimed at helping universities recruit and retain greater numbers of women in leading faculty and administrative positions. Restructuring university practices will help transform the way universities do business and grow academic cultures where women, too, can flourish. ■

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Postponement of Parenthood—the Good, the Bad, and the Ugly



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As more women are choosing to enter the workforce—and often assuming leadership roles—their age at first childbirth has risen dramatically. In the U.S., that age is on average now 24.8 years, up from 22.1 in 1970.¹ Trends in Europe and Asia are similar, although the average age is older, for example 29 in Spain and 28 in Japan. Meanwhile, public awareness of fertility issues in women previously thought to be of “reproductive age” has increased.

Fertility naturally declines with age. The percentage of women not using contraception and desiring pregnancy, but remaining childless, rises steadily with age.² Six percent of women at age 20–24 cannot conceive, compared with 15% at age 30–34, 30% at age 35–39, and 64% at age 40–44.

These statistics reflect the natural loss of oocytes with age. When puberty begins, women have about 500,000 oocytes. Around 1,000 are recruited each month, about 20 are visible by ultrasound at the beginning of each menstrual cycle, and only one makes it to ovulation. Also, as women age, the quality of the oocytes diminishes because of the following factors:

- Damage to the oocytes during the woman’s fetal life
- Aging of the supporting somatic granulosa cells, which with the oocyte form the follicle
- Direct damage to the adult woman’s oocytes (from smoking, toxins, chemotherapy, or radiation)

Rates of monthly fecundity—the ability to conceive and have an embryo successfully implant—show this natural aging. In the clinical study summarized in Figure 1, fecundity rates in women aged 30 or younger average around 25% but drop off after age 31, the result of both falling numbers and diminished quality of oocytes.³ The women in this study were considered fertile and came to infertility clinics for donor insemination. The drop in fecundity with age is not related

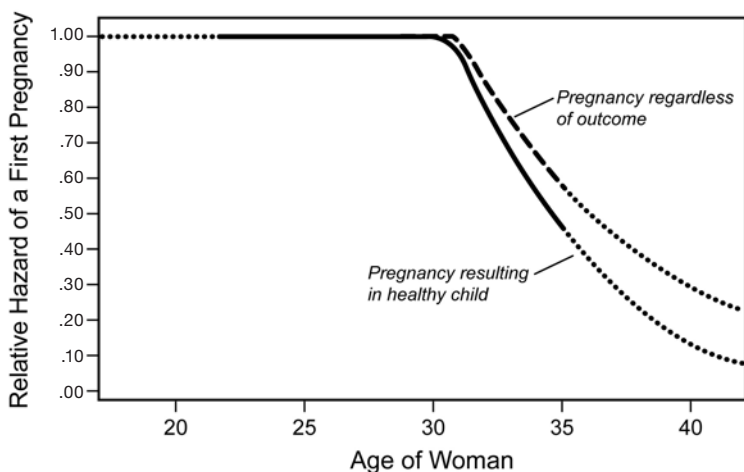


Figure 1. Rate for pregnancy by age with regard to outcome. Dashed lines: relatively fewer women in cohort, and hence a different mode of data analysis employed, but statistically significant. Reproduced from “Delaying childbearing: Effect of age on fecundity and outcome” by B.M. van Noord-Zaadstra et al., *BMJ* 302, 1361–1365 (1991) with permission from BMJ Publishing Group Ltd.³

to uterine factors, because studies with donor eggs reveal that the endometrium of women aged 50 or older responds to hormonal therapy and can support implantation and pregnancy. The rate-limiting step is the ovarian reserve—the number and quality of oocytes.

Moreover, assisted reproductive technologies, such as in vitro fertilization (IVF) or injectable gonadotropins combined with insemination (IUI), cannot correct this drop in fecundity; these patients experience the same age-related drops. By age 35, success rates are down to 30% for IVF and 15% for IUI, and by 40 they are less than 10% for both technologies.⁴ Although exceptions occur—we have all heard of a 42-year-old woman getting pregnant without trying—these women are usually not first-time parents, nor are they seeking help from infertility clinics.

Predicting the age of decreased fertility in twentysomethings would help with family planning. Unfortunately, such accurate tests do not exist. Today’s tests all relate to the ovarian reserve or the number of follicle cohorts recruited in each cycle. But most results do not become “abnormal” until

evidence of subfertility emerges. The most commonly used markers at IVF centers for predicting successful pregnancies are baseline levels of follicle-stimulating hormone (FSH) in the blood. (These are measured on day three of the menstrual cycle along with estradiol levels.) Because FSH levels rise quickly early in the cycle, elevated levels indicate that the pituitary is working overtime to induce follicle formation. Unfortunately, by the time this level rises to about 12 mIU/mL, most women will not respond to therapy treatments, and the chances of successful pregnancies with artificial reproductive technologies are low. The FSH assay cannot predict subfertility; it can only confirm it.

Measuring total antral follicle counts by ultrasound examination on day one or two of the menstrual cycle is routine today. Although scores of 11–14 are considered fertile, the test is inconsistent and subjective. Total ovarian volume is another ultrasonographic marker, with 14 mL representing normal fertility. Again, measurements can vary and this technique has also been criticized. Some studies suggest that anti-Müllerian hormone (normal



level is 8 ng/mL) and inhibin B (should be ~84 pg/mL) are the best serum markers because both are produced and released by antral follicles directly, unlike FSH. However, most insurance plans do not cover the antral follicle count test, and clinical labs do not commonly measure either serum marker. Also, no large-scale clinical studies validating these tests for predicting subfertility have been undertaken.

In one study, patients with premature ovarian failure had microdeletions in genes for oogenesis and folliculogenesis.⁵ This work and others have identified patterns of structural variation and complex deletions, primarily on the X chromosome.⁶ These findings are consistent with the premature ovarian failure or insufficiency that patients with Turner syndrome (X-chromosome monosomy) experience. Genetic screening tests to gauge predisposition to early ovarian depletion of oocytes may become available.

So far, we have no blood tests that can predict reduced reproductive life span when intervention might still be an option.

So far, we have no blood tests that can predict reduced reproductive life span when intervention might still be an option. Research efforts are investigating genetic testing options, but infertility and shortening of the reproductive life span are probably complex traits. Current clinical strategies to predict reproductive life span include combinations of ovarian imaging and hormonal markers.

Oocyte and ovarian cryopreservation have gained attention recently as options to preserve fertility, but both techniques are flawed and risky. Although removing ovarian tis-

sue and freezing it at the time of staging surgery for cancer has been used extensively, the method has produced only two live births worldwide. Optimizing the freezing and, more critically, the thawing of the ovarian cortex is an area of active investigation in humans and animals. Freezing fertilized embryos is common practice in most of the world's IVF centers, and related pregnancy rates are comparable to those involving fresh embryo transfers. Oocyte cryopreservation, however, has not been nearly as successful. Immature oocytes retrieved without conventional IVF protocols, such as ovulation induction and in vivo maturation, do not survive thawing, most likely because of problems with the critical processes of spindle formation and resuming meiosis. Mature oocytes obtained by inducing ovulation and through in vivo maturation have improved freeze-thaw morphology and maturation, but intracytoplasmic sperm injection, a micromanipulation technique, is required to achieve fertilization. Pregnancy rates for this procedure range from 10% to 17%—less than half the normal IVF rates. Also, the high concentrations of cryoprotectants used (e.g., 1,2-propanediol, dimethyl sulfoxide, and ethylene glycol)—and their short- and long-term effects on the oocyte—have raised concerns.

Ideally, research either will identify genetic markers to predict premature depletion of the egg supply or will establish serum markers to diagnose dwindling follicle numbers or oocyte quality earlier in the ovarian life cycle.

We need genetic markers correlated with abnormalities in folliculogenesis and oocyte quality, coupled with longitudinal data, to predict time from detecting elevated biomarkers to menopause. Ideally, research either will identify genetic markers to predict premature depletion of the egg supply or will establish serum markers to diagnose dwindling follicle numbers or oocyte quality earlier in the ovarian life cycle. In time, tests could accurately predict individual spans of reproductive competence. However, to repeat, such tests are currently not available. ■

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Postponement of Parenthood: Implications for Women Scientists



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In 2004 I authored a Women in Cell Biology (WICB) column, “On Being a Scientist and Parent,”¹ wherein I wrote the following:

When to have kids? Obviously it’s easier when you see a coherent career path before you, and don’t feel you need to rush it—you can be a great first-time parent in your late 30s/early 40s. But having babies earlier can work out fine also; it’s just more dicey to pull off.

What this observation ignored, naively, was the reality of diminishing fertility as we age. This reality is detailed in another WICB column by Kelle Moley, called “Postponing Parenthood—the Good, the Bad, and the Ugly” (see page 111).² Women in their late 30s and early 40s may have the qualities to be great first-time parents, but they may discover that they don’t have the wherewithal to conceive, given that egg reserves decline dramatically in many women after age 35.

[T]he median age of women who succeed in obtaining an academic position is 35, already at the fertility tipping point.

While I was aware that conception was more difficult with age, my flawed premise was that, should conception prove difficult, there was always the option of in vitro fertilization (IVF), albeit at considerable cost. In fact, IVF proves to be just as compromised by egg-reserve depletion as is natural conception. Moreover, as detailed in Moley’s article, there are currently no tests available that predict the future status of a woman’s egg reserves; the existing tests only confirm

that radical depletion has already occurred. As one academic gynecologist remarked: “I’ve noticed that several months after rotating through our fertility clinic, many of our female residents show up pregnant.”

There are, of course, other options—the use of donor eggs, or adoption, or acceptance of a child-free lifestyle (which some women elect from the outset). But given that most women who intend to have children prefer that they be genetically related, the fertility statistics obviously collide head-on with current career profiles in the sciences. Challenges arise in all scientific career trajectories; the focus here will be on academia since that’s what I’m most familiar with.

Recent studies³⁻⁵ indicate that a key factor in the loss of women Ph.D. scientists to academic careers is their perception that such careers are just too demanding to tackle if they also want to have a family. There are good reasons to hold this perception from the fertility perspective. The median age for receipt of Ph.D. in the biomedical sciences is 31, and the median length of postdoctoral training is four years,⁶ meaning that the median age of women who succeed in obtaining an academic position is 35, already at the fertility tipping point. The biggest hurdle then lies ahead, with a five- to seven-year window to meet what many perceive to be an increasingly high bar of research-productivity, teaching-excellence, and departmental-service expectations.⁷ Were it the case, as I had blithely assumed, that one could with impunity land tenured on the other side of this marathon and then start a family, all would be fine. But too many women who have made this gamble have wound up childless. It’s a risky game plan.

So from the fertility perspective, the viable game plan is that women scientists who wish to have children start their families as graduate students or postdocs or early faculty members. It probably goes without saying that

academia is at present quite ill-prepared here. To be sure, most institutions have by now implemented at least minimalist maternity-leave and clock-stopping formulae for their faculty, but graduate students and postdocs are for the most part operating in poorly defined territory. Some thesis advisors/PIs are encouraging and flexible, but many others, with their eyes focused on the next grant-renewal deadline, are decidedly less so, and all of us sense that we are working without either a map or a net. When a woman in one’s lab has a baby, it is all too often regarded as a problem to be solved, or a difficulty to contend with, or a challenge to face, rather than the normal course of events.

Hugely compounding “the problem” is the current situation with childcare. While some institutions have made commendable strides in providing affordable-quality childcare facilities, a recent survey carried out by the WICB Committee indicates that most have a very long way to go. Reports from Committee members and from WICB Network⁸ members on 24 institutions yield the following.

- Wait lists: times range from three months to two years, with the mean at least a year. (Comments: “If you don’t get your child in as an infant, chances are slim that you’ll ever get in;” “The postdocs in my husband’s lab say that the moment you know you’re pregnant you start putting yourself on waitlists;” “I signed the list two years ago and they still haven’t contacted me”).
- Cost per month
 - Range for infants=\$650–\$1,500; mean=\$1,000
 - Range for toddlers=\$675–\$1,800; mean=\$1,100

Translation: a postdoc with a \$36,000/year salary and two children needs to spend 2/3 of her salary on childcare—if, that is, she can find places that have openings.



When universities recognize that pregnant young women and young parents are the expectation and not the exception, and organize their expectations accordingly, we may start to get somewhere in the equal-opportunity department.

The obvious “solution” here is a radical revision in the relationship between the academy and family. As is often noted, the academic career trajectory was set up in an era when most of the academics were males with wives at home. Since the 1970s, programs and plans have been layered over the existing system to create a patchwork of exceptions to the rules, and women attempt to navigate these waters as best they can or, far too often, decide not to bother. When universities recognize that pregnant young women and young parents are the expectation and not the exception, and organize their expectations accordingly, we may start to get somewhere in the equal-opportunity department. ■

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On Supporting Female Postdoctoral Fellows with Children



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It is perfectly natural and normal for postdocs to have children, but it has not always seemed so. As a graduate student and postdoctoral fellow in the mid-1960s, I had several female colleagues, but with the notable exception of Merrill (and Bertil) Hille, none had children. Somehow I felt that this was in the natural order of things and represented the sacrifice a woman had to make to have a successful career in science. Indeed, during the first 13 years I was on the Massachusetts Institute of Technology (MIT) faculty, I had many female students and postdocs in the lab, but none had children, and I never thought to discuss this—or any other family matter—with them. This despite the fact that my wife and I were raising three wonderful children, and I was aware of the great satisfaction I was getting helping them grow and develop into successful young adults.

This all changed in 1981 when Alice Dautry joined my lab as a postdoc. Her husband was a postdoc with Robert Weinberg, and she was at Harvard Medical School when I interviewed her. It took only a few minutes for me to recognize her talents, and I gladly accepted her into my group. Partly in collaboration with Aaron Ciechanover, Alice carried out a brilliant series of studies elucidating the pathway of iron delivery from transferrin into cells involving endocytic recycling of apotransferrin and the transferrin receptor.

In late 1982 Alice announced that she was pregnant. At that time there were no protocols for PIs to follow in pregnancy matters, and none of my faculty colleagues could offer much advice. For example, Alice recently wrote me that she “was wearing a lead apron, very heavy, while I was pregnant, to work with ^{125}I -transferrin.” (Such work would probably be forbidden today.) She also wrote, “I remember, being one of the first women scientists pregnant at MIT, walking around campus, and people were asking me in a very pleasant way how I was feeling, and so on. It was



really nice and warm.” And “I also remember presenting a large seminar at MIT, where everybody was there, to present the results on the transferrin receptor cycle. I was quite pregnant and again, I had nice comments, both scientific and personal.”

Her son Raphael was born in May 1983. Not knowing what else to do, I suggested that she use her maternity leave to write two review articles, one of which was published in *Scientific American* and the other in a more conventional review journal. I remember going to her flat and working on drafts of the articles with her while she was nursing; somehow this seemed like the natural thing to do. Alice’s account: “I wrote two review papers during [Raphael’s] first two months, and I am still very grateful for your support at that time. I really wrote them while having [him] in my arms part of the time, working on my first personal computer I had purchased specially for that.”

... I suddenly realized that having a postdoc with a small child was natural, and it occurred to me that there was no reason why such individuals would be less productive than those without children.

My point is not that I was a sensitive male PI in touch with his emotions and wanting to do the politically correct thing. I wanted these papers published expeditiously, and if sitting with a nursing mother was what had to be done, then so be it. It was then that I suddenly realized that having a postdoc with a small child was natural, and it occurred to me that there was no reason why such indi-

viduals would be less productive than those without children.

Alice was the first of many women who had children before or while they were in my lab, and all were exceptionally productive and successful both while at Whitehead/MIT and afterward. The list is long (Svetlana Bergelson, Giulia Baldini, Miyoung Chun, Ana Maria Garcia, Ursula Klingmüller, Petra Knaus, Carol Mulford, Drorit Neumann, Jean Schaffer, Merav Socolovsky, Wei Tong, Stephanie Watowich, Rebecca Wells, Lilian Wikström, Hong Wu, and Jing Zhang), as is the list of top journals in which they published while in my group.¹

Perhaps more important is what happened after they left my lab. In 2005 Alice was appointed president of the Pasteur Institute in Paris. Four women from my lab have had successful careers in pharmaceutical companies and one in publishing. The others accepted tenure-track faculty positions at top universities.² All were promoted and tenured at the appropriate time.

When interviewing potential postdocs, I never ask anything about family matters or children—such questions are illegal in any case. I do volunteer information about nearby childcare facilities and the fact that many of my postdocs have children. Often I now show them pictures of my own seven grandchildren or of our annual lab swimming party where 20 or so small children, with parents, fill the pool. These “offhand” comments make the point that I welcome postdocs with children. I also make sure that interviewees meet both male and female postdocs who have small children. I have found this approach extremely useful in recruiting outstanding postdocs of both sexes. Again, I do this out of self-interest for my laboratory and my research—my objective is to attract the best postdocs I can, and being sympathetic to children is, I have found, one way to accomplish this goal.

Institutional support of childcare is not only the right thing to do; it is important in attracting and retaining the best students and staff in an increasingly competitive environment.

Childcare is the big issue, and my hope is that institutions will realize that not having affordable childcare onsite will cause them to lose outstanding students and postdocs to institutions that do. A recent survey of Whitehead postdocs emphasized the importance of this issue.³ Of the 87 (of 130 invited) who responded, 67% are married. All but three of the 58 married postdocs have (33) or expect to have (22) children. Of the female postdocs specifically, 76% are married, and of these most either have (60%) or expect to have (36%) children. The recently opened Stata Center at MIT has a childcare facility, but the waiting list includes several hundred children. The financial cost of childcare for postdoc families is huge and takes up a sizable amount of their take-home pay—about 25% on average, as indicated by the survey.

Thus, as a community, postdocs (and graduate students) need subsidies for childcare, as well as more childcare centers that are close by. Clearly, Whitehead/MIT must and will do more in the childcare area if it is to continue to attract the best and the brightest students, postdocs, and faculty of both sexes. Institutional support of childcare is not only the right thing to do; it is important in attracting and retaining the best students and staff in an increasingly competitive environment. The sooner each biomedical institution figures this out, the better the situation will become. ■

FOOTNOTES

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