

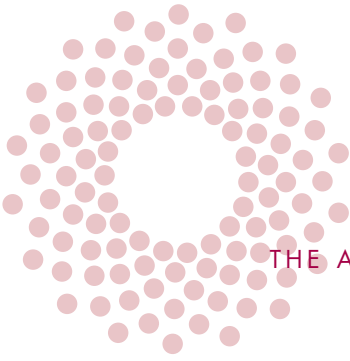


THE AMERICAN
SOCIETY FOR
CELL
BIOLOGY

Career Advice

for
Life
Scientists
Volumes I & II

*Women in
Cell Biology*

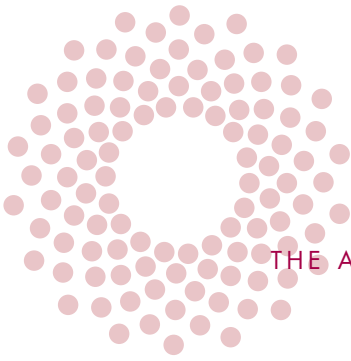


THE AMERICAN SOCIETY FOR CELL BIOLOGY

Career Advice for Life Scientists

Volumes I & II





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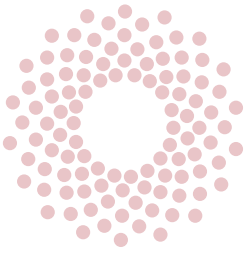


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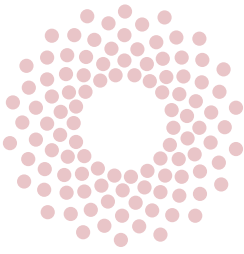


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THE AMERICAN SOCIETY FOR CELL BIOLOGY

Career Advice for Life Scientists

Volume I



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Laura Williams, 1996–2000

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Introduction to Career Advice for Life Scientists



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The American Society for Cell Biology
1998-2003*



W. Sue Shafer

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1994-1997*

The Women in Cell Biology 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 in New Orleans that year. They posted flyers on the back of bathroom stalls and thirty women showed up.

The first sustained effort of this pick-up group was a “newsletter”—a bimonthly mimeographed job—featuring entries as diverse and important as sexist advertisements in scientific journals, job opportunities (though the jobs had not been advertised) and ACLU 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 thirty years, women in cell biology and The Women in Cell Biology have achieved sufficient progress as to make 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.

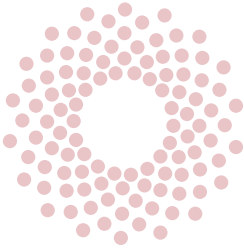
One of the keys to the success of the Women in Cell Biology is that its activities and services have served the many male members of the ASCB and the scientific community as well as its women. This has never been so true as in the past several years, when the challenge of students and post-docs in establishing a satisfying career in the life sciences has become acute. In response, the WICB has given high priority to programs, events, publications and awards that support the career aspirations of scientists. In its way, the Women in Cell Biology Committee has become the heart and soul of the cell biology community.

This volume represents selected articles from the acclaimed Women in Cell Biology column of the award-winning *ASCB Newsletter*, those ranked by

WICB members as providing the most helpful career advice for life scientists. We trust that the compilation will prove even more helpful than the sum of its parts.

At risk of inadvertently excluding deserving colleagues, we can't let the presses roll without acknowledging the many people who together have conspired to make the American Society for Cell Biology Women in Cell Biology Committee and its column widely imitated and praised. Virginia Walbot, Mary Clutter and Mary Lake Polan were that small critical mass from Yale that lighted the spark in 1971; Susan Goldhor and Elizabeth Harris were early editors of the "Women in Cell Biology Newsletter," whose job included gathering \$1 and \$5 contributions from colleagues to keep it going; chairs before the WICB 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); Dorothy Skinner, who served as the conscience of the ASCB Council in the early years; Laura Williams and Maureen Brandon, dedicated editors of the *ASCB Newsletter* WICB column (Laura did much of the research that contributed to this history); Emma Shelton, Dorothea Wilson and Elizabeth Marincola, ASCB Executive Directors who helped nurture women's activities through the Society, and Rosemary Simpson and Trina Armstrong, ASCB executive staff whose passion for the goals of the women in cell biology has been critical in turning ideas into action. Finally, but not least, we thank Joyce Rudick and Vivian Pinn from the NIH Office of Research on Women's Health for the ORWH's sponsorship of this publication. ■



1. THE HEAD GAME

The Impostor Phenomenon

Saying "No"

Unwritten Rules for Advancing
Your Career

The Impostor Phenomenon



Sue Wick
University of Minnesota

Have you ever felt that you did not deserve the professional status you have achieved or the recognition you have received for your career accomplishments? Do you wonder whether being admitted to graduate school, being awarded your Ph.D., being offered an exciting postdoc position, or getting a “real job” was just a mistake on the part of others who will eventually figure that out and expose your inadequacy? If so, you may be demonstrating a classic case of the Impostor Phenomenon—you and perhaps as many as half of your colleagues!

The term “Impostor Phenomenon” was coined by psychology professor Pauline Rose Clance and psychotherapist Suzanne Imes in 1978 to describe a sample of more than 150 high-achieving women. Impostor Phenomenon (also known as the “Impostor Syndrome”) has been defined variously as the persistent belief in one’s lack of competence, skill or intelligence in the face of consistent objective data to the contrary; an internal experience of intellectual fraudulence, particularly among high-achievers; the belief that one is

Do you wonder whether being admitted to graduate school, being awarded your Ph.D., being offered an exciting postdoc position, or getting a “real job” was just a mistake on the part of others who will eventually figure that out and expose your inadequacy?

not deserving of his/her career success and that others have been deceived into thinking otherwise; an intense subjective fear of the inability to repeat past success; a self-concept that one’s record of accomplishments is not



due to ability but rather only to luck, fate, charm, attractiveness, or having manipulated other people's impressions; the secret conviction that one is truly less intelligent and competent than he/she appears; and an unrealistic sense of one's competence in which one downplays strengths and exaggerates or does not tolerate any deficiencies or weaknesses.

Numerous doctoral theses and research papers have examined the type of person who tends to fall prey to the Impostor Phenomenon, and several psychological testing instruments have been devised to measure the degree of manifestation. While originally suspected as a problem primarily afflicting women, subsequent studies have made it clear that similar numbers of men also experience impostor feelings. In some professions, men experience more severe cases of Impostor Syndrome. For example, within a group of faculty members, men

While originally suspected as a problem primarily afflicting women, subsequent studies have made it clear that similar numbers of men also experience impostor feelings.

scored higher for the Impostor Phenomenon than women did, whereas groups of college students showed the opposite results. People in non-professional occupations likewise are susceptible to the impostor phenomenon.

Some characteristics and tendencies are generally correlated with people who feel like impostors. Such people may have feelings of depression, anxiety, fear of failure and of being discovered as a fraud; a propensity to feel shame, low self-esteem, and introversion as determined by the Myers-Briggs

Personality Type Indicator. (Introversion, as defined by Myers-Briggs testing, is a characteristic of many scientists.) Those who feel like impostors often believe that many decisions affecting them are made by other people (and they may be right—Ph.D. qualifying

Those who feel like impostors often believe that many decisions affecting them are made by other people.

exam committees or tenure and promotion committees, perhaps?) Those who experience the Impostor Phenomenon are likely to see intelligence as a fixed entity and not a malleable quality. They are very achievement-oriented. They are motivated in academic settings by the need to look smart; when faced with learning difficulties, they become anxious, shameful, and concerned about looking bad compared to others.

According to the literature, certain family situations tend to spawn impostor feelings. These include not receiving encouragement to pursue educational or career aspirations because they conflict with, or at least are atypical of, the gender role, race, or age expectations of the family. Particularly for women, having goals that will put you outside your family's socioeconomic class may have the same result. Families that impose unrealistic standards, those in which there is only selective validation, or those in which there is much conflict and expressed anger also put children at risk for developing the impostor phenomenon. Growing up with an alcoholic or incestuous parent or in another kind of dysfunctional family can lead to high levels of impostorism. (Such serious factors can also lead to psychosis such as Multiple Personality Disorder.)

Families that impose unrealistic standards, those in which there is only selective validation, or those in which there is much conflict and expressed anger also put children at risk for developing the impostor phenomenon.

Racial identity attitudes apparently have influences also. Research on African American graduate and professional students reveals that those who had attended historically black undergraduate institutions and/or who relied strongly on spiritual beliefs when making decisions about educational or career goals were much less likely to feel like impostors.

...those who had attended historically black undergraduate institutions and/or who relied strongly on spiritual beliefs when making decisions about educational or career goals were much less likely to feel like impostors.

The good news is that the self-deprecating and debilitating feelings associated with the impostor phenomenon appear to decrease as a person remains in a particular position or attains a higher rank—that is, unless the person perceives job uncertainty, ambiguous job expectations, or a high degree of challenge in their position and

does not have a high tolerance for these situations. Studies report that, at least for some people, having a mentor is helpful for overcoming the sense of fraudulence. (Presumably, having a mentor who understands the impostor phenomenon would be optimal.) Clance and her co-workers suggest that the most positive results are obtained through regular meetings with a group of people who can give honest feedback about their perceptions of your abilities. Such groups can be very good at pointing out when your self-perception about talents and achievements is distort-

...having a mentor is helpful for overcoming the sense of fraudulence.

ed, i.e., out of line with what they observe. Thus, they can help you learn to acknowledge your competence. Making the effort to find an effective mentor and assemble a support group for yourself may be the key not only to survival but also to improving your self esteem during your grad school experience, job probationary period, or even the middle or advanced stages of your career.

Making the effort to find an effective mentor and assemble a support group for yourself may be the key...to survival.

Clance also recommends a three-point exercise for those who recognize that they have impostor traits, as published in *New Woman* magazine:



- document both positive feedback and your doubts about its authenticity. This exercise “will demonstrate how you discount the opinions of other people,” says Clance;
- examine the messages that you may have received about yourself from your family and others. Understanding where your negative self-image comes from can empower you to break free, and
- imagine telling your peers and superiors how you have fooled them. Realize how ridiculous you would sound. ■

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Saying “No”



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As the countdown to the next millennium draws closer, it seems that the life of a working cell biologist grows more hectic everyday: too many commitments, too many demands, days that are too short. How do you manage your time and keep control of your professional and personal life?

“No” is one of the most powerful words in the English language. When I was asked to write this article, my first inclination was to say “No”. But I said “Yes”, because I felt that I had the responsibility to do so. I have learned to control my life, get satisfaction from doing an excellent job, make decisions, take chances, and have fun. So, how do you decide when to say “No” and, more importantly, when to say “Yes”?

When to Say “Yes”

The road to Hell is paved with good intentions. Saying “Yes” always has a cost, even when there is a benefit. Develop a clear concept of your reasons for saying “Yes” or “No” to requests. First ask, “do I have the time?” There are time-consuming activities that need to be done for career advancement, personal interest, or

Trust your inner voice that you are doing things for the right reasons.

other positive motives. Set career objectives and priorities, realizing the inherent obligations. However, recognize that there is a fine line between entitlement and helping out. Try to avoid being exploited.

Secondly, ask, “do I know how to do this?” If you do not have the expertise, then avoid the challenge. A poor job benefits no one.

Setting priorities helps to develop a set of responses, although not all situations are black and white. Trust



your inner voice that you are doing things for the right reasons. Some examples of these are included below.

Being a good citizen. While managing time is a prime goal, good citizenship is expected, too. Agreeing to laboratory, university and public duties is an essential part of the scientific and educational endeavor. Science is largely self-motivated and self-governed. We all need to take part, but you don't need to be a saint.

Responsibility. Faculty members, students, post-docs, teachers, researchers, and administrators have certain duties and responsibilities to teach, serve on committees, mentor and engage in public service. It is irresponsible to shirk these responsibilities, or to do such a bad job that you will not be asked to do them in the future.

Science is largely self-motivated and self-governed. We all need to take part, but you don't need to be a saint.

Career Advancement. Visibility and recognition of research activities and teaching are essential to move ahead in a career as a scientist. A career involves investment and sacrifice, such as agreeing to write review articles, giving research seminars, attending meetings, reviewing papers and grants, and getting involved in the activities of your school and professional societies. Be as selective as possible to achieve the most from the most efficient expenditure of time. Quality counts more than quantity.

Interest. Define your specific interests when setting priorities. If you are passionate about encouraging girls to get interested in science, mentoring graduate students, or interacting with politicians, then say "Yes" to

activities that have these goals, even at the expense of other requests.

Why to Say "Yes"

Analyze why you say "Yes." Do you agree to do things for the wrong reasons? Here is a small set of examples:

Flattery. Are you seduced into saying "Yes," because you are told that you are the only one who would do a stellar job? Are you flattered to be asked to give a lecture by a caller who tells you how wonderful your last article is, and how only you will make their lecture series complete? Perhaps you are approached by an old graduate school buddy to review a grant, manuscript, or college program because you have the unique and perfect qualifications to do a good job. Accept the compliment graciously, but do not agree to the flatterer's request as payment for the praise. Recognition that is only of value as a commodity is not worth the paper it is written on.

Are you flattered to be asked to give a lecture by a caller who tells you how wonderful your last article is, and how only you will make their lecture series complete?

Criticism. This is just as effective as praise for getting people to do things they do not want to do. The hint that someone is not a dedicated teacher or a sensitive mentor lowers self-esteem and coerces others into making a commitment for fear of offending someone. Take time to evaluate your imperfections, the source of the criticism, and its intent before agreeing to do something.

Desire for approval. Do you say "Yes" to teaching an additional course during a semes-

ter off for research, or sitting on twice as many committees as your colleagues, because the department chair will approve of going beyond the call of duty? The problem with saying “Yes” for approval is that soon those extra tasks become an expectation. When you take on more tasks to show how indispensable you are, you eventually burn out.

The problem with saying “Yes” for approval is that soon those extra tasks become an expectation.

Intimidation. Do you say “Yes” to unreasonable requests out of fear for your professional life? For example, do you do extra shifts, postpone a planned vacation to do another set of experiments, show up at a meeting or revise the curriculum at two days’ notice because the requester hints that if you don’t you will not get a merit increase, a good letter of recommendation, or a positive recommendation for tenure? Insecurity makes people do unnecessary things out of fear of offending a supervisor.

Avoiding conflict. Too often people say “Yes” to avoid conflict at all costs. They end up being a de facto martyr, and see themselves as powerless to change their lives, time management, space, or salary.

Greed. Do you agree to teach a course in the summer rather than taking the time to do research or write a paper, because you will get paid extra? Do you say “Yes” to give a lecture at a boring meeting, because they will give you a large honorarium? There is nothing wrong with being self-serving so long as it is not at the expense of something more important in the long run.

Picking up the slack. Do others take advantage of your inability to say “No” to dump unpopular tasks on you, such as clearing out 50-year-old department files, or

teaching a third introductory course so that the department does not have to hire another lecturer? If no one else is willing to do these things, perhaps they are not worth doing.

Don’t be manipulated because others are irresponsible with their deadlines. Resist the temptation to do other peoples’ work because they are chronically late, or do such a poor job that they appear to be incompetent and will not be asked again.

Guilt. If you feel guilty about having gone on vacation, taken a sabbatical, taken parental leave, or made a mistake, wait until the guilt subsides before committing to any additional responsibilities.

Resist the temptation to do other peoples’ work because they are chronically late, or do such a poor job that they appear to be incompetent and will not be asked again.

When to Say “No”

Saying “No” is essential to achieving your personal and professional goals. It is an indication that you value your time, energy, talents and experience, and that you control your life. Striking a balance between enjoying life as a cell biologist and resenting the demands put upon you is essential to personal and professional empowerment.

Saying “No” can be a right or an option. You have the right to say “No” if you have questions about the ethics, professional standards or quality of the request. You have the right to invoke your conscience in making decisions. You have the option of declining career-building duties, if the timing is wrong, you can’t do a good job, or meet a deadline.



Your priorities are critical factors in saying “No”. It is essential to have plans for achieving goals. It helps to make a list of everything to which you say “Yes” and “No” over a month or year to evaluate how you are doing. Once a pattern emerges, begin planning for a year, five years, a career.

Once you have learned to say “No,” avoid using your newfound assertiveness as a weapon to refuse to do tasks with sadistic glee. This can boomerang.

How to Say “No”

Learning to say “No” is not negativism. It actually frees you to say “Yes” to the things that really matter. It is essential to make choices. There is a world of difference between knowing what you do not want to do and refusing to do it, and knowing what you want and going for it. Get advice from friends and colleagues that seem to have their priorities right.

Using “No” is more powerful in declining than saying, “I don’t think so.” It helps to practice saying “No” to friends, family or labmates. If you resent always doing the ordering, replenishing the photocopier paper, or taking a speaker out to dinner, then take a stand and say “No!”

Determine whether the answer is, “No”, “Yes” or “Maybe.” It is OK to ask for time to think it over. Ascertain exactly what the request entails. Is one lecture or a whole course needed?

While it is not necessary to offer an explanation for your refusal, it is often useful to give a brief legitimate reason for saying “No”. Avoid a long, drawn-out excuse or explanation, or you may be argued out of your refusal.

You can say “No”, while agreeing to do part of the request.

Offer alternatives by suggesting someone else to do the work, or giving a student or fellow the chance to give the talk or write the review. However, be careful that super-
vising the substitute is not time-consuming.

Don't feel guilty. It is not up to you to solve everyone's problems or to do everything.

Sometimes, saying “No” actually postpones saying “Yes.” Maybe you can’t do it now because of your teaching schedule, but you can do it next semester.

Be prepared for people who do not want “No” for an answer to have difficulty getting the point. If the person persists after several “No” answers, try silence, or change the subject.

If you feel that you are being manipulated or volunteered, verbalize your desire to be consulted first.

It is OK to change a “Yes” answer to a “No” answer.

Finally, don’t feel guilty. It is not up to you to solve everyone’s problems or to do everything. ■

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Unwritten Rules for Advancing Your Career



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Unwritten rules: those tidbits of information that can make or break a first impression or a reputation. How does a cell biologist discover the unwritten rules of an organization and protect and ensure their career advancement by fulfilling unstated expectations? Following are some of the most common unwritten rules and advice on how to address them:

Mentors Are Key Sources of Information

It may seem that the role of mentors as the panacea of a scientist's career is exaggerated, but they truly are important figures. Most successful people, no matter from what field, can name at least one person senior to themselves who was instrumental in their success and with whom they have had a long-term relationship. But a mentor does not have to be narrowly defined, nor represent an exclusive relationship. Mentors are those individuals in an organization that have the "necessary" knowledge. Seek out colleagues to discuss scientific matters, such as how much unpublished information to reveal to a competitor, as well as more mundane but still important matters, such as how to dress for an invited seminar.

Meeting Expectations

The first unwritten rule is 'do not expect the written rules to cover everything.' Young scientists should meet regularly with their supervisors to assess their progress. Ask for constructive criticism and advice. In an academic environment, it may be important to clarify how many publications (and in which types of journals) are necessary for tenure or promotion, or how much time to devote to service at the institutional and national level. In addition, teaching is usually taken seriously, even at institutions with a heavy emphasis on research productivity for promotion.



If the written rules at an institution seem to be in a state of flux, the junior scientist is compelled to be in frequent communication with supervisors and other more senior scientists. Obtain clearly stated guidelines for advancement that can be referenced at promotion time. These should be available in writing as they are indeed the written rules. Get a copy of them.

Obtain clearly stated guidelines for advancement that can be referenced at promotion time.

Promote Yourself

Junior scientists must take steps to promote themselves, or no one else will. However, there are ways to accomplish self-promotion without offending others by being overly aggressive or compromising your own personality. When an opportunity arises for an award, membership on a prestigious committee or even a choice class schedule, approach the individual making the selection with a document delineating your credentials, qualifications and accomplishments that make you an attractive candidate. Mentors can be extremely helpful in this situation by advising a young scientist about what opportunities to pursue and speaking to selection committees on behalf of their protégé.

Territoriality

Never assume that ideas, space or equipment have common ownership. The microcentrifuge in the third floor cold room might belong to the senior research scientist on the fourth floor. The empty shelf in that same cold room may have been cleared by the chair's graduate students to store precious clinical samples arriving the next day. If a colleague shares unpublished data, ask permis-

sion before citing it in your manuscript. Always ask before acting: a reputation as a trusted colleague may depend on it.

Managing Employees and Students

Most scientists are not trained in management techniques, so learning skills to manage students and staff may feel like trial by fire. However, classes and books on general management skills that apply to any work situation are easily available. The most efficient way to learn management skills may be to observe and speak with scientific and busi-

There are ways to accomplish self-promotion without offending others by being overly aggressive or compromising your own personality.

ness colleagues who appear to have admirable management styles. From these discussions, young scientists need to develop their own standards and expectations for their employees that are then stated and written clearly and reinforced frequently. Be aware that students and staff may not have

Most scientists are not trained in management techniques, so learning skills to manage students and staff may feel like trial by fire.

the same career goals as their supervisors, so their expectations may need to be determined as well. These are essential skills for a scientist, since one's career advancement is often

directly proportional to the productivity of staff and students.

Conflict Resolution

Like management techniques, conflict resolution is an essential skill for which scientists are not trained specifically. Books or workshops on conflict resolution are available, but a few simple rules may be enough to defuse most situations. Use time, space and/or humor to place distance between dissenting

Young scientists would be wise to choose their battles carefully to avoid being labeled contentious.

individuals. Obtain another perspective of the problem by speaking to someone who is familiar with the individuals. If necessary, bring in a neutral party to help resolve the issue. Young scientists would be wise to choose their battles carefully to avoid being labeled contentious.

Use All Available Resources

Secretaries, administrative assistants and staff members of an organization are often vast storehouses of information. They can often help with questions about the general

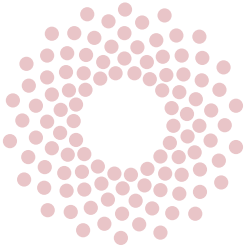
atmosphere of a department, appropriate dress or behavior, personalities of other organization members, and what senior peo-

Secretaries, administrative assistants and staff members of an organization are often vast storehouses of information.

ple can “get away with” while junior people cannot. For questions that are too sensitive to broach with local colleagues, speaking to mentors at other institutions by phone or e-mail is an excellent solution. In addition, the internet may be a quick way to obtain information about management or conflict resolution skills, to name a couple.

Although mastering the unwritten rules of scientific society may seem daunting, the key is identifying the few individuals with the most information. After this, mastering the written rules will seem like a piece of cake! ■

This article was based on a Women in Cell Biology Committee presentation of “The Unwritten Rules” at the ASCB 40th Annual Meeting in San Francisco in December 2000. Caroline Kane moderated the session, which featured Mina Bissell, Frank Solomon, Julie Theriot and Donella Wilson.



2. TEACHING & LEARNING

The Scholarship of Teaching

Teaching Science in High School

Getting the Most from Your Graduate
Experience

The Scholarship of Teaching



Christopher Dobson
Front Range Community College

New faculty members commonly make their instructional debut by diving head-first into teaching, with little formal training or preparation in pedagogy, to either sink or swim. Naturally, many instructors adopt a teaching method based primarily on how they were taught as students. This seems reasonable, but is it effective?

Although effectiveness as a teacher is difficult to measure, any such measurement should be based on its impact on student learning. The central importance of learning was highlighted in the seminal article, “From Teaching to Learning—A New Paradigm for Undergraduate Education” (1995), and more recently in the national videoconference, *Tools for Transformation: Making the Learning Paradigm a Reality* (1999). The purpose of both was to advocate systemic change at a national level that would place the focus of educators on learning.

Effectiveness as a teacher is difficult to measure; any such measurement should be based on its impact on student learning.

Many instructors attempt to improve their teaching over time by adopting ad hoc pedagogical techniques. But without systematic and purposeful implementation, an individual’s teaching method may not change significantly over the course of a career. While instructors often measure their teaching effectiveness by the successes of their students after graduation, some students may succeed in spite of our teaching, not because of it.

Instructors at all levels need a formal and comprehensive treatment, a scholarship of teaching, with the



ultimate goal of increasing student learning. In addition, educators need a working model that they can use to guide their professional development in a systematic and purposeful manner over the course of their careers. Such a model must be general enough to encompass as many aspects of teaching as possible, yet specific enough to have practical value.

Without systematic and purposeful implementation, an individual's teaching method may not change significantly over the course of a career.

The model presented here is based on the concept of scholarship defined by Ernest Boyer in *Scholarship Reconsidered: Priorities of the Professoriate* (1990). Boyer's development of scholarship, however, was in relation to discipline-specific research, rather than teaching per se. Our model embraces three distinct yet overlapping elements that coalesce to form the body of one's teaching. These elements are a scholarly approach, rationale and classroom practice. In brief, successful teachers have a rationale for their teaching methods, based on an adequate knowledge of their discipline and pedagogy that translates into effective classroom practice. The scholarly approach, which consists of a mindset that compels a persistent exploration of one's teaching, serves as the mechanism that continues to inform an educator's rationale and classroom practice over time. It is the most central and cohesive element of the model.

Traits that characterize the mindset of a scholarly approach include inquiry, reflection and receptiveness. Inquisitive scholars continually question teaching methods with the purpose of improving student learning. They

actively reflect on their teaching, openly inviting constructive criticism from peers. Scholars are receptive to new ideas and demonstrate a willingness to try new teaching techniques.

Traits that characterize the mindset of a scholarly approach include inquiry, reflection and receptiveness.

This scholarly mindset drives an exploration of one's teaching through activities, such as discovery, integration, application and interaction. Discoveries germane to teaching can be made through classroom observation, experimentation and assessment, as well as through activities, such as reviewing the literature and attending conferences. Scholars integrate the results of this exploration with their knowledge of pedagogy and apply their findings to future teaching methods in the classroom. Scholars share their discoveries by interacting with colleagues through discussion, publications and presentations.

Since teachers are unique individuals, success in any component of our model is relative, and subject to continual refinement. Serving as a road map, the model can guide an educator's professional development by targeting specific components of the model for development.

The scholarly approach is not new. Academic researchers typically employ a scholarly approach when contributing to knowledge in their field. They are inherently inquisitive and reflective about their study subject, engaging in various methods of discovery, integration, application and interaction. Readily apparent in the sciences, researchers regularly investigate the causal

relationships of natural phenomena. During this exploration, it is essential that researchers be receptive to new ideas and demonstrate a willingness to modify their methods as needed. Integration of findings with an existing understanding of their field and application of this product is crucial in realizing the larger implications of their work. Interaction with colleagues through publications and presentations is the natural culmination of their efforts.

Teachers can approach the classroom as researchers and attempt to assess the effectiveness of both their teaching and their impact on student learning.

The scholarly approach, typically seen in research, can be directed with the same rigor to developing aspects of one's teaching rationale and classroom practice. For example, teachers can approach the classroom as researchers and attempt to assess the effectiveness of both their teaching and their impact on student learning. Based on this evaluation, educators can modify both their rationale and classroom practice accordingly.

Some students may succeed in spite of our teaching, not because of it.

By practicing a scholarship of teaching, educators can accumulate a number of teaching strategies, each based on sound rationale and intended for specific learning situations. Over time they acquire a portable toolbox of pedagogical methods and the ability to discern opportunities for employing various techniques. In other words, they become excellent classroom practitioners whose methods are prescribed by a rationale based on a sound knowledge of their discipline and pedagogy, which is tested and strengthened over time by a vigorous scholarly approach. ■

Sharolyn Belzer and Stephen Burton were instrumental in the development of this model.

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Teaching Science in High School



William Wallace
Georgetown Day High School

A cell biologist has the special opportunity to present science as a living discipline to a high school biology or chemistry class. The experiences of designing experiments, interpreting results, writing papers, and applying for grants are unique qualifications that will enrich the understanding and appreciation of science for a biology or chemistry student. Students will benefit from a teacher who can teach science as a process instead of a simple collection of facts.

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Why Would a Scientist Want to Teach?

Abstractly, the intellectual challenge is to present biology as a unified view of the world, and as an ongoing process of inquiry. This view includes presenting “big pictures” of such diverse concepts as ecology, evolution, physiology and molecular biology. However, even more important is to guide the students toward an understanding of the connections between each of these disciplines. The students are more likely to remember these connections than the specific facts of any one topic. In addition, there is the challenge of teaching students to think skeptically, like a scientist, through the scientific method.

On a personal level, teaching can be tremendously satisfying for the academic and personal effects that a teacher can have on the development of a student. The simple fact that they have done science gives any scientist-teacher a number of unique advantages. First, being a participant of the discipline of biology, a scien-

tist brings a certain enthusiasm for the subject that will infect the students, especially if it is a topic that he or she actively researched in the laboratory. Second, the scientist will have a greater credibility for any point of view. The

Nothing impresses a student more than to discuss personal experiences with a scientist who is introduced in a textbook.

speculation of a scientist-teacher has great weight even if it is a profession of ignorance. Third, a scientist-teacher can make a topic come alive with anecdotes from his or her own career experiences. Nothing impresses a student more than to discuss personal experiences with a scientist who is introduced in a textbook. Students love to hear of the foibles of scientists, especially famous ones. Great lessons can be taught about the process of biology through such anecdotes. Finally, a scientist-teacher has spent a career making a network of friends, colleagues and mentors that can be exploited for the benefit of students. These connections can be used as potential research hosts for motivated students or as expert speakers for the whole class.

What Is it Like to Teach?

For the first few years, teaching requires a similar time commitment as does research. This time commitment includes actual contact time with students (both in and out of the classroom), preparation for classes and assessments of the students. However, the manner in which teachers organize their day differs from research because they are obligated to be prepared and present a lesson at set times during the day: they do not have the

Teaching can be tremendously satisfying for the academic and personal effects that a teacher can have on the development of a student.

freedom to start an experiment or write a manuscript when they roll into the lab.

Generally, a high school science teacher has four or five classes (a total of 60 to 150 students, depending upon the school) in two or three different levels (called “preps”). Scientist-teachers need to fight the urge to present every lesson as a seminar. In fact, talks with slides should be avoided. Instead, introduce the topic and then have the students take over the discussion. It is amazing how relatively little time a teacher needs to talk. The teacher does need to become an “expert” in a wide range of various topics, such as ecological succession or punctate equilibrium, so that they can be sure that the students extract the important points from each of these concepts.

It is amazing how relatively little time a teacher needs to talk.

In addition to teaching classes, the obligations of teachers include contributions to the community of the school. This obligation can include coaching sports, drama or sponsoring a club. It is an important part of the teacher’s job to make this commitment, even if the school does not officially require it. So a typical day will start at 7:00 AM and finish around 5:00 PM, excluding any after-school activities such as sports or clubs.



Three other important reasons to teach are June, July and August. The summer is an amazing time for possibilities, academic or otherwise. It is surprising how enjoyable it is to work in a research lab during this time without having to produce any papers.

Three other important reasons to teach are June, July and August.

The starting salary for a teacher varies with experience and level of education. In the Fairfax, Virginia public schools, a starting teacher with a Ph.D. can earn about \$40,000 annually (slightly less with a Master's degree), while in private schools the salary will generally be slightly lower.

How to Get a Teaching Position

The application process in private schools is different than in public schools. Private schools have greater flexibility to judge the qualifications of each teaching candidate. Therefore, applying for a teaching position in private schools is much less complicated. A candidate can simply send a letter of interest and an accompanying resume.

Public schools require a more complicated application process because they require teaching certification. Each state has its own qualifications for determining certification. Myra Thayer of the Fairfax County Public Schools states that the certification process examines competence in both science content (for example, an understanding of all the concepts of biology) and pedagogy (teaching skills). While scientists will have less difficulty in proving competence in science content (although a cell biologist will need to know a more diverse view of biology, such as population ecology and evolution), usually they

will need to take classes in educational techniques. Completing the necessary classes takes approximately four semesters, and includes topics such as child psychology and instructional methods. Perhaps most important, classes will include a teaching internship with a master teacher in a local school. Many public school systems work closely with local colleges to offer an education program that is certifiable in that school district. For example, the Fairfax schools cooperate with George Mason University, which offers classes in the evening to interfere as little as possible with a candidate's day job. Eventually, a competence test (called a Praxis Examination) must be passed for certification.

Public school systems are generally willing to give selected candidates who are not yet certified provisional contracts that last three to five years. These contracts allow the scientist to begin teaching immediately under the provision that the scientist will undertake the education program for certification in the first years of teaching.

How to Get Started

As an applicant for a teaching position, any school system will be looking for experiences with teaching. An application from a scientist should emphasize a commitment to teach. The number of publications and grants will not impress a school system. Instead, a resume needs to show experience in teaching high school students, and an interest in educational issues.

There are numerous opportunities to gain experience teaching biology to high school students. For example, a scientist can talk at a local school — this obligation is very small. As long as the scientist makes an earnest effort to reach his audience (i.e. do not present your most recent research seminar), no matter what is presented, the students will be grateful. A slightly greater obligation is to

mentor a student through a research project in the laboratory. This mentorship should be an active intellectual involvement of the stu-

The satisfaction of having a former student return to tell you she is becoming a biologist because of your teaching matches the thrills of an acceptance letter from Nature or a positive pink sheet for an NIH grant application.

dent in the research, not simply having the student “shadow” in the lab. The project should include a beginning (framing a biological question and hypothesis), a middle (performing the experiments to test the hypothesis), and an end (writing a report that summarizes the entire project). The student does not need to win the Nobel Prize with the project, nor even produce a publication, but it is cheating the student if a project

does not contain these elements. Other ways that a scientist can get experience teaching at the high school level include helping a local school system with the biology curriculum, or teaching a course in contemporary methods in cellular or molecular biology for high school teachers.

Local schools (public or private) are always interested in taking advantage of the experiences of scientists to teach. For private schools, it is easier to talk directly with principals or science department chairs, while in public schools, administrators (such as curricular specialists) will be the initial contacts. These officials can be used as sources of information and advice for an application. Take advantage of their knowledge and willingness to help.

Teaching high school is a wonderful way to use your research experiences to influence a child’s life. The satisfaction of having a former student return to tell you that he or she is becoming a biologist because of your teaching matches the thrills of an acceptance letter from *Nature* or a positive pink sheet for an NIH grant application. ■

Getting the Most from Your Graduate Experience



Leana Topper
University of North Carolina
Chapel Hill

The foundation of a good scientist is built in graduate school. Although at the time progress can seem painfully slow, scientists often look back over their graduate years and consider how quickly the time passed. By taking advantage of the many opportunities during graduate training, students can become well-rounded scientists, and potentially avoid regret in later years. Following are suggestions to make the path through graduate school less rough and more rewarding.

The Technical Challenge

Unlike graduate students in the humanities, who are required to propose a thesis for admission, graduate students in the basic sciences usually have the opportunity to complete several laboratory rotations before choosing a thesis advisor and designing a project. These short periods of research in various labs allow students to gain knowledge of diverse techniques, to build a strong foundation for bench work, and also aid in understanding the literature. Even after choosing an advisor, it is wise to learn as much as possible about a wide range of techniques that will be useful in a post-doctoral or first independent position. In addition, students with knowledge of diverse techniques are valuable sources of information for their training lab.

Organization

Organization is critical to maintaining sanity. Although the advisor is a graduate student's guide, the student is accountable for doing the background research and pushing the project ahead. Critical examinations of the published literature are essential to forming the framework of a project and keeping up with advancements in the field. It is impossible to read or plan too much. Short and long term organization will help determine and retain a clear direction for a project. Keep a calendar of experiments and other

preparations that need to be done a week in advance. Planning experiments on a daily basis will help to avoid frustration and indecision. Planning for the long term is more dif-

Keep a calendar of experiments and other preparations that need to be done a week in advance.

ficult and requires more flexibility, but can be as simple as listing which parts of a project should be accomplished in the next three months. Without clear planning, it is all too easy to lose direction and, as a result, a sense of self-worth.

Along with a plan to carry out the work, decide how to collect the data in an organized fashion. Proper documentation can pre-empt having to re-do work and serves as a potential reference for months, sometimes even years later, when a particular technique may again be needed. Planning for both the short- and long-term also teaches prioritizing skills—that will be useful later in juggling the many responsibilities of a career.

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Getting Involved

Most graduate programs have some type of student organization. For departments without this type of council, students can speak to faculty and the department chair

about forming one and funding it. Students with access to this resource should use it. The academic gatherings provided through this type of organization offer a forum to give presentations and an opportunity to ask questions in an atmosphere that is more relaxed than a typical department seminar or meeting presentation. Also, discussions among peers help hone critical thinking and scientific thinking skills. These groups may also sponsor social events—a great way to build friendships. The best support during graduate school will most likely come from peers. Moreover, classmates can be valuable allies in the future.

Discussions among peers help hone critical thinking and scientific thinking skills.

Mentoring

The thesis advisor is considered a graduate student's principal mentor, so it is imperative to develop a good working relationship with the advisor. However, the members of a student's thesis committee can also be valuable guides. Do not wait for a committee meeting to discuss research directions or other concerns with committee members. In addition, faculty members both in and outside of the department may be excellent sources of insight and advice. Make appointments and visit them. Though it may be intimidating at first, overcome the fear of asking for help. Also, remember that graduate students are in a position to be mentors to other graduate students or to undergraduates who may be working in the department. Instructing others on techniques can expand the instructor's knowledge, while discussing thesis projects with others may rekindle excitement for one's own work.



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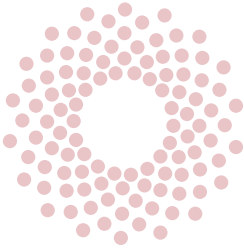
Networking

Meetings and conferences are significant opportunities to broaden graduate students' knowledge within and beyond their field of interest. Attend a meeting or conference each year not just to look at posters and listen to presentations, but also to step forward and

ask questions about the research presented. Don't pass up the timely chance to meet new people, discuss projects, and find answers to common technical problems. It is also an occasion to meet future post-doctoral advisors and potential employers.

Individual Initiative

Completing graduate school is a long and, at times, difficult adventure. Ask yourself what you expect from your graduate training and then make a plan for reaching those goals. Your project is unique, which means you must learn to think and act independently, take control, and accept the responsibility for the direction of your work. Doing so may lessen some of the worry and pain along the way to obtaining a degree, and build a strong foundation for becoming an exceptional scientist. ■



3. COMMUNICATION

Communicating Effectively in
Departmental Meetings

“And Our Next Speaker Is...”

The Unicorn in the Garden or Why
Cell Biologists Should Meet the Press

Communicating Effectively in Departmental Meetings



Maureen Brandon
Idaho State University



Virginia Allen
Idaho State University

Why are some individuals effective at promoting their projects, while other equally meritorious ideas are never advanced? How do you get your own innovative plans accepted and initiated by your organization? At least part of the answer may come from understanding the group dynamics of meetings.

There are many reasons why colleagues do not voice supporting opinions in a public forum. A few common ones are:

- They may need time to think about the idea before forming an opinion.
- They do not want to align themselves with the speaker.
- They want the meeting to be over.
- They are not paying attention.
- They are part of the group only to pad their resume or because it seems un-community-spirited to decline to serve but they never intended to participate fully.
- They are competing with the speaker for position or power, or have a competing proposal.

One successful strategy to counteract several of these problems is to solicit opinions or support from fellow group members before the meeting, either in person or by e-mail. This method allows others time to consider a proposal and formulate support — although it also carries an inherent risk of allowing time to formulate opposition. In any case, it is likely that when participants are aware of an idea prior to the meeting, they will pay closer attention when it comes up for discussion in a group. Compromises with competing individuals can also be addressed ahead of time, further increasing the chances of success. In general, this is a skill that men have developed better than women.



One successful strategy to counteract several of these problems is to solicit opinions or support from fellow group members before the meeting, either in person or by e-mail.

Another strategy to combat the natural attention loss during lengthy meetings is to volunteer to speak first at group meetings. Topics near the top of the agenda will get more attention because group members are more alert.

Women often hinder their ability to effectively communicate with a group by assigning themselves roles within the group. For example, some women view themselves in the traditional, passive role of the group facilitator, moving the meeting toward closure even if it means withholding their opinion. A related posture is one of preventing conflict, either because it is uncomfortable to the individual or because she takes opposing comments personally. In order to participate fully at meetings, women need to release themselves from these self-imposed roles. One of the best qualities that women can

One of the best qualities that women can bring to a group is the ability to admit mistakes and work to correct them.

bring to a group is the ability to admit mistakes and work to correct them. Women also tend to be better listeners. Without the full participation of women, group decisions may suffer due to the loss of these perspectives.

Another reason that individuals do not participate in group discussions is lack of self-con-

fidence or intimidation by the group. These individuals may find it easier to assert themselves if they accept that their position within the group was earned through their abilities.

Why should anyone express their opinions at meetings? One very important reason is

Some women view themselves in the traditional, passive role of the group facilitator, moving the meeting toward closure even if it means withholding their opinion.

that silence is usually viewed as approval. The group decision-making process may be the only opportunity to express opposition to or reservations concerning a decision. Without these comments, the group may be stuck with a poor choice for a very long time. An equally important reason to fully partici-

An individual who never supports fellow group members' proposals or never initiates their own programs is invisible in the group.

pate in groups is visibility. An individual who never supports fellow group members' proposals or never initiates their own programs is invisible in the group. This is especially detrimental for women and minorities seeking to gain acceptance in new fields.

Even if you have planned ahead, polled your group like a politician, and managed to place your program at the top of the agenda, do not wait for or depend on others to voice their support. Decide which mountains to climb and be prepared to climb them alone. The penalty for silence is powerlessness. ■

“And Our Next Speaker Is...”



Elizabeth J. Taparowsky
Purdue University

You have just received notice from the ASCB Annual Meeting Program Committee and discover that your abstract has been selected for a symposium presentation. Your initial reaction is one of joy, followed rapidly by feelings of fear or even panic as you envision yourself standing in front of several hundred people and speaking. You have many weeks to prepare, but your mind is racing — hoping that you will be able to generate new data, wondering how large the audience will be, and speculating on who may be in attendance at the session. You lie awake at night going over in your head what may happen — good scenarios and bad. You feel inadequate since you are convinced that public speaking comes naturally only to really good scientists.

Your initial reaction is one of joy, followed rapidly by feelings of fear or even panic as you envision yourself standing in front of several hundred people and speaking.

What you may not realize is that up to 80% of the general population (and probably the vast majority of speakers at the ASCB Annual Meeting) experience nervousness, trepidation, and anxiety at the prospect of speaking in front of an audience. Paradoxically, some experts believe that controlled nervousness and tension enhances public speaking performance. But, while you may find comfort in knowing that the fear you are experiencing is normal, it does not change the fact that you will be expected to speak! Is it possible to implement some strategies now that will help you control your nervousness and minimize the effect that this



...controlled nervousness and tension enhances public speaking performance.

physical and emotional state will have on the quality of your presentation? The answer to that question is ‘yes’.

First of all, it is important to establish if your fear of public speaking is a “trait” or a “state”. As defined by Rudolf Verderber in *The Challenge of Effective Speaking*, a “trait” is a relatively ongoing characteristic of an individual, while a state is the “state” of mind a person experiences from time-to-time. If you suffer from trait nervousness, all communication tasks you perform — laboratory meetings, teaching, even friendly conversations — are impaired by this fear. It is estimated that up to 20% of the population may experience trait communication nervousness, which may require formal attention from public speaking professionals in order to be controlled. If, on the other hand, you handle routine communication tasks with ease, then it is likely that you suffer from a state of nervousness, the possible negative consequences of which may be avoided with the following preparation strategies:

Select the Content of Your Presentation Carefully

Make an outline of your talk. The first outline you prepare is likely to contain more information than can be accommodated comfortably in the time allowed. Prune your data to include the best evidence to support your conclusions. Unless absolutely necessary, do not present experiments or procedures with which you are not thoroughly familiar or data from new experiments that may be preliminary. Likewise, do not use slides that con-

tain extraneous information. Take advantage of the technology available to make slides customized for your talk. Presenting clear, informative slides will benefit your audience, and it will make preparing and giving your talk much easier. On your slides, label data

...do not present experiments or procedures with which you are not thoroughly familiar or data from new experiments that may be preliminary.

with short, descriptive words. Numbering lanes on a gel may be suitable for a manuscript, but, when flashed on a screen, these numerals will convey nothing to your audience. More importantly, they will not function as a prompt for you during your talk. If your work involves a new or a modified technology, project a flow diagram of the technique as you are describing it verbally. Lastly, think about including a brief heading for each slide which will highlight the point you would like to make.

Prepare a Scripted Beginning and Ending to Your Presentation

Once the content of your presentation has been finalized, the next step is to write one or two opening sentences that summarize concisely the research question your data will address. These sentences should be scripted, memorized and typed legibly on a note card which will accompany you to the podium. Stage fright peaks at the moment immediately before you are introduced and it is not at all uncommon for you to “blank out” on the way to the stage. You can rebound quickly by having your introduction readily available. Once you begin to speak, you will calm

Stage fright peaks at the moment immediately before you are introduced and it is not at all uncommon for you to “blank out.”

down. The remainder of the talk should be organized around your slides and jotted down in outline form only. Do not attempt to write down and memorize the entire talk. However, prepare your conclusion in the same manner as your introduction, with one or two summary sentences written on a note card. This advance planning will insure that your ending will be strong and that you summarize to your audience exactly what you wanted to say.

Practice, Practice, Practice

Practice your presentation several times, alone and then in front of a group. Invite your labmates and friends to be your audience, but also invite colleagues outside your immediate field since they will be able to comment on whether you have successfully conveyed

... invite colleagues outside your immediate field since they will be able to comment on whether you have successfully conveyed your points to a general scientific audience.

your points to a general scientific audience. Hold your practice in a relatively large room, and have your audience critique the visibility, as well as the information content, of your slides. Make a conscious effort to speak slow-

ly when you practice, because you will surely speed up at your talk. The most effective speakers use a strong, expressive voice and speak slowly in order to allow their audience time to absorb the information they present. Another way to enable the audience to absorb the information is to insert pauses throughout your talk. Pausing will also provide you with the time necessary to recall your next slide or remember what you want to say next. Use your practice sessions with an audience to help you to prepare for questions, but do not spend too much time trying to predict questions and prepare answers. Your efforts need to be focused on the content of your talk.

Familiarize Yourself with the Room and the Audiovisual Equipment Ahead of Time

Sometime before your talk, visit the room in which you will be speaking and try out the laser pointer, microphone and visual equipment. Request a podium, if there is not one available. A podium provides an anchor for fidgety speakers and a physical barrier to lessen the feeling of being out there on the stage all alone. In selecting what you will wear on the day of your talk, make sure your clothes are neat and comfortable. You should not have to think of your clothes at all during your presentation. Far better to wear your old stand-by that you know will hold up to reaching and bending than to splurge on something new to make you look “great” only to learn on stage that it has a faulty zipper.

Implement Self-Calming Strategies Directly Before You Talk

There are a variety of techniques professional speakers use to calm those pre-presentation jitters and, as you gain experience in public speaking, you will find a routine that



works best for you. Make your trip to the restroom well in advance of your scheduled talk. Available to you on the podium should be a glass of water—without ice, because ice makes it harder to drink, the noise it makes may be picked up by the microphone, and ice can numb your mouth. A brief walk in the minutes prior to your introduction is very helpful, but often is not possible. As an alternative, while you are seated in the audience, engage in deep, controlled breathing. Close your eyes and visualize yourself giving a

Close your eyes and visualize yourself giving a great talk. Think about how wonderful you will feel once your presentation is over.

great talk. Think about how wonderful you will feel once your presentation is over. It is important that you think positively in those preceding minutes so that your nervous ten-

sion will work to your advantage during the opening segment of your presentation.

...public speaking comes naturally to only a rare few of us. For most, it is a skill that is practiced and developed over time.

The ASCB Annual Meeting is rapidly approaching. Some attendees will be speaking for the first time in front of a large audience; others will have spoken so many times they will have lost count! Sharing your observations and discoveries with your colleagues at professional meetings is one of the most rewarding components of a scientific career. However, public speaking comes naturally to only a rare few of us. For most, it is a skill that is practiced and developed over time. Welcome any opportunity you have to speak publicly and use your experience to develop a preparation strategy and communication style that works best for you. ■

The Unicorn in the Garden or Why Cell Biologists Should Meet the Press



John Fleischman
*The American Society
for Cell Biology*

There is a famous medieval tapestry in New York's Metropolitan Museum of Art of a great lady in a fantastical garden holding up a mirror to the unicorn reclining on her lap. Both are fascinated by what they behold. The tapestry is a riot of living things; flowers are intricately woven into her dress and all around the green hummock where they sit are rabbits, foxes, hounds and strange creatures in harmonious co-existence. That garden came to mind with the 2001 publication in *Nature* and *Science* of the complete human genome.

The revelation that an organism with only 30,000–40,000 genes could be as complex as a human being stunned biologists. But scientists, by and large, are delighted by unexpected discoveries: waking up last month as a member of a 30,000–40,000-gene species was for many of us like finding a unicorn in the garden. The unexpected makes the cellular garden that much more interesting to explore with new arguments to wage, new reputations to be made, and new fields to open.

The public, by and large, is either confused or annoyed. The confusion is understandable but the annoyance is dangerous.

However, the public, by and large, is either confused or annoyed. The confusion is understandable but the annoyance is dangerous. It has its roots in a belief that science doesn't know what it's talking about and that means it's out of control.

This dangerous annoyance is affecting cell biology. It can be seen in "hot button" political positions that render complex subjects such as genetically modified



organisms or stem cell research into two-dimensional cartoons. Beyond that, there's an impatience with basic biomedical research where the answer so often turns out only to be the next question. In this view, it's all tax money down the lab sink or a plot by money-hungry biotechs to sow Frankenfood or experiment on defenseless worms.

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As a cell biologist, you can shrug this off and get back to the lab where real people understand what's at stake. Or can you? Sadly, the more complex, the more powerful, and the more unexpected cell biology becomes, the more dangerous it is to keep it in the garden like a unicorn on a rope. You have to get out there. You have to explain that we all live in the cellular garden and that these are exciting times in research. That means you have to deal with the media.

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Unfortunately, much of what scientists believe about general journalistic coverage of science is true. It's inadequate, sensational and simplistic. Scientists are misquoted, their

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points distorted, and their work is presented out of context. Conversely, much of what science journalists believe about researchers is untrue: that most scientists are control freaks, personally possessive of what should be public knowledge, and so caught up in specifics that they can offer no context to outsiders.

It can be rough, but as a practicing cell biologist, you need to be out there. The ASCB's Public Information Committee believes that cell biology is too important to leave to cell biologists alone. We must illuminate our science before a wider audience. We must raise the level of biology literacy in the media, in government, and in our schools. We must widen the circle of informed public discussion.

For most researchers, their first professional contact with the news media is when they publish something startling that's considered news. Often it's not their most important paper that attracts the press calls but the quirkiest one. They have demonstrated something interesting in mice and the press jumps on the "mice get X" angle, missing the whole point. Or do they? Journalists are constantly looking for an "angle" or a news peg to "sell" a particular story to their editors or producers. An angle can also draw a general reader into a difficult science story. More readers (and editors) know mice than know intracellular signaling. The mice, though, can be reader-bait, at least in the hands of a skilled reporter who understands the real significance of a paper.

Making the reporter understand is your job. You need to be able to tell a reporter or an assignment editor what your paper means in the larger context. That goes against the grain for many scientists. In writing for journals, young scientists are drilled in the professional aesthetic of understatement and minimizing implications. If your lab did stumble onto the fundamental mechanism that causes ALL cancers, the title of your paper to *Science* is the last place you would mention that.

Cell biology is too important to leave to cell biologists alone.

Still if your work has significance, try “selling” it first to your institution’s public information office with a brief one- or two-paragraph “take away message.” Send it along with the text of your paper and send it as soon as possible after you get an acceptance and a publication date. Public information officers can embargo a paper until publication but they need time to write a press release and distribute it. Convincing your public information officer that your paper has news value is the first step in finding out what you want to say to a journalist or the Rotary Club. Don’t hype a tiny paper to death but good work has implications.

Journalists come in all shapes, abilities and deadline schedules. Even science reporters cover a wide range of topics from day to day so don’t assume that a writer from a big name outfit will have background in your field. Don’t talk down but be prepared to get basic. Get the reporter a copy of your paper to read before the interview. If there’s an up-to-date review of the literature in print, get a copy of that. If your previous papers will help, have them on hand.

Most journalistic organizations have a strong taboo against showing a subject a

story before it appears or goes on air. Yet writing about a complicated science subject on a short deadline is difficult and experienced reporters know how easy it is to make mistakes. Believe it or not, they don’t like making mistakes. Help journalists to be accurate without being threatening. Offer to read a draft for factual errors. Offer to listen to the reporter read back quotes or individual paragraphs. Offer to listen to a paraphrase of the story. Offer corrections or further explanations in a calm voice. Remember also that editors and news producers come behind the reporters. Stories will be edited. Film will be cut. If the final result is, in your opinion, a mess, see if you can salvage something, a relationship with the reporter for the next story or an offer from an editor to submit an opinion article to the Editorial page.

You want to be the name in a reporter’s Rolodex that rings the bell, the expert who’s willing to comment, or the scientist who may not know a specific answer but can steer a journalist to someone who does.

Being in the news will help prepare you for your next assignment—shaping the news as a public scientist. You want to become what the PIC calls “an unusually reliable source.” You want to be the name in a reporter’s Rolodex that rings the bell, the expert who’s willing to comment, or the scientist who may not know a specific answer but can steer a journalist to someone who does. You want to contribute to Editorial pages or serve as a “talking head” on Sunday morning. You want to find out if

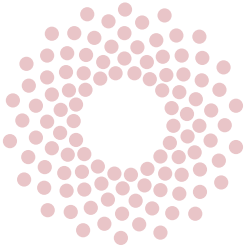


your local newspaper has a science or medical writer (and sound deeply shocked if you are told that they do not). You want to introduce yourself to the editors or TV news producers who coordinate science/health coverage and convince them that a big amorphous “national” story like the human genome has a local angle and a local face. That face does not have to be your face. Suggest names and numbers.

Talking on science policy issues requires support. Consult websites such as the ASCB’s

that has the Society’s statements and backgrounds on such issues as stem cells, fetal tissue and genetically modified foods.

There’s professional danger here and a fair amount of thankless work. You can be misunderstood. You can be ignored. But there’s an even greater danger in biologists speaking only to other biologists. We can make great and unexpected discoveries in the lab only to discover that the world doesn’t recognize a unicorn when it sees one. ■



4. MANAGEMENT

A Crash Course in Management

Designing Productive Lab Meetings

Some Tips on Successful Negotiation

A Crash Course in Management



Elizabeth Marincola
The American Society
for Cell Biology

Most people who are managers — those who are responsible for the supervision of people, money and/or other resources — have not been formally trained in management. Many untrained managers rise to the challenge successfully. Harold Varmus is a stunning example of an untrained manager who served a spectacular tenure as Director of a \$15 billion, 16,000-person federal agency, having never managed anything more extensive than his own lab.

But every successful manager has learned lessons along the way. Here are some to consider:

Don't Act, Ask

The first thing a new manager should do, even before the first day on the job, is to draw out those who are already there. Ask the previous manager what his greatest contribution and biggest mistake was; ask current employees what they like and dislike about the environment; ask the clerical staff how operations can be improved; ask the supervisor for her expectations; ask the grounds keepers for a good route for a walk and about security concerns. Collecting this important information has the added benefit of signaling that the new manager values others' opinions.

Don't take immediate action. If it is clear that changes should be made, for example in personnel, ask several people in the organization for their advice before doing anything. Even after building confidence and experience, asking others for advice is rarely harmful and always helpful, if it is considered seriously.

Sincerity and Equity Are More Effective than Flattery and Favoritism

The most enduring working relationships are those built on honesty and consistency. It is tempting to give into insecurities by pandering to others, but the loyalty it may engender is fickle. Be quick to note when others



have done good work, but don't feel that each day must be started by making the rounds telling people how nice they look or inquiring about their children or pets. People can smell insincerity quickly. They respect those who respect their own time. In a professional setting it is better to be respected than adored; to be trusted than everyone's best friend.

It is tempting to give into insecurities by pandering to others, but the loyalty it may engender is fickle.

Be Specific in Your Criticism

If someone makes a mistake or produces poor work, it is the manager's responsibility to let him know it and why. First, look for aspects of the work that can be praised. Compare the work to assignments produced by the same person that were done better. Praise publicly, but criticize privately. Criticism should be clear and helpful, not punitive. Do not generalize criticism: stick to the actual mistakes made in the case at hand. Do not apologize for having to confront someone with their weaknesses: it is not only the manager's job, but she is also helping colleagues improve, which is to everyone's benefit.

Don't Apologize

Perhaps having internalized the traditional subordinate mother's role of an earlier generation, women in particular often have a hard time asking people to do something for them, even if it is the person's job, such as with a secretary or assistant. "Please" should be used abundantly, but "sorry" should be used sparingly. For example, "would you

please copy this paper for me?" is more appropriate than, "I'm sorry, would you mind copying this paper for me?" if it is indeed the person's job to perform such tasks. "Can you do me a favor and...?" is another form that should be avoided (unless it is a favor, e.g. something personal). Many women are so used to being apologetic about

Praise publicly, but criticize privately. Criticism should be clear and helpful, not punitive. Do not generalize criticism: stick to the actual mistakes made in the case at hand.

managing other people that they are not even conscious of this terminology, which weakens them.

Drive Your Own Priorities

There is not necessarily a correlation between how insistent or anxious people are for the manager's attention and the importance of their projects. Give your attention to what is most important, not what (who) is loudest in demanding your attention. An exception to this rule is if a quick review by the manager will allow an entire production process to move forward. Managers who are over-responsive to the most insistent demands will not be able to effectively achieve their most important objectives.

Let Others Look Good

Resist the instinct to be jealous of colleagues. If the organization (lab, department, company) looks good, everyone looks good. Encourage junior colleagues to give a paper,

make a presentation, serve on a committee or author a memo when appropriate. One person cannot pretend to be as knowledgeable about each aspect of an operation as the sum of all the others. This also satisfies the employees' natural need to be recognized for their own work, contributing to the retention of valuable people.

One caveat, though, is that the manager will ultimately be held accountable for the work of others. Allowing others to take the credit they deserve does not extend to relinquishing involvement and control. In the end, the manager is accountable for the quality of work.

Women in particular often have a hard time asking people to do something for them.

It's the Money, Stupid!

In almost any work environment, whether or not the purpose of the organization is to make money, the bottom line is... the bottom line. Be certain that the financial aspects of risky and/or creative projects are fully analyzed in advance. Storms are weathered much more successfully if detractors cannot say, "and besides, look at the money she's lost us!"

Penny Wisdom is Pound Foolishness

Pay people what they're worth within the constraints of the organization. In reviewing salary, the guiding principle should be how badly hurt the organization would be in the long run if the person in question were to leave. For service and knowledge industries, employees are the most valuable assets of an organization. Turnover is expensive in training, lost productivity, and the uncertainty of being able to recruit a replacement effectively.

Negotiate for the Long Term

In negotiations, leave something on the table. The most successful negotiations leave all parties feeling they have "won." Decide which variables are most important and concede something of the others. For example, an offer of a lower starting salary to a new employee may be made more attractive by a flexible start date or a travel allowance. Always assume an ongoing business relationship with negotiating partners.

Set an Example

Acknowledge mistakes, and apologize for them. Work hard. Perform beyond the level expected of employees. Start meetings on time to avoid a culture of tardiness and consequent lost time. Follow through. Actively defend subordinates when they have been unfairly accused. Have a sense of humor, especially about yourself. ■

Designing Productive Lab Meetings



Beth Burnside
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Science is not only about discovery; it is about communicating discovery. Lab meetings are training grounds for both. It is here that young scientists learn about the level of rigor necessary to convince colleagues of their results, and about how to behave and communicate effectively. This is accomplished by instructing students how to evaluate and present results, receive and deliver feedback, think on their feet, and respect the procedural boundaries and ethics of the profession. Ideally they will emerge from this process confident of their skills, but respectful of science and other scientists.

Science is not only about discovery; it is about communicating discovery.

The benefits of lab meetings are myriad. Presentations at lab meetings demand that each lab member step back to review accumulating data and justify their experimental plan. This process alone can produce important shifts in perspective and prioritization. The actual presentation can be even more useful depending on how skillful the lab group is at providing constructive feedback.

Effective criticism is a fine and delicate art; achieving it in lab meetings is challenging. It is crucial that every member of the lab group give honest feedback about the science and share any reservation about the validity or interpretation of data. The lab group is the “home team” who knows most about the subject. It is their job to ensure that the speaker gets a harder time at home than anywhere else. This function is critical to building confidence in a young scientist’s presentation skills. Everyone in the group should give and expect to receive this kind of feedback from all other lab mem-

bers. The content of the criticism should address both the science and the effectiveness of the communication.

Effective criticism is a fine and delicate art; achieving it in lab meetings is challenging.

How the feedback is given is of paramount importance. Criticism must be directed at procedural or scientific issues. The challenge for lab members is to learn how to expose the weak points in the science and experimental detail without attacking the speaker personally. Sarcasm and condescension have no place in a lab meeting. Even a little of this will cause people to become taciturn and poison the cooperative atmosphere of a laboratory, enormously reducing its effectiveness and productivity. The principal investigator and senior people in the lab group serve as role models for group meeting behavior, setting the standards not only for rigor and ethics but also for manners.

The challenge...is to learn how to expose the weak points in the science and experimental detail without attacking the speaker personally.

The details of lab meeting organization are variable among labs, although several concepts recur. Food is crucial. Blood sugar and creativity must surely be associated. Attendance at lab meetings by all lab members is usually mandatory (possibly also correlated to food). The time period reserved for lab meetings is generally one to two hours,

but some presentations stimulate large group discussions which cause time limits to be ignored. Most lab meetings occur in conference rooms, but some groups meet in the lab. The lab setting allows the speaker to quickly retrieve additional data, demonstrate a unique piece of equipment or experimental arrangement, or view a computer image.

Most principal investigators plan some combination of regular short progress reports and less frequent formal presentations which include literature review, research strategy, and critical evaluation of results. The progress reports keep the group informed of

Food is crucial.

each member's progress, and permit feedback critical to keeping the research strategy on track. Formal presentations provide an opportunity for maturing scientists to hone their speaking skills. Often the formal presentations occur in group meetings shared with another laboratory with similar interests. This permits speakers to practice within a strict time limit in front of a larger group. Some groups alternate these two types of meetings from week to week: one week with data presentation, in which each lab member uses five to fifteen minutes to briefly discuss their successes and failures, followed the next week by a journal club presentation or comprehensive research presentation by one speaker.

For progress report presentations, speakers use prepared overheads or slides to present actual data. If no experiments have been done since the last presentation, the speaker can present future plans, ideas, or hypotheses. Some principal investigators require the speakers to write a summary of the presentation and distribute it to lab members before



The lab group is the “home team” who knows most about the subject. It is their job to ensure that the speaker gets a harder time at home than anywhere else.

or at the meeting. This practice stimulates the speaker to organize data for presentation, allows colleagues to consider substance in advance and generates a written record of progress. Other principal investigators require annual or biannual written progress reports, complete with literature review, research progress, discussion, and future plans.

These are reviewed by the principal investigator, revised in response to the criticisms, then collected into a laboratory notebook.

These lab presentation notebooks or progress reports are important historical documents for the laboratory as well as helpful starting points for papers or theses.

Journal clubs are common adjuncts to regular research lab meetings. An analysis of a recent paper provides additional opportunity for young scientists to practice formal presentation. Journal clubs also keep the entire lab current with the relevant literature and provide an opportunity to practice critical evaluation of other scientists' observations and interpretations.

As integral features of the culture of academic science, lab meetings help train young scientists and push each laboratory toward optimal research performance. At the same time, lab meetings set the tone for each laboratory's style of doing science. An emphasis on discovery and constructive feedback in lab meetings can enhance everyone's effectiveness and productivity, and make doing science much more fun. ■

Some Tips on Successful Negotiation



Elizabeth Marincola
The American Society
for Cell Biology

There is much pop-wisdom associated with negotiation. For example, seating your negotiating partner in a broken chair or an overheated room, because increasing the other's discomfort is believed to reduce one's own perceived advantage. In contrast to this frivolous pseudo-science, basic, time-proven negotiating skills are important and useful across industries and a variety of personal and professional situations. Following are some basic negotiating tactics:

Recognize When to Negotiate

Take control of framing the negotiation. For example, if an employee receives a competitive job offer, determine first if the threatened outcome would be advantageous or disadvantageous to the organization. If the change would be mutually beneficial, even if the threat is just a gambit to gain attention, do not rise to the bait. Tell the

Do not assume that there is no room for negotiation or reconsideration just because a statement is declarative.

person that they will be missed. If, on the other hand, the threatened outcome is not beneficial to the organization, do not assume that there is no room for negotiation or reconsideration just because a statement is declarative.

Determine What the Other Person Wants

Often people assume that the "obvious" issue is the most important issue or even the only issue. For example, employment unhappiness is not always primarily about salary. It is often about title, reporting relationships, acknowledgment, independence, work



environment, or hours, even though the stated issue may have been about salary.

Often people assume that the “obvious” issue is the most important issue or even the only issue.

Add Value

Think about what changes will improve both positions. For example, occasional telecommuting may earn the employer greater productivity and the employee more freedom.

Learn as Much as You Can

Draw the person out by asking probing questions. Gather as much information as possible before reaching conclusions or proposing solutions. Imagine what the other person is thinking.

Do not interrupt the other person. Ask open-ended questions. The more a person talks, the more she reveals about herself, which will help clarify what concessions will be most valuable and/or what demands most reasonable.

Very few real-life situations are zero-sum games. The object is for everyone to come away feeling that they have gotten much of what they want.

Re-state the Other Person’s Position

Once a position has been described, re-state it calmly and impartially to the other

person. This strategy confirms that the negotiating partner has been listening carefully and offers the opportunity to correct misunderstandings. In addition, neutral construction reduces the other person’s defensiveness.

There Really Is Such a Thing as a Win-Win Negotiation. There Are Also Lose-Lose Negotiations

Very few real-life situations are zero-sum games. The object is for everyone to come away feeling that they have gotten much of what they want. Negotiating partners frequently have an ongoing relationship. Therefore, if every last concession is extracted out of one partner, the other partner may get more in the short term, but at the expense of resentment by the first. The long term cost may be unreasonable.

Take Advantage of Your Leverage, but Stay Within a Reasonable Range

The negotiating partner who has the upper hand can afford to be ambitious. But stay within a reasonable range. Everyone has their limit, and if a negotiating partner pushes beyond it, they may risk blowing a negotiation that had every chance of resolving to their advantage.

Concede Where Possible

What may come at a small price to one person could have disproportional value to the other. If small issues are conceded, the compromiser will be better positioned to demand compromise on bigger issues.

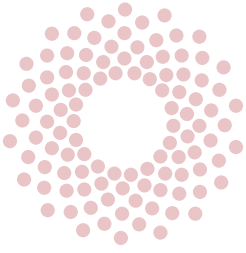
Do Not Personalize or Generalize

Avoid constructions such as “You always...”, “You never...” or “You’re so...”. Do not make comments about the other per-

son's style, habits or personality. Avoid all criticism if possible, personal criticism especially.

Everyone has their limit, and if a negotiating partner pushes beyond it, they may risk blowing a negotiation that had every chance of resolving to their advantage.

Although the examples discussed are set at work, good negotiating skills are essential for many aspects of life. Basic negotiating tactics are likely to be useful in personal as well as professional relationships. ■



5. LEADERSHIP

Creative Mentoring Strategies

Crossing to the Other Side

Dealing with Unstable Colleagues

Creative Mentoring Strategies



Christine H. Block
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All sports have a coach who guides the players, not only through the technical aspects of the game, but, more importantly, toward the goal of winning through strategic thinking. Likewise, success in science requires coaching. Early in a scientist's career, there is extensive formal education, with strong emphasis on didactics, technical skills and critical thinking. During this period, less weight is placed on the strategic aspects of the career. The maturing scientist moves into the next position, perhaps facing a novel requirement, like writing a grant to support their research. Suddenly, the mechanics of being a scientist must be learned in a crash course. Where was I when this was taught in school?, they ask. At this point, the junior scientist may seek out a coach for the specific situation, such as writing that first grant or addressing and rebutting a reviewer's comments, and the mentor-mentee relationship is born.

Where was I when this was taught in school?

Scientists, in general, are naïve in the practice of science as business. They think hypothetically and seek answers through logical reasoning and experimentation. This process isolates them intellectually from the shrewd tactics of politics that pervade the business of science. Obtaining funding for a research project with adequate indirect costs, or learning that a well-designed research question and hypotheses are not in vogue or fundable, can be perplexing to the neophyte scientist. Skills in grantsmanship, ethics, animal welfare, traditional careers in science and alternative academic positions are rarely considered in graduate school. In addition, with keen competition for limited



positions and research funding, and changes in ethical and animal welfare issues, the need for guidance in the business of science is great. Mentors who are well-versed in all of these issues are necessary in the current climate.

Scientists, in general, are naïve in the practice of science as business.

In science, the mentor role has been assigned traditionally to the principal investigator of the laboratory. This mentor has vested interest in the junior scientist's involvement in the research program. Often mentoring is concentrated in technical aspects of the program, while other survival skills necessary for success in science and academia are not on the agenda. The department chair is another traditional mentor, but he or she may be more detached from the junior scientist, or may represent authority that is not comfortably approached, thus not suitable to provide the necessary guidance.

From the mentor's perspective, mentoring relationships have certain attributes that make them effective. Listening effectively and being able to identify key issues are necessary to provide practical guidance for the junior scientist. Mentor-mentee relationships do not appear to be gender-specific, although it may be necessary to market them to a greater extent to female scientists since they may be more reluctant to seek guidance and form networks.

As the need for formal mentoring of scientists has become evident, training of faculty in academic survival skills has developed.¹ Further, several institutions have begun to incorporate "mentor-like" positions in research offices, with the purpose of assisting and training faculty in academic skills.

A formal mentor may start by conducting an interview with the junior investigator. Particulars of the research project are discussed but, more importantly, tangential aspects of the research and academic issues become apparent that might have gone undiscovered in a forum that is not one-on-one. For example, advice on how to manage criticism from peers, be critical of one's own ideas, or adapt ideas to science trends often emerge.

Mentor-mentee relationships do not appear to be gender-specific, although it may be necessary to market them to a greater extent to female scientists since they may be more reluctant to seek guidance and form networks.

Seminars on topics that are not a regular component of graduate training, like grantsmanship and scientific writing, or are difficult to discuss with a mentor, such as career alternatives, postdoctoral anticipation, or ethics in research, are critical for graduate students.

Academia can be rigid and it can be difficult to modify rules. Instead, one must "think outside the box" and seek advice from some-

Advice on how to manage criticism from peers, be critical of one's own ideas, or adapt ideas to science trends often emerge.

one with more experience. The scientific community offers numerous opportunities for a well-trained scientist to excel, be creative, be

satisfied and, most importantly, be balanced. Finding mentors to assist with the process is critical and rewarding. ■

Reference

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Crossing to the Other Side



Julie Theriot
Stanford University

Scientific research is usually a collaborative effort, most successful and most fun when performed by a team of individuals who complement each others' knowledge and talents. In academia, small laboratories are generally directed by just one person, the faculty member or principal investigator (the P.I.). The success and happiness of the lab depends in large measure on the ability of the P.I. to keep the team working together smoothly. The relevant people-management skills are taught in business schools, but are not generally part of Ph.D. or postdoctoral training.

In academic research, the transition from team member to team director is usually sharp. Graduate students and postdoctoral fellows often get the opportunity to train more junior members of their lab, and some even directly supervise the work of a technician, but it is rare to gain experience in managing a whole group at these stages. For most faculty members, the start of the first appointment as an assistant professor marks a time when the individual stops being one of "us", the team of postdoctoral fellows, students, and technicians that do the bulk of the work, and suddenly becomes one of "them", the P.I.'s.

The start of the first appointment as an assistant professor marks a time when the individual stops being one of "us" ... and suddenly becomes one of "them," the P.I.'s.

The sharpness and completeness of this transition takes many new assistant professors by surprise, and its artificiality makes scientists at this point in their

careers extremely susceptible to the “Impostor Phenomenon” (described in Chapter 1). Particularly difficult is the transition to playing the opposite part in the mentor-student relationship. Science is one of the few professions that is still entered by apprenticeship, and the dynamic between graduate students and faculty is complex. A little informal surveying has revealed some common themes and experiences on the part of those doing the crossing over:

“Graduate Students Listen Too Carefully to Everything I Say.”

Even though the new P.I. is the same person she was a month before as a postdoctoral fellow, with no more wisdom and very little more experience, her words suddenly carry disproportionate weight. Students are much more likely to remember an offhand comment or supposition of a P.I. than the P.I. is likely to remember it herself. An off-color remark or moment of inappropriate public behavior, which would have been laughed at and forgotten when the P.I. was one of “us,” can become a rich source of gossip after she has crossed over to the other side. And no matter how hard a P.I. tries to be unobtrusive, her personality quirks will be diligently noted and faithfully reproduced in student skits.

Good graduate advisors must develop a balance between guiding students and letting them figure things out for themselves.

The best way to deal with this is to learn to choose words carefully. We all remember how a few cutting words from our own graduate advisor could sting, and, likewise, how

justified praise at the right moment could mean so much. Do not worry too much about the quirks. Students don’t make fun of the faculty they despise; being lampooned is a real sign of affection.

“Graduate Students Don’t Listen to Anything I Say.”

Of course, the P.I. does not get to select which words the students choose to retain. In a competitive research field, it is often important to get results quickly; a few weeks or months of delay can mean getting scooped. Since the new P.I. has spent so much time learning to do science, is now so good at it, and has so much riding on the early success of the new lab, the temptation is strong to rescue a floundering student’s work (in the planning, experimental or analysis stage) by saying, “here, let me just do that.” Good graduate advisors must develop a balance between guiding students and letting them figure things out for themselves, even if this sometimes takes longer than just doing the work for the students. Many students will be smart and opinionated (maybe like the P.I. once was in graduate school) and will prefer to try new things their own way. This can be frustrating for a P.I. who feels that she is usually right. A common and useful solution is to let the student do things both ways. If the P.I. is right, the student will figure this out, and perhaps take advice more easily in the future. If the student’s way turns out to be better, then everyone is better off anyway.

“Nobody in the Lab Ever Tells Me When There Are Problems.”

When the P.I. spends much of the time alone in an office that is separated from the lab, major conflicts can arise among the team that do not come to light until weeks or months later. It is a shock to many new assistant professors to learn that the famous obliv-



iousness of most faculty is not necessarily innate, but happens because people can only process the available information. Lab citizens can carefully and restrictively filter this relevant information. A new P.I.'s increased visibility as one of "them" means that everyone is aware of her presence. For example, silence will descend when a P.I. enters a crowded and cheerful elevator, and she will probably hear less swearing than she is accustomed to in the lab.

Even though the new P.I. is the same person she was a month before... her words suddenly carry disproportionate weight.

In the one-on-one advisor-student relationship, the filtering can be an impediment to the progress of the research. Many students are happy to speak to their advisor when things are working, but avoid them when things are not; they may be reluctant to admit confusion or defeat. A P.I. must, therefore, learn to listen carefully and closely to what the student does not say, since silence probably indicates perplexity. It is important to ferret out the problems, with patience and compassion.

"My Students Don't Tolerate My Faults; I Am Just a Human Being."

One graduate student weighs in, "I've heard this 'The P. I. is a human being' schtick before. I just don't buy it." There may be no immediate solution to this, but someday this graduate student is likely to be running a lab of his own. Like new parents who suddenly develop an appreciation for the behavior and foibles of their own parents, new assistant professors almost always have retroactive sympathy for their former advisors.

A P.I. must... learn to listen carefully and closely to what the student does not say.

In the end, every new assistant professor must develop her or his own style of mentoring and managing a research group. Senior colleagues can be an invaluable source of advice, and friends in business or other fields who manage teams of people may be even more helpful. The learning curve is very steep for the first few years, but when the team works well together to develop a new breakthrough, the taste of success is much sweeter than individual accomplishment. ■

Dealing with Unstable Colleagues



Sara (Sally) Tobin
Stanford University

Science requires intense dedication, and scientists generally tolerate the eccentricities of their equally intense colleagues. However, sometimes behavior by a colleague can interfere with the work environment. Following are some general guidelines about how to recognize and deal with unstable colleagues. Symptoms of three levels of counterproductive behavior—those that transcend working styles or eccentricities—are summarized, and actions are suggested.

It is a challenge to distinguish between problems that can be resolved by firmness, support and information, and those that require specialized expertise and resources. Most scientists do not have the necessary mental health training to deal with a person who has significant mental health issues. It is always appropriate to provide positive mentoring, but not therapy.

Most potential problems can be avoided by taking care in hiring employees and in taking on students and postdoctoral fellows. Talk with previous supervisors and review performance records. Be clear about expectations for laboratory conduct, cooperation, professionalism and safety, and discuss possible consequences. Whenever possible, have the person do a trial or rotation in the lab, and give periodic feedback about whether standards are being achieved. However, even with these precautions, problem behavior may still appear.

Handling Manipulative Behavior

Sometimes behavior patterns can reflect a coping style designed, perhaps unconsciously, to keep others off balance, or to elicit special treatment. Such behavior can range from abusive outbursts to a pattern of excuses or passive inaction. For instance, a colleague may engage in “inspired incompetence” that results in shifting responsibilities to others. Occasionally a student



may lose belief in his or her abilities and become overly dependent.

Sometimes behavior patterns can reflect a coping style designed, perhaps unconsciously, to keep others off balance, or to elicit special treatment.

Such behavior patterns can test a supervisor's authority and self-confidence. These behaviors are best dealt with by setting firm limits, providing encouragement, confirming mutual roles and responsibilities with cheerful chats and e-mails, and calmly holding ground in the face of mild to moderate escalation to test the supervisor's resolve. Once it is clear that standards and consequences are firm and applied with fairness, the problem may be minimized. However, if the level of escalation progresses to an uncomfortable level, it may be appropriate to seek advice and support as discussed below.

Identifying Possible Mental Instability

Signs of mental instability can include inexplicable mood swings, irrational statements, extreme cycles of productivity, unexplained absences, depression, and violent or abusive behavior. These signs are an order of magnitude beyond normal acute disappointment expressed over an intractable experiment or a grant application that is not funded. The person may fail to follow laboratory standards for cooperation or safety. They may display an insensitive or overtly cruel attitude toward others or toward laboratory animals. They may initiate episodes of interpersonal friction in the laboratory and may alienate or frighten co-workers. Their state-

ments may seem inconsistent, and they may react defensively when asked for clarification. Obsessive behavior toward other individuals, such as following someone home, can be another important symptom. In many cases, symptoms increase gradually over time until they reach an intolerable level. However, sometimes stressful workplace or personal events can trigger a crisis.

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When encouragement, limits on behavior, and standards of performance do not bring improvements, it may be time to enlist someone with professional training and experience. Most educational institutions and companies have Employee Assistance Programs, which are confidential and professional sources of help for employees and students. An EAP is equipped to deal with problems directly or to make appropriate referrals for mental health issues, family problems, or drug and alcohol abuse. If the obvious options have been exhausted and the best course of action is unclear, consider conferring with EAP personnel about your perceptions and about developing strategies for dealing with the situation.

Recognizing Violence

Violence includes pounding on walls, throwing items to the floor, angry damage to equipment, as well as physical threats toward co-workers or supervisors. Threats of violence are especially serious if they appear to

escalate or become more detailed. “I could just kill him,” can indicate simple annoyance; “I’m going to get my brother’s ’38 and just walk into his office some morning and blow him away,” includes plans of time, place, and means, and is cause for immediate action. Violence or threats of violence are unacceptable and cannot be tolerated, whether they are directed toward inanimate objects, toward others, or are self-destructive.

“I could just kill him,” can indicate simple annoyance; “I’m going to get my brother’s ’38 and just walk into his office some morning and blow him away,” ...is cause for immediate action.

In the face of violent behavior, a supervisor might choose to give a single warning, e.g., for throwing a gel comb to the floor; otherwise, anyone who observes violence should involve others immediately. Depending on the episode, such notification might involve any or all of the following: the supervisor, the institution’s EAP, the department head, the dean, and/or campus security. In extreme cases, confrontation can be dangerous, so let professionals handle the situation. If you find yourself in a volatile situation, stay cool, speak more slowly than the potentially violent person, and ask the person to suggest solutions that would have avoided activating his or her anger.

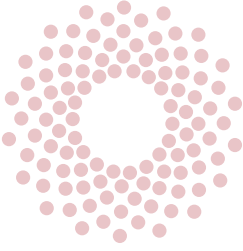
In all interactions, preserve the other person’s dignity. Maintain confidentiality and be humane. If others must be informed about the situation, do so in private. The bottom line is that it may be necessary to ask an unstable individual to leave your labora-

tory. This may become more difficult with time, so it is important to be equitable and allow opportunities for resolution, but to move decisively if these efforts are unsuccessful. Ask for advice to make sure that you comply with relevant personnel policies. However, be aware of the responsibility carried by every supervisor to ensure a safe working environment that enhances everyone’s ability to achieve their personal and scientific goals.

Of course, if the unstable person is an equal or a supervisor, then many of these options would be difficult to implement. However, regardless of the level of one’s position, it is wise to seek consultation about the best possible strategies, document episodes as they occur, solicit support among other colleagues, and set limits. If the situation becomes intolerable, consider other actions, such as filing a grievance or looking for a position that provides a positive working environment.

In all interactions, preserve the other person’s dignity. Maintain confidentiality and be humane.

Some people feel an overwhelming level of guilt and uncertainty at finding themselves in a difficult interpersonal situation, even when their contribution has been minimal. However, it is more productive to engage in assessment and problem-solving than self-reproach. Every professional benefits from developing the skills to work productively with a wide variety of people, and this includes recognizing and taking appropriate action when behavior patterns disrupt the work environment. Sometimes professional help can be a key element in developing a resolution that benefits everyone involved. ■



6. UNDERREPRESENTATION IN SCIENCE CAREERS

Affirmative Action for the Next
Generation

Increasing Representation of People of
Color in Science

Affirmative Action for the Next Generation



Donella Wilson
The American Cancer Society

What has been known for decades as “affirmative action” is being strongly challenged from a variety of directions, and the concept is being perceived in a spirit far different from that which was originally intended. In reality, affirmative action has never been precisely defined. Instead, the principle that connotes equitable treatment and inclusion has evolved as a collection of laws and executive orders over the last 60 years in an attempt to remove barriers to opportunities for minorities and women. Yet today, there are still glass ceilings in universities, hospitals, law firms and other workplaces due to vestiges of deliberate exclusion of underrepresented populations, as well as to thinly veiled, but no less real, practices of non-inclusion.

Affirmative action becomes a business issue for academia as colleges and universities attempt to create diverse faculties to serve increasingly diverse student populations, and at the same time compete in the global society.

There are still glass ceilings in universities, hospitals, law firms and other workplaces due to vestiges of deliberate exclusion of underrepresented populations, as well as to thinly veiled, but no less real, practices of non-inclusion.

One reason women have been more successful than minorities in bridging the gap legislatively is that their numbers are greater and their pipeline readily developed. As a result of our country’s history, pipelines for minorities need to be built. However, it is not legal to even consider race when providing opportunities in universities. The 1995 case of *Hopwood v. Texas* ruled



that the University of Texas Law School could not take race into consideration when admitting students unless such action was necessary to remedy past discrimination by the school. Filling fixed minority quotas is no longer an acceptable admissions policy.

In 2001, providing specialized opportunity to underserved/underrepresented populations is still acceptable legally, but may not be for long. In March 2001, a White-owned Colorado business complained that small business bonuses given to contractors who subcontract to minority businesses discriminate against non-minorities (*Adarand Constructors, Inc. v. Peña*). In the meantime, Georgia Power Company (April 2001) faces a potential class action discrimination lawsuit due to lack of fair promotion of African-

*The law is not meant to be fair;
it is meant to be just.*

Americans in their company. Company executives reported that they were unaware that the presence of hangman's nooses throughout company property was a racial slur against African-Americans.

It is sometimes difficult to be fair and honest. However, the law is not meant to be fair; it is meant to be just. Equal opportunity will never be equal as long as selections and decisions involve human beings who knowingly or unknowingly permit familiar favoritisms to creep into decision-making. For example, honesty is compromised when collegial and/or familial networks (the old boy system), economic status or one's ability to easily pay, group stereotypes, the way one looks, speaks or walks, or other comfortable familiarities influence the decision-making process. We must all deal with this truth, making it incumbent upon us to participate

constructively in decision-making and the formation of the law.

The Shape of the River,¹ a book by William Bowen and Derek Bok, is a good resource for those studying "the long-term consequences of considering race in college and university admissions." The authors state, "there is a collective concern that we are failing to develop to its fullest, the human potential of the country and a growing realization that our society, with its evermore diverse population, cannot ultimately succeed as a democracy if we fail to close the gaps in opportunity that continue to be associated with race." These studies conclude that avoiding a short term lack of insight and making provisions to consider underprivileged and diversified populations ultimately strengthen most experiences and persons involved on both sides. That is, it is a positive developmental factor for both Whites and Non-Whites.

Some scientists don't want to be bothered with all this political "stuff." They just want to be successful in learning the hows and whys of the experimental world.

Some scientists don't want to be bothered with all this political "stuff." They just want to be successful in learning the hows and whys of the experimental world. However, external obstacles may emerge, providing non-objective barriers to success that most scientists have not been adequately trained to handle. Some scientists who are not like the mainstream are faced with special barriers to which the mainstream must become sensitized to even know that such obstacles exist.

Majority scientists who “step out of the box” to promote overall enhancement of creativity and efficiency for the work environment by recognizing and helping to break down barriers for their minority colleagues make a significant contribution to science and technology in America. Carefully crafted programs for the underserved are still needed to develop this country’s quest for excellence and democracy.¹⁻⁴ However, rather than argue the endless debate on affirmative action, following are some suggested behaviors that anyone can use to raise levels of awareness despite the challenges that biased environments pose:

Some scientists who are not like the mainstream are faced with special barriers to which the mainstream must become sensitized to even know that such obstacles exist.

Advocate Diversity

Diversity does not include just women, Blacks and Whites, but a wide variety of differences that we might not readily consider as sources of bias, such as sexual preference and age. It also includes the disabled, regional differences within the U.S., citizen vs. alien, dread-locs vs. straight hair, males with one or two earrings, Gentile vs. Jew. Advocate diversity, not so much to right the wrongs of the past, but to ensure our nation’s worldly competitiveness in science. Be serious minded in developing the next generation of talent and leadership pools for the future of our existence. The challenge is to acknowledge diversity as enriched, varied perspectives which increase the value of all, rather than as anti-

“me” statements. Before the year 2050, over half of the U.S. population will be comprised of persons of color; minorities will become the majority. Shall we ignore this inevitability, try to beat it in court, or adequately prepare for it?

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An enriched cultural make-up in the current environment permits several benefits, like seeing a panoramic picture from different angles. In business, as in life, the input of concepts from various sides of the whole scene yields a more complete view of the situation. Increased clarity of the total picture often leads to creative solutions and more rapid advancements.

Bring Biased Incidents to an Individual’s Attention in a Non-confrontational Manner

Barriers can be overcome with healthy discussion about group-sensitive practices in a non-confrontational manner. Some who are oppressors are not even aware of their actions because others do not speak up against it, or think of expressing prejudices as acceptable behavior. Try to analyze the situation from both points of view.

Recommend Choices that Can Help Individuals Grow Away from Biases

First and foremost, try to constantly be mindful of being inclusive. Often people in majority environments, in an effort to be focused and decisive, do not think about being inclusive because it is not at the top of



Often people in majority environments, in an effort to be focused and decisive, do not think about being inclusive because it is not at the top of their immediate priorities.

their immediate priorities. People in these environments often do not take time to see how it would be beneficial. For example, peer review committees are often reminded to be less biased with minority applications just by the presence of a minority reviewer on the

Diversity is not a program, it is a process for growth and development of talent for the next century.

committee. Diversity is not a program, it is a process for growth and development of talent for the next century. It may require in-house awareness training seminars and/or questioning of managers' practices. Ideally, inclusivity will become an automatic process, something that just "is."

If an individual's work environment is not conducive to development of personal goals due to negative biases, the individual has the choice to leave, or to stay and fight. If one leaves with no compromises due to unheard or irreconcilable differences or biases, it may be unfortunate for the entire community. In addition, the institution may ultimately lose by failing to embrace a long-term commitment to listen and ponder carefully the issues and benefits of diversity. Such issues must be brought to a fair resolution to promote a productive work environment.

The American Society for Cell Biology has been assertive and productive in efforts to educate members on the true meaning of diversity by its strong support of the Minorities Affairs and Women in Cell Biology committees, and has even incorporated an inclusive clause for minorities and women in the ASCB Statement of Objectives. And yet more action is needed to grow successfully diverse pools and break glass ceilings. ■

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Increasing Representation of People of Color in Science



Lydia Villa-Komaroff
Northwestern University

In the influential 1945 report *Science – the Endless Frontier*, Vannevar Bush observed, “there are talented individuals in every segment of the population, but with few exceptions, those without the means of buying higher education go without it. Here is a tremendous waste of the greatest resource of a nation – the intelligence of its citizens.” Since that report, over half a century ago, there have been substantial efforts to increase the participation of both women and minorities in the scientific endeavor. In at least some fields, including cell biology, substantial progress has been made with respect to the participation of women, but the participation of minority individuals continues to be disappointingly low.

To increase the number of underrepresented minorities in science, there are three areas that must be addressed: getting children through high school with the expectation of going to college, maintaining interest in science throughout college, and increasing the number of students who enter graduate programs in science.

It may be that the only way to make a substantial difference in the number of minority individuals in science is to intervene in early childhood.

In an attempt to recruit and retain minority individuals in scientific fields, a large number of programs aimed at undergraduates have been implemented. These programs are designed to retain interested undergraduates in science and recruit them into graduate programs. As a whole, these programs can be considered a modest success, since the number of minority individuals obtaining degrees in science, math and

engineering has increased very slightly, while the overall number of students graduating with science degrees has declined. However, if the status quo is only sustained, there will be no substantial change in the representation of minority individuals in science.

Children seem to conclude very early that there are some professions that are not open to them.

It may be that the only way to make a substantial difference in the number of minority individuals in science is to intervene in early childhood. Particularly with underrepresented individuals, children must be given the opportunity to envision a future beyond that of their immediate circumstances. There is not a child under six who is not intensely interested in the way the world works. Unfortunately, most children lose this interest before they leave elementary school. If the natural interest that every child has in science could be maintained, many more children from all backgrounds would enter science. In addition, children seem to conclude very early that there are some professions that are not open to them. This is vividly illustrated by a comment made by a 4-year-old to his mother, a lawyer, after visiting with his aunts, one a banker, one a scientist. "Oh, Mom," he said, "I can't be a lawyer, I can't be a banker, and I can't be a scientist, because those are girls' jobs!" Children need to see images of people they can identify with as scientists to give them a sense of possibility and the belief that they belong in the mainstream world.

One highly successful program aimed at elementary-aged minority children is the Mother–Daughter Program in El Paso, Texas. This program was established in 1986 by Josefina Villamil Tinajero, Professor of

Bilingual Education and Acting Dean in the College of Education at the University of Texas at El Paso, who is also a child of a Texas barrio. Tinajero began the program in an attempt to reduce the high level of teen pregnancy, increase high school graduation rates, and increase college enrollment which had been essentially nonexistent, among children growing up in the poor neighborhoods of El Paso. In these families English is spoken poorly if at all, there is no family history of higher education, and both the children and their parents have low expectations of themselves.

In the first cohort of 33 girls, 32 graduated from high school, 10 as honor students, and all of the 32 enrolled in college.

There are four key approaches instrumental to the success of the Mother–Daughter Program. First, children and parents are involved when the children are young. Tinajero reasoned that intervention must occur before the children enter adolescence, when peer pressure and hormonal changes make outside influence difficult, so the program focuses on sixth graders. Second, at least one parent is required to be heavily involved in the program. Third, the program provides experiences that instill children with the feeling that they are both capable of and entitled to a college education. Finally, the program provides adult role models.

Potential program participants are identified by fifth grade teachers as those girls who show great promise but are at risk because of economic, family or neighborhood problems. When a group of candidates is identified, an invitation to participate in the Mother–Daughter Program is extended to both moth-

ers and their daughters. Participants enter a one-year program where they visit the University of Texas campus several times, including at least one overnight visit in a dorm. They have the opportunity to meet and talk to students. They also meet and question Mexican-American women in a variety of professions including police-women, lawyers, judges, accountants, scientists, writers and airline pilots. At the end-of-the-year ceremony, the mothers and daughters make pledges to each other. The daughters pledge to do their homework every day, to finish high school, to not get pregnant until after marriage. The mothers pledge to help the daughters find a place to do homework, and to support their daughters' ambitions. Participants decide on the pledges they wish to make and write the pledges on decorative paper provided by the program. The handwritten pledges are often framed and placed prominently in homes. The program has recently been expanded to include grades 7–12.

Over 2400 daughters and their mothers have participated in the program since its inception in 1986.

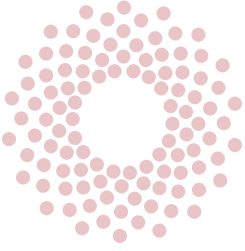
In the first cohort of 33 girls, 32 graduated from high school, 10 as honor students, and all of the 32 enrolled in college. Three mothers in this cohort have graduated from the University of Texas at El Paso, and many others are pursuing their education. Over 2400 daughters and their mothers have participated in the program since its inception in 1986.

Many of the former participants who are currently in college are acting as “big sisters” for new sixth graders entering the program. In addition, the rate of teen pregnancy in the program participants is far lower than for their classmates.

Margaret Mead once observed that it took three generations of education before a woman would aspire to and obtain an advanced degree.

The Mother–Daughter Program has been so successful that it has been extended to five University of Texas systems as well as institutions in other parts of the Southwest and California. In 1998, Tinajero began a similar program for boys and their fathers, and she is developing programs to enhance the math and science skills of teachers. The programs have been supported by AT&T, the Rotary Club, the Kellogg Foundation, the Freedom Forum, Meadow Foundation, Southwestern Bell and the U.S. Department of Education.

Margaret Mead once observed that it took three generations of education before a woman would aspire to and obtain an advanced degree. Only 1% of Hispanic women have advanced degrees, and fewer than 7% of PhDs in the sciences are awarded to minority individuals. These disappointing numbers represent several generations of lost talent. Unless we expand the availability of programs such as Mother–Daughter, we will continue to lose the talent of a significant portion of our population. ■



7. TENURE

The Tenure Process Viewed
from the Top

Earning Tenure: Ten Recommendations

The Negative Tenure Decision

The Tenure Process Viewed from the Top



Martha D. Berliner
Retired

The department chairperson is instrumental in shaping the outcome of tenure applications. Following are some considerations for those who aspire to tenure, before they join a department and after they've arrived, from the Chair's point of view:

Department Composition

Does the department recruiting you consist of one or two professors, a few associate professors, and many untenured assistant professors and instructors? If so, ask if the university and/or the department has a tenure cap. This is a way for university budget officials to limit promotions, while legitimately advertising tenure-track positions. It is also important to remember that there is no mandatory retirement age for faculty. Unless attractive early retirement packages are offered to older, tenured faculty, slots for promotion may open up only rarely. The combination of a relatively young tenured faculty and tenure caps may create a situation where obtaining tenure is unrealistic.

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Tenure History and Competition

Learn when the last time was that tenure was granted, how many tenure requests have been denied and how many tenure-track positions are being filled currently. Many schools hire scientists on the tenure-track in order to keep the money-making basic and service courses staffed, with only occasional teaching responsibilities in specialty courses. However, there usually are



not enough permanent positions for all of these scientists. Therefore, if more than two people in the department are waiting for tenure at the same time you are, your chances for obtaining tenure are probably slim.

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Government Influence

For state institutions, how much does the state legislature influence tenure trends? Be cautious if the position for which you are applying is not a budget line item. Without this protection, the position could be cut without any consideration of your qualifications or productivity.

Influence from Outside the Department

A department chairperson is responsible to deans and other administrators who have different agendas. While the chairpersons may make promises in good faith, there are external factors over which they have no control, such as budgets and enrollments. These factors may prevent them from fulfilling promises made to their faculty. One way to understand better the external factors influencing personnel decisions is to request appointments on one or two meaningful department and university committees. The seats of power and knowledge are on budget, facilities, future planning and curriculum committees.

Where Do You Want to Be?

Is the institution a place where you want to spend the rest of your personal and profes-

sional life? A person with tenure can become frozen at an institution and community because it then is very difficult to compete for new faculty positions at higher levels, unless you are willing to become an administrator or to change fields.

Joint Appointments

Avoid accepting a joint appointment with a department with different standards for tenure and promotion. The result of joint appointments is that neither department gives the joint appointee its full support or considers them a full-fledged member. In addition, the joint appointee is often expected to perform two full-time jobs. Such appointments are often driven by budget problems and cobbled together out of necessity rather than career development. This is a serious conundrum for cell biologists with joint appointments in basic science and clinical departments, where tenure expectations are often incompatible.

All Politics Are Local

While e-mail and other forms of telecommunications have eased professional and social isolation, tenure and promotion decisions are made by the small circle of colleagues with whom you interact every day, not predominantly by the world outside the university. At the same time, it is important to become part of the outside community life, and not focus solely on internal politics.

Support Staff

Secretaries, bookkeepers, lab personnel, maintenance and repair people can be of immense help behind the scenes. Respect their work and get your grades, budgets, proposals and purchase orders in on time and in the format required, no matter how arcane. This advice also applies to other professional

personnel such as librarians and computer specialists. This is not a time to cut corners and by-pass established procedures.

Tenure and promotion decisions are made by the small circle of colleagues with whom you interact every day, not predominantly by the world outside the university.

Collaboration

Graduate school and postdoctoral fellowships tend to see people as narrow specialists. Now is the time to explore new areas

with a knowledgeable colleague who has an established lab, funding sources and graduate students in the pipeline. In return, generously share your experience and networks. Become a mentor, rather than needing a mentor yourself. One of the principal criteria for tenure is demonstration of intellectual growth and leadership.

Innovation

One of the worst things to do is to restrict your research to what you did as a graduate student or postdoctoral fellow, because it makes you a competitor for the same grant funds as your previous mentors.

Although a tenure-track position is the objective for many academic scientists, tenure should not be your sole goal. In itself, it does not assure personal or scientific success, fame or fortune. ■

Earning Tenure: Ten Recommendations



Sara (Sally) Tobin
Stanford University

Tenure is a pivotal evaluation in the career of an academic scientist. The tenure process can be a gratifying recognition of achievement that emerges easily from one's scientific successes, or it can be energy-draining, stressful, and full of conflicts. Many factors influence the process, some of which can be anticipated in advance, while others may emerge unexpectedly. On the basis of a broad sampling of tenure histories, ten recommendations are offered to smooth the path of a candidate through the process. Ideally, preparation for tenure begins before arrival on campus.

Find Out What the Tenure Requirements Are and Plan to Meet Them

After the welcome phone call offering you the position, you will eventually receive a letter of appointment from the Dean or other officer. It will summarize the terms of the appointment and will specify the academic year in which you will be considered for tenure. For a typical initial academic appointment, it is probably best to request as much time as possible before the tenure decision; if your

The tenure clock does not stop if the maintenance crew is delayed by emergency remodeling of the Provost's conference room.

work goes especially well, the timeline can be moved forward. Write a formal response summarizing the conditions under which the offer is accepted, such as salary, teaching responsibilities, start-up funds, and laboratory renovations with the target date for com-

pletion. The tenure clock does not stop if the maintenance crew is delayed by emergency remodeling of the Provost's conference room.

Request a copy of the faculty manual at this time because it will specify the general requirements, the timing of the process and the potential for flexibility in the tenure clock to accommodate parenthood or family emergencies. In addition to the general procedures outlined in the faculty manual, the department, school and/or college may have additional written tenure policies. It makes sense to know the rules.

Create a Record of Productivity Long before Tenure

Write grant applications before you move to the new institution so that they will be in review during the disruption of establishing the new laboratory. Design some "bread-and-butter" approaches that are sure to

Design some "bread-and-butter" approaches that are sure to yield publishable results and will document your ability to complete scientific projects successfully.

yield publishable results and will document your ability to complete scientific projects successfully. Do not abandon your scientific standards, but it will not hurt to carry out some lower risk projects also, perhaps with the help of undergraduate students. If all of your projects are high-risk, your chances of obtaining tenure are high-risk. Even if you are able to pull off a late-breaking scientific coup, you will still be vulnerable to the accusation of uneven performance that

many consider a poor predictor of future productivity.

Gain the Support of Your Department Chair

The support of your chair is an important factor in ensuring a smooth transition through the tenure process. The chair almost always makes a separate tenure recommendation to the school and college and, because he or she is presumed to be familiar with your performance, this evaluation carries significant weight within the department and at higher administrative levels.

The chair who hired you often has a stake in promoting your success and values your area of expertise.

The chair who hired you often has a stake in promoting your success and values your area of expertise. However, sometimes a new chair with a different vision of the department will take charge, and the prospect of an additional faculty position to be filled with someone in a favorite specialty area can be tempting. Educate your chair and department about your field by inviting well-known scientists for seminars.

In some departments, the question of tenure is not presented for a full departmental vote. Instead, a committee (appointed by the chair or elected by the department) makes a recommendation. This can mean that your file is not open to the full department and can work to your disadvantage if your chair is not supportive.

The moral: make your chair's life easy. Make progress with your science, teach well, do your fair share of work and let your chair know of your successes.



Maintain Cordial Relationships within Your Department

Ideally, your position will be in a cohesive and pleasant department that will make it easy for you to concentrate on your science while participating in departmental goals. However, this is not always the case and, if schisms develop, you may be pressured to choose sides. Such a no-win situation can be a big problem for support at tenure time whether or not you tactfully avoid allying yourself with a particular party. One essay for such schisms (devised by Betty Craig of the University of Wisconsin) is to ask each faculty member during the job interview, “Where do you see this department going in the next 5-10 years?”

Women and minorities need to be especially careful about overload because they will be highly visible and in demand for committee service.

Recruit Mentors

Much has been written about the importance of mentors in ensuring a successful career path, especially for members of under-represented minority groups and women. You will need guides to the unfamiliar territory represented by your new position and institution. Some institutions assign mentors because they want their young faculty to do well. Even if you are in such an enlightened atmosphere, recruit other campus mentors so that you have access to a variety of advice. Take them to lunch. Chat. It is a compliment to them that you value their expertise, but be considerate of the other demands on their time. Recruit external mentors in your field of

research and draw on their perspectives and experience.

Get to Know Others on Campus

It is wise to limit participation in campus committees and concentrate on your experiments, but a few selected activities may be helpful because they permit you to get to know people in other departments. Such connections can expand your networking capabilities, enhance the identification of mentors, provide support at tenure time and fulfill the modest consideration of service that is included in a tenure evaluation. Women and minorities need to be especially careful about overload because they will be highly visible and in demand for committee service and often feel a special responsibility to assume a role in shaping institutional policy. Ask your mentors for advice in optimizing choices that will allow you to make a meaningful contribution without jeopardizing the research and teaching activities that are key to your achievement of tenure.

Know the Procedures for Tenure at Your Institution

Who assembles your file? Do you get to see it? Do you have the opportunity to respond to the evaluation of your file by your chair or departmental committee? Are you requested to be available for information at the time your file is discussed? Who compiles the list of those from whom letters of recommendation will be requested? Who chooses which ones get included in your dossier? Is there a departmental committee that evaluates your credentials and, if so, is there a mechanism to ensure the accuracy of both the verbal and written information they are given? Are you notified as your tenure application is acted upon at each successive administrative level?

Ask for Supportive Letters

As a tenure candidate, you will usually be invited to contribute names of leading scientists in your field who will be able to place your scientific work in context and evaluate its quality. If it is permitted, you should contact these eminent scientists and ask whether they would be willing to write a letter of evaluation in the necessary time frame. Ideally, you are already acquainted with them and they admire your work. Letters about your teaching and service may also be requested from local faculty. This is a chance to draw on your mentors. If you have doubts, it is not inappropriate to ask whether the person feels they can write you a strong letter. Be sure that they are told whether or not their letter will be confidential, and make certain that they will be sent copies of all your papers and manuscripts.

Be aware of your own tendency to be self-effacing. This is the time to highlight your achievements.

Assemble Complete Documentation

When you walk into your office as a brand-new faculty member, your first official act should be to grab a file folder, label it "Tenure," and put it in the file drawer of your desk (not that filing cabinet across the room). EVERY time you give a talk at the local high

school, organize a meeting, serve on a committee or receive an award, make a note of the date and event and put it into the file. Otherwise, you will never remember the many contributions you have made when you are under pressure to assemble your tenure file five years later.

Be aware of your own tendency to be self-effacing. This is the time to highlight your achievements. Include documentation of your papers' citations and a summary of scientific achievements.

Don't Be Afraid to Fight

If something goes wrong and you feel that you are not being evaluated equitably, use the institutional appeal processes available to you, as outlined in the faculty manual. Let others in the department know what is going on and you may be surprised at the help and support that you receive. It may also be appropriate to seek legal advice or to apply for positions elsewhere. If the available administrative remedies do not resolve the issue (this may take 1-2 years), you will need to think long and hard about whether to engage in the stress and expense of a protracted legal battle that will affect your family and your science regardless of the outcome.

Tenure is a form of acceptance of one's professional merit and is an important landmark in the life of an academic scientist. It makes sense to prepare for the process so that it will run smoothly and provide a fair evaluation of the successes you have worked so hard to achieve. ■

The Negative Tenure Decision



Sally Amero
The National Institutes of Health



Maureen Brandon
Idaho State University

It happens — some of us don't get tenure, few of us discuss not getting it, and nobody is prepared to deal with an unfavorable outcome. Although the reasons vary with each individual, a negative tenure decision can evolve in one of two ways. First, the departmental chairperson or promotions committee may be unwilling to support the application for tenure, particularly if certain aspects are weak in comparison to other tenure packets. Second, the request may be denied by administrative officials or committees after it leaves the department. In either case, the negative decision can present a major stumbling block to your career, or a new beginning — the choice is yours. This article suggests strategies for a new beginning.

Collect Information

The first thing a faculty member who learns of a negative tenure decision needs to do is gather reliable information and formulate a course of action. If the outcome is a surprise, explanations should be sought from the departmental chairperson, other senior faculty, and administration officials.

Do not overlook the value of informal support systems.

Consider Appeal

An appeal with a reversed decision is possible in the year following a negative tenure decision, if the deficits are appropriately addressed. Was the candidate's funding level comparable to those of other junior faculty? Is the publication record acceptable? Were letters of reference favorable? Do not overlook the value of informal support systems. Senior colleagues in other depart-

ments and previous mentors often have additional insight or can speak on the candidate's behalf. Legal action should be considered only if gross injustice can be documented and if the candidate is willing to see it through.

Set the Tone

The candidate denied tenure must function for a while in the system that terminated him or her, and it is best to actively pre-empt potential ill will. Establishing a cordial tone is critical, because this period becomes the springboard to the next, and gossip travels in

Establishing a cordial tone is critical, because this period becomes the springboard to the next, and gossip travels in the scientific community as in any other.

the scientific community as in any other. Whether or not co-workers are listed as official contacts on job applications, assume they could be contacted. Formulate a noncommittal response to questions, and acknowledge concern and sympathy courteously. Be prepared for allegiances to shift: those who were once trusted may be aloof, while mere acquaintances may rush to "help". Quite possibly, the candidate's allies took a beating in his or her defense; on the other hand, misery loves company — it's easy to become fuel for someone else's fire.

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Ironically, the candidate denied tenure is faced with even greater pressure than before the tenure decision because she or he must find a job and also maintain ongoing faculty

obligations. Distractions should be minimized: resign from committees, re-assign rotating students, reduce your lecture burden. If another shot at academia is the goal, then manuscript submissions and the grant proposal of a lifetime are essential. A senior lab member can be appointed as field commander; a remote location can be chosen for uninterrupted concentration, and telephone or e-mail messages can pile up temporarily.

Each person in the candidate's laboratory also needs an exit plan with defined time lines. New graduate students may switch to other laboratories; senior graduate students may finish ahead of schedule or follow the candidate to another institution; postdocs and technicians may seek employment elsewhere. As difficult as it is to watch a carefully constructed team disintegrate, the faculty member has a responsibility to ensure that damage to the careers of students, post-docs and staff is minimized.

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Seek Positive Reinforcement

A positive approach is essential to a successful job search, but the candidate denied tenure may well lack self-esteem. Conscious effort must be expended to find creative outlets and fortify one's self-image. Listing transferable skills is a good place to start. A faculty member must possess excellent problem-solving skills, an ability to prioritize and reach goals, good writing and computer skills, and management experience — all highly valued in the business world. Also, now is the perfect



time to resurrect those outside interests that were sacrificed for the faculty position. Join a health club or enroll in an evening class. Outside activities can be deeply rewarding and enhance self-confidence.

Look before Leaping

The candidate denied tenure is entitled to a terminal contract following the decision, barring extenuating circumstances such as gross unethical conduct. A quick departure may be possible if a new position awaits. However, if there was no time (or perceived need) for job searching prior to the decision, the terminal contract can provide twelve to eighteen months to find another. Some great academic positions open up in the spring and summer, but this job market typically peaks in autumn. Thus, the spring semester can be spent preparing for the upcoming application cycle.

Every academic department has a unique character, so it is advisable to carefully research a new academic position to avoid a similar tenure situation down the road. Before responding to an advertisement, check out the department's web site to get a sense of the faculty's interests and activities. Then, prepare an application that highlights your special strengths and matches the needs of that department. Once an interview has been

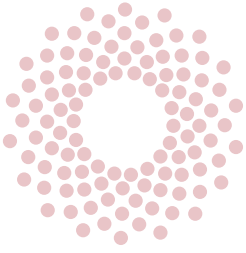
arranged, formulate a set of questions to probe the environment of the department such as: What is its goal? What kind of infrastructure is available to support teaching and/or research activities? What is the tenure success rate of junior faculty? During your visit ask each faculty member these questions and look for similar answers.

Do not assume that a denial of tenure will be viewed unfavorably by another institution.

Do not assume that a denial of tenure will be viewed unfavorably by another institution. Every institution has unique tenure requirements, and many are delighted to identify a faculty candidate with proven teaching and/or research skills.

Consider other Options

If academia is no longer attractive, take this time — the terminal contract year — to explore new avenues. In many respects, a negative tenure decision provides opportunities for greater professional freedom than at any other time of your career. If you allow it, the world can truly be your oyster. ■



8. PARENTHOOD & SCIENCE CAREERS

Juggling Career and Family

Optimizing the Family-Career Balance

Juggling Career and Family



Mary Ann Stepp
George Washington University

How can a person learn to juggle family life with children, run a research team at a medical school, and teach graduate and medical students? There are ways to learn to handle it all and stay happy, but it takes acknowledging the reality of some not-so-simple truths:

Having It All Is a Fantasy; Having Enough Can Be Reality

Learn to accept the fact that none of the tasks will be done to the level of perfection that would be possible if there were more hours in a day or fewer responsibilities to manage.

Be Prepared to Spend All Income

Managing family, a category which can include children, house, and aging parents, demands flexibility coupled with enough money to allow the purchase of good support for the family's needs. Good childcare is worth the cost and will allow parents to feel good about their time at work. When children are very

Good childcare is worth the cost and will allow parents to feel good about their time at work.

young, especially if there is more than one child in the family, childcare costs can exceed one parent's income. Despite this, most scientists would never consider not working. Flexibility in childcare arrangements is important since different solutions to the need for quality childcare arise in response to the differing needs of the children as they grow. For example, over time, childcare arrangements may evolve from a



European au pair to a progressive day care center to family day care. In addition, special needs of two-career couples or of the children may dictate a particular arrangement. A child who is chronically ill with ear infections contracted in a day care setting makes it difficult for parents to work consistent hours. A live-in childcare provider may be the best solution in this case.

Do Not Micromanage the Family

Many women tend to believe that they have to run the house the way their mothers did: take total responsibility for raising the children and doing all the housework. That model simply does not work. Fathers deserve to play as important a role as mothers do in the lives of the children. If mothers allow this to happen, it will free up their time and build close relationships between children and dad. Take pleasure in knowing that the children and their dad can get along fine when mom has to work extra hours. Many mothers resent spending home time cleaning and cooking, rather than playing with the children and doing school projects and homework. If this is the case, hire a housekeeper, learn to be more tolerant of the messes, or both. If there isn't time to cook, order takeout or go out to eat. Homework can be started after the meal has been ordered and before the food arrives at the table.

While the Family Is Young, Keep the Research Focused on One or Two Central Problems

Realize that laboratory expansion and publication rates will be less than those of colleagues without young children. The

challenge while the children are young is to stay active and in the game. The research programs of many scientists often experience dramatic expansions after their children are grown.

Set Limits on Hours Spent on Teaching-related Activities

In collaboration with a supervisor or chairperson, determine how much time teaching responsibilities should take and stick to that budget. Teaching is often the hardest activity to compartmentalize and juggle successfully. No matter how well prepared a lecture is, there is always another paper to read or a better way to organize and present the lecture material. Also, adult students are demanding, and they require and deserve mentoring. It is hard to close the door and focus on research when active-

The challenge while the children are young is to stay active and in the game.

ly teaching a course or mentoring a student in the lab. But, just as parents have to learn to let their children grow up, teachers have to learn to let students solve some of their own problems and identify additional resource people.

Teaching assistants and secretaries can handle some of the students' academic and personal questions; let them.

If you keep in mind these not-so-simple truths, you will be able to keep all those balls in the air and stay sane. ■

Optimizing the Family-Career Balance



Elizabeth Marincola
The American Society
for Cell Biology

People in general, but perhaps mothers more than anyone, are phenomenal self-rationalizers. Thus, if a woman voluntarily foregoes a profession to raise her children without conflict of a demanding career, she will believe passionately that this choice, and the personal, financial, marital, and moral sacrifices it entails was the correct one for her family. No less passionate is the woman who believes that continuing to invest in her career as she raises her family is in the best interest of her family. This should not be surprising, since all parents love their children more than anything and put their welfare first.

For those of us who have the choice to work, a caution: if you ever hear the expression “Super Mom” or “Super Dad,” you should immediately reject it and focus on reality. The Superhuman Parent is an accolade earned exclusively by women and men who have no choices. These are parents for whom working is not a social statement nor a feminist right, but an economic necessity and often a monotonous burden.

Talk about the day's excitement or problem in a way your children can understand. This allows them to get closer to you by sharing your real frustrations and satisfactions... Ask their advice; it may be good.

Those who have the luxury of choosing to develop a career and who are passionate about their work will find a way to maintain and build it while raising their family. Conversely, those who are fearful of how children will fit into their impossible life won't regret finding the courage of their conviction: parenthood will



make the importance of everything else fade in comparison.

Simultaneously building a career and raising a family demands tradeoffs among time, money and intimacy. For example, parents may wish to be the one to take their children to the pediatrician or participate in school field trips. However, if others do the laundry and/or grocery shopping, there is little emotional “expense” to the family. Invest in the best possible childcare and homecare you can find. Even if one entire income is devoted to these needs in the early years, it should be considered an investment in career and family.

“Quality time” is defined by a common focus and the opportunity for satisfying conversation.

Work hard, long and efficiently when possible in order to be free of guilt when the children need you. Conversely, go on every field trip you can so when you can’t, you won’t hear, “but Mom, you never come!” Try to avoid regularly constraining both ends of the workday. Many partners develop a pattern whereby one goes to work early, even before the children wake up, while the other gets the children to school or daycare before going to work. The partner on the early shift may be able to get home correspondingly early, and supervise homework while cooking dinner, allowing the late shift partner to work into the evening. In this way, each can take advantage of precious quiet work time, while maximizing the hours in the day that children can enjoy parental attention.

All parents are anxious to maximize time with their children. Scientists may be more anxious than most, because time is particularly precious, and maybe because anxiety is in their nature. Here are some nuts-and-bolts

suggestions from one mother’s thirty child-years of experience:

If those for whom you are directly responsible (typically children and spouse) are at home, don’t answer the phone. That’s why God invented voice mail.

- If just those and all those for whom you are directly responsible (typically children and spouse) are at home, don’t answer the phone. That’s why God invented voice mail. There’s nothing that can’t wait. An involved conversation easily derails an activity or conversation.
- Eat dinner together every possible night. This may mean late dinners and/or resuming work (preferably from home) after children are in bed. As my grandfather the Rabbi used to say, “there’s no greater blessing than eight [or ten or six] feet under the table.”

As my grandfather the Rabbi used to say, “there’s no greater blessing than eight [or ten or six] feet under the table.”

- Eliminate music, telephone or other distractions when your children are in the car. The conversation it can inspire is amazing. A typical moment: total silence from your five-year-old for three blocks, followed by a voice from the backseat: “when people die, the world still stays here... right?”

-
- “Quality time” is defined by a common focus and the opportunity for satisfying conversation. Thus, pulling weeds can be richly rewarding; conversely, the circus or ballpark may contribute little to your relationship with your children if other adults demand your attention and the children are reduced to an annoyance.

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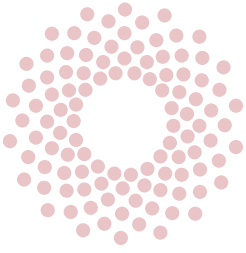
- Involve your children in your work in appropriate ways as they grow. The less of a black hole the office or lab, the less mystery and resentment it engenders. Talk about the day’s excitement or problem in a way your children can understand. This allows them to get closer to you by sharing

your real frustrations and satisfactions, and also helps cultivate their skills of listening, empathy and analysis. Ask their advice; it may be good.

The key to sanity may be to eliminate everything imaginable that serves neither your family relationship nor your career. This may include activities which seemed indispensable previously, like regular routines of reading the newspaper or working out.

A career in science is a noble investment in society but it is also an economic and moral investment in your family. Parents who actively seek to peel away expendable burdens, and account aggressively for their expendability, may be pleasantly surprised that even a career in science, as demanding as it may be, can leave significant time for the family, as long as there are no illusions that there will be much time for anything else. But, then again, nothing else will seem as fun and satisfying. ■

Adapted from the Fae Golden Kass Lecture by the author, Harvard Medical School, May 1999.



9. EXPLORING VENUES FOR SCIENCE

Breaking into Biotech

Research at a Small Institution:
Not as Different as You Think

Breaking into Biotech



Leslie Holsinger
Sugen Inc.

Qualifications for employment in the biotechnology industry can vary. For a scientist-level position, most biotech companies want someone with either a PhD or an MD, and at least three years of postdoctoral experience. You don't need previous experience in industry such as an internship. Some companies do offer postdoctoral positions. This can be a wonderful avenue into a company and can lead to a permanent position as a staff scientist after a few years. However, some companies have specific protocols about permanent hiring of internal postdoctoral fellows. You need to ask about the company's policies before taking a postdoctoral position.

Job openings can occur at any time, but many biotech companies do their annual review and budgeting in December. New positions are often created then and hiring begins in January. A few companies also do budgeting in July, with subsequent hiring cycles in the fall.

Postdoctoral positions...can be a wonderful avenue into a company and can lead to a permanent position as a staff scientist after a few years.

Apply for as many jobs as interest you! It's important to mount a wide job search that lets you interview at a number of places in parallel within a short period of time. That way, you can compare positions and compare companies. Equally important, biotech companies move fast, much faster than your average university. You can expect a hiring decision within a few weeks. However, if you are offered a position, they'll expect an acceptance from you within two or three



weeks. You need to be prepared to make your decision fairly rapidly. That's why you want all the offers on the table within a short period of time.

Send your CV and cover letter to "HR"—Human Resources. However, personal contacts are extremely important in biotech. So send a copy to a contact within the company as well. This could be a personal acquaintance or just a friend of a friend but find a name if you can. Be creative. The important thing is to bring your CV to the attention of the hiring manager, the person you'll be working for, and nothing helps like a referral from someone already in the company.

Send your CV to HR but send a copy to a contact within the company as well.

Conferences are an excellent place to make biotech contacts. Look for poster abstracts and presentations by scientists from particular companies. Approach them with comments and questions, and leave them a CV.

You can also go to the web sites of interesting companies. Most biotech companies put a lot of effort into their sites. They'll tell you a lot about what the company does plus there will be up-to-date job listings. At the very least, you can get the HR department address. There are also biotech job web sites such as www.biospace.com. Read the ads in scientific journals. If you find a company that interests you that isn't hiring, it's still a good idea to send a CV to HR. Biotech is dynamic and new openings can appear at any time.

To a certain extent, companies seek scientists with specialized skills and interests. If you are a graduate student now but planning on a career in biotech, it might be a good idea

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to see what specific skills are in demand in biotech and consider widening your skill set. However, the nature of the biotech industry is that things change quickly. Projects and priorities can be restructured overnight. The best candidate is still a well-rounded scientist with a wide breadth of skills and experiences that can be applied to many problems. You also need to be someone who likes change.

In the interview process, candidates are typically invited to spend a day at a company, usually at the company's expense. You'll be asked to give a seminar, and then to meet with the hiring manager for that position. You'll meet the other researchers with whom you would be working. Be prepared for a long, exhausting day, from early in the morning and on through

Companies are more focused now, and often look for someone with specific qualifications.

dinner. You'll probably meet with someone from Human Resources who will discuss salary and benefits. Salary should not be a focus of an interview, but come prepared with a range for an acceptable salary. This is important. A company wants to know if your expectations are in line with that particular position. Job candidates are only invited back for a second interview if it's close between candidates.

There are four components of a successful interview. First: communication. You have to

be able to communicate your scientific knowledge and interests. Biotech puts a big emphasis on teamwork, and interviewers are looking for someone who communicates effectively within the team. Get a colleague to give you a mock interview and pretend she doesn't know anything about your work. Prepare and practice clear and concise answers to common interview questions ahead of time, such as "what is the most significant thing you have done in your scientific career?" or "what is the reason you have chosen to look for a career in biotech?" Second: plan a good seminar. Your presentation should be well-prepared and executed but also tailored to your audience. Don't

Get a colleague to give you a mock interview and pretend she doesn't know anything about your work.

assume they know your patch of science. Find out from the hiring manager prior to your interview who the audience will be, and try to assess their interests. Make sure you give them a good introduction to your subject and don't bog down in details or side issues. In addition, try to relate your work to the company's objectives. This is a different kind of seminar than you might be used to. You are the real subject and your audience wants to know how you and your work relate to them. That's the third thing: research the company before the interview.

Try to relate your work to the company's objectives. This is a different kind of seminar than you might be used to. You are the real subject and your audience wants to know how you and your work relate to them.

Find out who will be at your seminar and look up their publications. Read about the company in the business and scientific press. Find out if they have competitors and research them. Outside the seminar, be prepared to ask questions about the day-to-day operations of the division where you would be working. Ask about the culture at the company, and whether you will be encouraged to publish your work and attend conferences. In addition, you need to have your career goals in mind. Your interviewers will want to know where you see yourself going at the company. Are you strictly a researcher or does the business or management side of biotech interest you? Fourth: Follow-up. After the interview, send thank you notes to everyone with whom you interviewed. Thank them for having given you the opportunity to speak and for the chance to interview. Good follow-up shows you have it all: communication, planning, research and enthusiasm. ■

This article is based on an interview of Holsinger by Maureen Brandon.

Research at a Small Institution: Not as Different as You Think



Dianna Bourke
University of Charleston

What do you mean research at a small institution? Isn't that an oxymoron? They only teach at small schools, don't they? Rest assured you won't be the only one asking these questions. But a research career at a small institution can become a career alternative that isn't really, well... all that alternative.

Why Choose a Smaller Institution?

What would possess someone who had spent a decade in training to actively choose to work at a smaller institution? The general consensus of the small institution faculty interviewed cite these critical factors: 1) they enjoy teaching; 2) they like the job security and the fact that their salaries are derived from 100% hard money, and/or 3) they prefer the reduced pressure to publish at smaller institutions, but rejoice in the opportunity to maintain a research program.

These faculty consider their teaching ability a strength and couldn't imagine not having daily student contact. They also feel that teaching is taken

During an interview at the NIH I was assured that if I took the job, I would never have to teach again, as though this were a great perk.

more seriously at smaller institutions and rewarded more appropriately. "I get jazzed from teaching," says Yolanda Cruz of Oberlin College. "When I was looking for a job, I applied to several different kinds of institutions. During an interview at the NIH I was assured that if I took the job, I would never have to teach again, as though this were a great perk. This

really upset me because I like to teach!" Elisa Konieczko, Assistant Professor at Gannon University in Erie, Pennsylvania, indicated that, "although I was happy doing research as a postdoc at Yale, it became very clear to me that only doing research would not be enough. I had to get back to teaching."

Job stability was often cited as an attraction to smaller schools. This is based on the assumption that it is easier to get tenure at a smaller place because of decreased publishing demands. Though tenure is beginning to be more of a moving target in some cases, this is often the case. Cruz recalls that, "when I asked in the NIH interview what would happen after the initial six-year appointment, I was given the vague answer that hopefully another position would open up. I didn't really want to be searching for a new job at the age of 41." Kathryn Loesser-Casey of Mary Washington College in Fredericksburg, Virginia, had other concerns: "when I was looking for a job, my husband said, 'I will follow you wherever you choose, but plan to make it permanent because that will be where I set up my medical practice.'" All the faculty interviewed agreed that not having to derive any of their salary from grant monies was an attraction. Limited travel support from the institution for scholarly endeavors was even included in some recruitment offers.

Research at a Smaller Institution

What about research at smaller schools? Faculty agree that research publishing requirements for tenure and promotion at their institutions are considerably more modest in numbers of papers than in the schools where they had trained. But all caution that quality of work was still an important issue in tenure review. After having wit-

After having witnessed the daily routine of their advisors and colleagues, most indicated that they had actively chosen a place where research occurred at a different pace.

nessed the daily routine of their advisors and colleagues, most indicate that they had actively chosen a place where research occurred at a different pace. At the same time they accept that effective research in a small school environment can be a challenge. It is critical to keep in mind the main focus of your school to avoid frustration when, for example, students don't work as intensely as university graduate students or when the school refuses to buy equipment.

Support

An increasing number of small institutions are beginning to set aside realistic funds to support space, equipment and faculty-release time. While this transition is positive, it also ironically increases pressure to meet newly intensified research requirements for the

An increasing number of small institutions are beginning to set aside realistic funds to support space, equipment and faculty-release time.

most junior faculty members. Echoing concerns typical at research-intensive institutions, some indicate that this is resulting in unrealistic tenure expectations.



The level of support for such things as facilities, equipment and money for consumables varies widely from school to school. The more exclusive liberal arts colleges have more money. "It's the cash-strapped privates and the old teachers' colleges or branch campuses that have these sorts of [funding] issues," observes Deborah Cook of Clark Atlanta University in Atlanta, Georgia. Of the faculty polled, start-up funds were reported from high four-figure amounts to a comparatively generous \$50,000. Continuing funds are often obtained by intramural competitive proposals for small amounts of \$1,000 to as much as the low five figures. Clearly, very little in the way of equipment can be bought for such amounts while still allowing anything left over for experiments, so obtaining equipment is often left as a complicated dance

Fortunately, more grants for smaller institutions are being offered both by the NIH and the NSF.

with administration. My first Director of Academic Affairs was a historian, and the figures I quoted for laboratory equipment boggled his mind. "Faculty at smaller institutions are caught in a frustrating cycle when competing for external support: reviewers often respond to such requests by indicating that the item should be provided by one's institution. But the institution depends on faculty to get equipment by writing grants!", notes Cynthia Galloway of Texas A&M's Kingsville campus. Fortunately, more grants for smaller institutions are being offered both by the NIH and the NSF. An old standby for obtaining equipment is

to write a grant for educational purposes and use it during non-class time for your research.

Personnel

If you like hands-on science, small colleges may be the perfect opportunity, because usually there is no one else around to do the work. Unless you manage to get a major grant with money for a technician, the most consistent workforce for the lab is undergraduate students. Some places may have

Research must be divided into small, discrete, do-able units that the students can handle within the school calendar.

master's degree programs, but the majority do not. "You need to pick [undergraduates] out early and grow them up," half-jokes Cruz. Of course it takes a lot of time to train and supervise undergraduates; often just when they become productive, they move on. Many institutions have student stipends to support research during the school year or over the summer. A consistent comment was that research must be divided into small, discrete, do-able units that the students can handle within the school calendar. Despite the difficulties, working with undergraduates can prove invigorating.

Isolation and Alienation

"So when are you going to get a real job?" "You aren't planning on staying there, are you?" These questions are familiar to small-school faculty. How does the ego handle the perception by some colleagues that taking a job at a small institution is opting out of science, failing, or even worse? The answer is

A mentor may not be as near as the next office, but as near as the Internet instead.

sometimes not very well, but it is hoped that this perception will soon change. Several faculty interviewed expressed feelings not of alienation from their research colleagues, but more of isolation and feeling left out of mainstream research. They fear that they will be perceived as doing minor league science.

A few years ago at a Keystone Symposium I found myself standing in the middle of a sea of posters where all kinds of interesting experiments were being presented, but I had no poster of my own. I had the most profound feeling that I would never be able to do this kind of work again. Donald Kimmel of Davidson College in Davidson, North Carolina, who made the transition from Brown to Davidson in 1971, comments, "I had to change my research completely when I came to Davidson, to adjust to what was available and to what the students could do."

Lack of name recognition can also lead to a feeling of isolation. At a national meeting, after a quick look at my badge, the first comment I get is, "Charleston, South Carolina, what a lovely town." I agree, except that I'm in West Virginia. I have developed a sense of humor and learned to carry a map. Karen Lee from the University of Pittsburgh at Johnstown is frequently asked, "is that where they had the flood?" She claims to get sympathy, but that is not what she is after.

A problem that many scientists face is discipline isolation. In a four-person department, one colleague might be a marine biologist, one an environmental biologist, another an invertebrate physiologist and another a biomedically oriented cell biologist. "You just

have to make your own rules," notes Cruz. A mentor may not be as near as the next office, but as near as the Internet instead.

Many departments have never dealt with bench-type cell biologists before and all are having to make adjustments. Many of the older faculty at smaller schools were field biologists who gathered their data in the summer and crunched it for the rest of the year. This is assuming they did any research at all; many did not. This dichotomy may inevitably lead to tension between modern and traditional scientists in the same department.

Many of the older faculty at smaller schools were field biologists who gathered their data in the summer and crunched it for the rest of the year.

Finding a New Collegiality

How does one make research in a small school work? Adapt to your environment, find a way to change what must be changed, compromise where possible, ask for help, have extreme patience... and win the lottery. Asking for help is possibly the most critical advice, but it is often the most difficult thing to do. Reviving old research ties can open

A good scientist shouldn't care where you work as long as your work is creative and good.

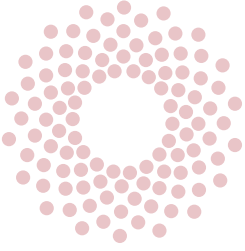
doors ranging from full-scale collaborations to simply borrowing equipment. Try to make new contacts with people you admire.



Sometimes it is difficult not to feel like a poor relation at a holiday dinner, but pride will get you nowhere. It is surprising how receptive people can be to ideas as long as you know your science and pull your weight. A good scientist shouldn't care where you work as long as your work is creative and good.

The emergence of highly trained cell biologists with extensive training who have established their research careers at smaller

schools is creating a new breed of cell biologist, with needs and concerns that are different from their peers at research-intensive universities or from those at schools that require no research at all. A note to university-based investigators: ads for jobs at smaller institutions outnumber those at high profile institutions by a considerable margin, so treat this new breed of scientists with the respect they deserve. They are coming out of your labs! ■



10. WOMEN & SCIENCE CAREERS

Why Women Leave Science

Shaping the Future for Women
in Science

Why Women Leave Science



Caroline M. Kane
University of California
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Consider the following statistics from the recent past¹:

- Women were 51% of the U.S. population and 46% of its labor force, yet they comprised only 22% of the science and engineering labor force.
- Women were 44% of the total number of graduate students in all the sciences, and 48% of the total number of graduate students in the biological sciences.
- Women earned 40% of the Ph.D.s in the biological sciences (compared to 33% ten years before).
- Women comprised only 24% of the faculty in science and engineering and only 27% in the biosciences (while they comprised 44% of the faculty in non-science and engineering disciplines).
- Of all women who were science and engineering faculty, 36.5% were at public, 2-year institutions, while 17.5% were at research institutions.

What contributes to the contrast between the nearly 50% representation of women at the undergraduate and graduate levels to their 26% representation in the life sciences labor force? Why are women leaving science?

More women than men begin leaving science even as undergraduates. Many women (and men) enter university or college from a supportive high school background where teachers and advisors have encouraged the students' interests and developed the students' skills in science. Once at the college level, many women in the sciences feel "pressure, isolation, powerlessness and the constant need to prove themselves" in the face of an educational "system designed to induct young men into an adult male social structure."² That is, the



socialization of white males is well served, but the different expectations and requirements of women are often misunderstood, ignored or belittled. These include issues of self-confidence; for example, admitting dif-

The socialization of white males is well served, but the different expectations and requirements of women are often misunderstood, ignored or belittled.

ficulty in a subject may be interpreted as a weakness rather than an interest in sharing information in the process of learning. In one study,² many undergraduate women did not think that they were doing as well or were as well qualified as others in the classes, even in cases where the grades received said just the opposite! Also, organized help for academic work may be viewed by some faculty as remedial rather than as an important means for students to more thoroughly integrate information. Many of the expectations and requirements may also be shared by men, although the culture of science and engineering has been more focused on a

Learning as a competition instead of as an end in itself can often get in the way of success in the classroom.

make-it-or-break-it, win-lose dichotomy. Learning as a competition instead of as an end in itself can often get in the way of success in the classroom, and having to fight against other students for a grade can be

very discouraging when understanding is the overall goal.

Even given different perceptions among men and women, the top five reasons given by both men and women for switching out of science and engineering majors are the same.² Thus, both men and women who switched majors felt that their original reason for choosing the major proved inappropriate, that there was poor teaching by the faculty, that there was inadequate advising or help with academic problems, that other majors offered a better education or more interest, and that they were “turned off science.” Men and women defined “good teaching” and “good academic performance” differently, however. For women, good teaching included being able to establish a personal relationship with a faculty member; the faculty member needed to be interested in the student as well as the course material. For men, good teaching focused on presentation of material. For women, “good academic performance” based on tests and scores was not sufficient to doing well. They were doing well if they felt more integrated into the discipline by establishing the relationship with the professor(s). Networking and mentoring with the faculty are valuable routes to learning about a profession and about others who are successful in that profession.

In contrast, perpetuating the idea that science is “hard” and therefore only available to an “elite” with the inherent ability to deal with the material provides permission for faculty to continue to “weed out” rather than educate students with a genuine interest *and* aptitude for biology, and its predecessor courses, math, chemistry and physics. On this particular point, switchers and non-switchers were found to be of similar aptitude and ability, whether men or women.² Women are more likely to internalize criticism and negative feedback as indicators that

they are less capable, less on top of the class work, and perhaps the only ones having difficulty with the material. The message to students is that the less effort needed for navigating the system, the more savvy you are.

Women are more likely to internalize criticism and negative feedback as indicators that they are less capable.

When women enter a system in the sciences that has been developed for and has worked well for white men for years, they often get the message that they are outsiders—not that they are overtly unwelcome, but that they don't know the rules. Having guides, advisors, older peers, and faculty who validate their concerns and work with them to find learning strategies that work for them are all essential. Note that this applies as well to men, and that many men also leave the sciences for reasons having little to do with changes in interest or a lack of ability. More women, proportionately, leave perhaps because the system is not designed to induct them into the adult world of women as much as it is, as suggested by Seymour and Hewitt,² an extension of the system that young men have been experiencing their entire lives. Perhaps the “underlying cause of women’s difficulties lies in the structured incapacity of the traditional science, math, and engineering system to meet the educational needs of a diverse student population.”² Indeed, many similar issues impact minority students and scientists.

However, college and university faculty, both men and women, are not the sole explanation for why women leave science. Indeed, many faculty men and women are encourag-

ing young women to continue to pursue their interests in biology careers and to consider and pursue careers in secondary and higher education and research. Nearly 50% of the undergraduate degrees in the biological sciences are awarded to women; so, many women are not switching to other majors, despite the challenges of working within the biological sciences. Indeed, nearly 50% of the graduate student population in biology are women and 40% of the awarded Ph.D.'s in the biological sciences go to women. But if women are only 26% of the life sciences labor force, then where are these women going? Three recent articles in *Science* addressed what happens to women during the development of their professional careers.^{3,4,5}

Many women choose careers considered “alternative” (read, “non-research”) because they find them more compatible with having a family, more intellectually rewarding, even more financially remunerative and personally satisfying than independent research careers.

Many women choose careers considered “alternative” (read, “non-research”) because they find them more compatible with having a family, more intellectually rewarding, even more financially remunerative and personally satisfying than independent research careers. Men now are catching on to these alternatives as well. When a larger number of men and women with advanced degrees in the biological sciences enter business, law, journalism and the media, environmental work, consulting, primary and secondary



education, science education, government, and the myriad of other professions, perhaps the word “alternative” will be dropped.

Yet, independent research careers in academia, research institutions, or industry in which one develops approaches to decipher the workings of biological processes certainly are considered quite prestigious and desirable. Many women have this career as an aspiration upon entering graduate school. What happens to them once they have taken the first step to an independent research career?

Very few women have a partner whose career revolves around coordinating house and home and family in order to allow her to pursue her professional career.

Perhaps these research positions are less compatible with a variety of personal and family concerns. Very few women have a partner whose career revolves around coordinating house and home and family in order to allow her to pursue her professional career. With more two-career couples in research careers, there are many more examples of successful sharing of parenting and home responsibilities; yet, again and again, based on survey after survey, the larger share is assumed by the woman. This disproportion may be fully appropriate for individual relationships, but the issue is one of balancing career and personal issues to ensure that the pleasure of “doing science” remains fully worth the effort to do it.

Another problem women often encounter is how their behavior is perceived and accepted. Successful women very often have wonderful aggressive and persistent behaviors, as

do their male colleagues, that allow them to follow their curiosity into scientific questions. These behaviors on their part are sometimes viewed as negative by colleagues unaccustomed to women savoring fully the gusto of scientific discovery. On the other hand, a very feminine woman scientist (redundancy noted) might not be taken seriously regardless of the creativity and productivity of her research because her appearance and behavior are beyond the experience of the other “serious” scientists in her department. An increasing number of women faculty and researchers can contribute to eliminating the interpretation of these behaviors as unusual. Certainly there are many unusual behaviors observed among men scientists, but they are “diluted” by the numbers of men represented in biology departments. The presence of more women in the profession and their speaking at meetings can condition and teach men colleagues about inaccurate stereotypes and preconceived notions that interfere with what might be their legitimate efforts to welcome women into the academy.

Finally, a reason consistently mentioned by many women who choose not to pursue or continue a career in the biological sciences is the competitive environment. However, it is not competition *per se* that sours the professional experience, as many women enjoy competition and the rewards and personal satisfaction that come from “winning.” The crux for the sciences is the disconnect between a reward system in an intellectual endeavor that relies on “beating one’s competition to the finish line” rather than working with others to try to derive the answers to biological questions in a rapid, efficient, and collaborative fashion that highlights the joy of learning about life’s mysteries. The notion of winners and losers in scientific research is limited since scientific discoveries are based on years of prior work by many others.

Recognition of a new insight is important and extremely worthwhile, but an ethos based on having a loser rather than upon making a significant positive contribution requires setting up battlegrounds. These types of engagements have far too much impact on the definition of success in the sciences, and the logic, or lack thereof, of this behavior is often lost on successful professional women.

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From experiences during education to experiences in the professions, women and men are confronted with positive and negative feedback regarding careers in the biological sciences. Earlier networking and mentoring advice to students and junior colleagues would serve to help women determine

whether biological science is indeed the passion of their professional lives. The networking and mentoring that help in that decision making need to continue as the young professionals, and senior professionals, progress in their careers and encounter new issues unrelated to the passion for the discipline, but directly related to their ability to be successful in pursuing that discipline. From introductions at a national meeting to appointments onto powerful institutional committees, engaging women in the positive process of science as well as the pleasure of science may encourage more women to commit their energies to staying rather than leaving. ■

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Shaping the Future for Women in Science



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Bright and early one morning in the mid-1960s, the telephone rang in my laboratory; it was the executive secretary (as Scientific Review Administrators were then known) of an NIH study section. Would I become a member of a biochemistry study section? I chuckled, and said, “no thank you, you haven’t wanted me or thought me qualified before,” and as far as I knew nothing much had changed since the previous afternoon except that President Lyndon Johnson had decreed that all Federal Government advisory committees would, henceforth, have a substantial number of female members. I’d been getting along quite well without all that additional work and might just as well stick to the laboratory. But in the end, my ego or the promise of influence or the argument that my service would be good for female scientists got to me. I succumbed and did agree to be the token on various committees, though not a study section. I accomplished some interesting and important work for science — but also wasted many hours.

Many female colleagues from my generation can tell similar stories. Often, we served on even more committees and boards than our male colleagues because, given our small numbers and the mandated requirements for representation by women, we were needed, or so it was said. Some of us served on too many such bodies, giving up a great deal of time that could have been spent in the laboratory, the clinic, with our families, or walking on a beach.

In 1990, 25 years after President Johnson’s directive, I was completing a term on an influential interdisciplinary committee of the National Academy of Sciences. Members were discussing possible replacements for those about to rotate off the group. Physicists suggested physicists, biochemists suggested biochemists, and so forth. They turned to me and said that, with my departure, the committee would be without a female

Would I become a member of a biochemistry study section? I chuckled, and said, “no thank you, you haven’t wanted me or thought me qualified before,” and as far as I knew nothing much had changed...

member and would I please offer some ideas for women who might be appointed? I pointed out that people carrying two X chromosomes did not constitute a particular branch of science, and I thought that they would know the women in their own fields better than I would, so why didn’t they come up with the names. It was, I said, their responsibility, not mine, to be sure that women were part of the committee.

Since then, a great deal of progress has been made and the opportunities for women in research are substantially improved. When the *New York Times* Science Times featured a story about telomeres, all the major contributors credited were women, starting with Barbara McClintock’s studies on chromosome stability right through to the work of Elizabeth Blackburn and Carol Greider.

Yet, we have to face up to the fact that affirmative action, no matter how laudable it is, has worked at a snail’s pace. Many superb, accomplished female scientists have been trained in the last 25 years, but so few have reached the professorial ranks, and so many are still being discouraged. A 1992 *Science* magazine issue on women in science described the situation as so dismal that even chemistry was characterized as a field that was middling on opportunities for women, somewhere between neurobiology, seen as pretty good, and mathematics, which was the

pits. Yet, at how many chemistry departments do women abound and feel as though they belong?

We can wait around for a while longer in the hope that progress will slowly continue. In the meanwhile, a lot of money that could be used for good science will be spent on studies that try to determine why affirmative action has not worked more rapidly, and why

...except that President Lyndon Johnson had decreed that all Federal Government advisory committees would, henceforth, have a substantial number of female members.

young female scientists disappear somewhere between their Ph.D. or M.D. degrees and the assistant professor positions. Ultimately, all the “old school” men who still call us “honey” will age sufficiently to retire and maybe, just maybe, the younger men will be different.

I pointed out that people carrying two X chromosomes did not constitute a particular branch of science.

But it seems to me that waiting around is insufficient. Current strategies have an important flaw. No matter how hard we may work to have them succeed, they depend ultimately on other people, mainly men, changing their attitudes and expectations. At a Gordon Conference organized by Princeton biochemist [later president] Shirley Tilghman



in 1988, fully 33% of speakers were women; two years later, at another conference on the same subject organized by men, there were two female speakers. The contrast is powerful. Yet, when we speak of recruitment, retention, and reentry, we mean getting the current research institution hierarchies to be responsible for the advancement of women; the workplace climate is set by the current faculties, overwhelmingly men.

Current strategies have an important flaw. No matter how hard we may work to have them succeed, they depend ultimately on other people, mainly men, changing their attitudes and expectations.

We need a strategy that depends on women. One that assumes we will expend our energies on improving the opportunity for women to succeed in biomedical careers, not on complaining about the failure of others to do so. At their best, our networks help all of us cope with problems and disappointments. But how will effective connections be made between the best of networks and the places where decisions are being made? Networks can provide sympathetic ears, but they cannot easily provide a laboratory of one's own. And who really wants to be part of the "old boys' network"?

We have to stop expecting that our male colleagues will change. The fact is, many of them are, understandably and appropriately, much more concerned about their own research than about the status of women. We need to face the reality of our colleagues' ambitions, recognize our own, and acknowl-

We have to stop expecting that our male colleagues will change...We need to face the reality of our colleagues' ambitions, recognize our own, and acknowledge that ours will not change theirs.

edge that ours will not change theirs. Indeed, ambition and competition are mostly constructive contributors to good science. As Wallace Stegner puts it in his novel *Crossing to Safety*, "unconsidered, merely indulged, ambition becomes a vice; it can turn a man into a machine that knows nothing but how to run. Considered, it can be something else — pathway to the stars, maybe." We cannot expect that our male colleagues will become more collegial, less ambitious, or less competitive to meet our needs, and it is probably not desirable from the point of view of science.

Many superb, accomplished female scientists have been trained in the last 25 years, but so few have reached the professorial ranks, and so many are still being discouraged.

There is another flaw in our current strategies. They address the world as it is, not as it will be. Our energies should go into making sure that the future gets shaped to foster women's contributions to science. A new strategy, therefore, must have three essential elements. First, we must strive to do the best science that we can: the most original, the

most rigorous, the most interesting. Second, we must depend on ourselves and not on others to enable us to contribute to science and, thus, to human welfare. Third, we must make certain that we have a substantial say in the shape of the future. To achieve this, we can gather some clues from our male colleagues who have, in the past 40 years, built an extraordinarily successful research enterprise in our country. They, like the scientists concerned with telomeres, have chosen avenues of inquiry that opened new fields and expanded our very sense of what the questions are. We should emulate that but with our own agenda. In so doing we will move from the periphery, from being supplicants for fair treatment, to being the shapers of the future.

Consider the phenomenon of menopause. What fundamental aspects of living things will be revealed when we understand this profound change? What will the implications be for understanding aging in general? Consider contraception. Adolescents in the United States become sexually active at about the same age and rate as teens in Canada and Sweden, but the U.S. leads the industrialized world in teen pregnancy. Clearly, more choices among effective contraceptives are desper-

We need a strategy that depends on women. One that assumes we will expend our energies on improving the opportunity for women to succeed in biomedical careers, not on complaining about the failure of others to do so.

ately needed. Work in this area is likely to produce a substantial, fundamental understanding of the processes of ovulation, oocyte

and sperm maturation, and fertilization. A successful effort might also yield innovative routes out of a political issue that is tearing our country apart: access to abortion. Our male colleagues have not insisted that contraception be on the active research agenda, but we should be strongly motivated to guarantee that it is.

This area of research is important for yet another reason: the increasing world-wide concern for the environment. We all decry the extinction of uncounted, even unknown species. We need to face the fact that the unchecked expansion of our own species is a root cause of the loss of biological diversity.

There is another flaw in our current strategies. They address the world as it is, not as it will be. Our energies should go into making sure that the future gets shaped to foster women's contributions to science.

The agenda I am proposing will not be easy to achieve. In our country, there are powerful political forces that would prefer to forget that the ramifications of sex are central to all our lives. At least in part, such views reflect a deep denial of women and women's legitimate rights and interests. Menopause embarrasses people; contraception not only embarrasses but also gravely troubles many. Indeed, there are indications that if the antiabortion forces succeed in turning back the clock by overturning *Roe v. Wade*, they will then actively pursue an anticontraception agenda. But solid biomedical research in these areas will increasingly legitimize these fields and will make it more and more difficult to ignore the associated societal and cultural realities.



A sound scientific agenda, based on vital issues of concern to women, is one way to promote the role and status of female scientists. We must also ensure a healthy presence of women in Congress. Just as our male leaders have cultivated the interest of senators and representatives in biomedical research to extraordinarily good effect, female scientists, too, can cultivate the interest of women in

We will move from the periphery, from being supplicants for fair treatment, to being the shapers of the future.

Congress to assure the promotion of a women's health agenda. The availability of grants in research of interest to women and the excellent science they can support will not only contribute to the ability of women to capture faculty positions, but they also will strengthen bargaining positions during recruitment negotiations. Carl Djerassi suggested in a letter to *Science* that extra help for childcare should be considered comparable to the mortgage support that is used as a recruitment device in academic institutions. In families where one spouse's benefits provide for a family's health insurance, the other spouse could be offered childcare sup-

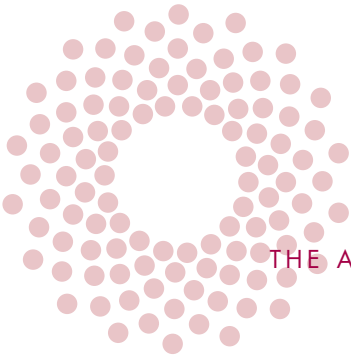
In our country, there are powerful political forces that would prefer to forget that the ramifications of sex are central to all our lives.

port as an employment benefit. There are many possibilities to think about. The important thing is to seize the opportunities that are being offered and to use them to define new scientific agendas that have the potential for major contributions to knowledge and alleviate societal problems. From this can come a vitality that cannot be ignored and that will place women at the center of the research enterprise. ■

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THE AMERICAN SOCIETY FOR CELL BIOLOGY

Career Advice for Life Scientists

Volume II



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Introduction to Career Advice for Life Scientists II



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The Women in Cell Biology 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 in New Orleans that year. They posted flyers on the back of bathroom stalls and thirty women showed up.

The first sustained effort of this pick-up group was a “newsletter”—a bimonthly mimeographed job—featuring entries as diverse and important as sexist advertisements in scientific journals, job opportunities (though the jobs had not been advertised), and ACLU 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.

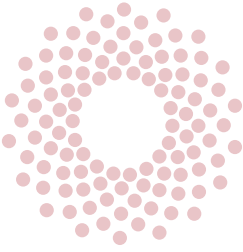
In the subsequent thirty-plus years, The Women in Cell Biology Committee has, in its way, become the heart and soul of the cell biology community. Women in cell biology and The Women in Cell Biology Committee have achieved sufficient progress as to make early concerns seem almost quaint. But the challenges 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 Women in Cell Biology 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 the past several years, when the challenge of students and post-docs in establishing a satisfying career in the life sciences has become acute. In response, The Women in Cell Biology 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 second volume of selected articles from the acclaimed “Women in Cell Biology” column of the award-winning *ASCB Newsletter*, those ranked by The Women in Cell Biology Committee members as providing the most helpful career advice for life scientists. The first volume was published in 2002 during the chairmanship of Zena Werb, who served as committee Chair from 1998 through 2001, following the successful leadership of W. Sue Shafer, who served in the same role from 1994 through 1997. Based on the success of the monthly *ASCB Newsletter* columns and the overwhelming popularity of *Career Advice for Life Scientists, Volume I*, we trust that this compilation will prove even more helpful than the sum of its parts.

At risk of inadvertently excluding deserving colleagues, we acknowledge proudly some of the many people who together have conspired to make The American Society for Cell Biology Women in Cell Biology 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*, whose job included gathering \$1 and \$5 contributions from colleagues to keep it going; chairs before The Women in Cell Biology 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, who served as the conscience of the ASCB Council in the early years; Laura Williams and Maureen Brandon, dedicated editors of the *ASCB Newsletter* “Women in Cell Biology” column (Laura did much of the research that contributed to this history), and Emma Shelton, Dorothea Wilson, Rosemary Simpson and Elizabeth Marincola, ASCB executives who helped nurture women’s activities through the Society. Finally, but not least, we thank the NIH Office of Research on Women’s Health and the Burroughs Wellcome Fund, without the support of which we could not offer this resource. ■



1. THE LAB COMMUNITY

Confronting the
Social Context of Science

Conflict Management

Two Cultures and the
Revolution in Biotechnology

Confronting the Social Context of Science



Carl Cohen
Science Management
Associates

Much of biological science both in academia and in the for-profit sector is done in complex group and organizational settings. Collaborative efforts are increasingly common and often result in spectacular contributions. But many partnerships do not succeed or are hampered by issues that transcend the scientific. Chief among these issues are those that fall into the social dimension of science, encompassing interpersonal conflict, poor team dynamics, and dysfunctional organizations.

Many partnerships do not succeed or are hampered by issues that transcend the scientific. Chief among these issues are those that fall into the social dimension of science, encompassing interpersonal conflict, poor team dynamics, and dysfunctional organizations.

American universities do a superb job of teaching scientific and technical skills to those who choose science as a profession. While there will continue to be debate as to whether we are producing too many or too few scientifically trained professionals, those that we do train are generally thought to be reasonably well prepared to pursue their careers. Are they?

Scientists are typically well trained in the technologies and academic subjects of their discipline. However, they are missing a set of skills that handicaps them both in academic and for-profit environments. These are the interpersonal, social, and organizational skills needed to practice science in a social context.



They include conflict management and negotiation skills, working in and managing teams, understanding and working within complex scientific organizations, and communication skills.

Every first-year graduate student can relate stories of projects stymied or collaborations hampered by principal investigators who fail to communicate clear objectives, simmering conflicts gone unaddressed, and team members who function more as antagonists than supporters. The private sector is afflicted by all of the problems encountered in academe (interpersonal conflicts, poor team dynamics, turf issues, etc.) and a few of its own. As the barrier between academe and the private sector, especially biotechnology, becomes more porous, the problems will become indistinguishable.

Scientists who enter the biotechnology industry spend their first three or more years adapting with difficulty to new reward structures and new work paradigms. In academia, rewards come largely on the basis of individual achievement (although much of the work

In academia, rewards come largely on the basis of individual achievement (although much of the work is done in teams). In the private sector, well-meaning attempts are made to reward on the basis of team performance.

is done in teams). In the private sector, well-meaning attempts are made to reward on the basis of team performance. Under such conditions, young scientists may hoard informa-

Traditionally, scientists have believed strongly that if you get the science right, everything else is irrelevant. While this view may be harmless in a scientist working by him- or herself, it is detrimental when adopted in a social or organizational scientific context and constitutes a fatal conceptual error when adopted by scientists in the private sector.

tion or ideas and use them as currency to enhance their individual status. In biotechnology especially, projects begin and end for reasons that are often opaque to bench scientists. Because scientists become intellectually bonded to projects, they often react to this experience with feelings of frustration and of being manipulated. In some cases they may avoid fully committing themselves to projects to minimize disappointment. These behaviors hamper productivity and are typically attributed to individual personality issues. In fact, they are a direct result of the poor preparation that scientists receive for functioning as a member of a team and of the failure of scientific leaders to anticipate and deal with the human consequences of scientific and business decisions. In short, both the members and leaders of science efforts are deficient in skills that extend beyond the technical discipline of their specialty.

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him- or herself, it is detrimental when adopted in a social or organizational scientific context and constitutes a fatal conceptual error when adopted by scientists in the private sector.

Scholarly studies in other disciplines reveal that biological scientists are no more likely to fall into the trap of focusing only on the technical aspects of their discipline than others. Analysis of catastrophic failures in the chemical industry,¹ in the space program,² and in military contexts³ is instructive. The principal cause of failure to learn from military disasters lies in the tendency of analysts to focus exclusively on technical and logistical explanations.³ This narrow focus betrays a naive indifference to the roles of leadership style, command structure, and of the organization as a whole. By the same token, because the business of biotechnology is one that is deeply rooted in science, what *post hoc* analyses of success and failures there are tend to focus on the science, technology, and economics and fail to include the organizational and managerial context in which the science was applied.

It is a tribute to the individuals and organizations involved that despite managerial and organizational problems, science, and often superb science, gets done. Scientists in training will bear an enormous amount of conflict, ambiguity, and heavy-handed manipulation in order to achieve their educational and professional goals. Unfortunately,

Training scientists without attention to this larger context makes no more sense than training soldiers in the use of automatic weapons without simultaneous training in teamwork and group tactics.

in addition to acquiring superb technical skills, trainees frequently are imprinted with the same dysfunctional managerial skills as their mentors. If we take the view that work style is as important for scientific and business success as technological methods and approaches, this is a serious deficiency.

The scope of scientific training should be increased in the service of improved communication, greater productivity, and, from the perspective of the private sector, greater return on investment. Seizing the opportunity requires an explicit recognition that much current biological science is inherently a team, group, or organizational activity done in the context of economic, business, and social constraints. Training scientists without attention to this larger context makes no more sense than training soldiers in the use of automatic weapons without simultaneous training in teamwork and group tactics. ■

Conflict Management



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Conflict is part of life: an inevitable consequence of interacting with other people. In both our professional lives and in our personal lives, we are constantly faced with statements, actions, needs, drives, wishes, demands, or positions that are incompatible with or opposed to our own. Conflict can create stress, produce anxiety, adversely affect performance, decrease productivity, and disrupt the work (or home) environment. It can be difficult to decide how to respond when faced with conflict. We often react emotionally or reflexively, without thought or conscious decision. Learning to deal effectively with conflict requires that we learn to control our response, choosing the most appropriate strategy for the particular situation.

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Responses to Conflict

Response to conflict can be described along two dimensions: assertiveness and cooperativeness. Assertiveness is the extent to which you attempt to satisfy your own concerns. Cooperativeness is the extent to which you attempt to satisfy another person's concerns. There are five well-described strategies for managing conflict, which comprise varying combinations of assertiveness and cooperativeness. They are *competing*, *accommodating*, *avoiding*, *collaborating*, and *compromising*.

Competing is assertive and uncooperative; you pursue your own concerns or interests exclusively. This is frequently characterized as "I win/you lose."

Accommodating is the opposite of competing; it is cooperative and unassertive. You pursue the interests or concerns of the other party and ignore your own: “I lose/you win.” *Avoiding* is both unassertive and uncooperative. You pursue neither the other party’s interest nor your own. You do not pursue the issue at all; you disengage from the encounter or situation. Extending the game metaphor, avoiding means, “I won’t play.” *Collaborating* is both assertive and cooperative; you simultaneously attempt to satisfy your own concerns and those of the other party. This is the “win/win” scenario. Collaborating is often the most difficult of the strategies to employ. It may require significant time and effort from both parties. *Compromising* may be described as unsuccessfully assertive or reluctantly cooperative; it is a trade-off, each party gets part of what they want. Depending on the quality of the compromise, this may be a low form of “win/win” or, in particularly acrimonious conflicts, it may be “lose/lose.”

To clarify the differences among these approaches, let us look at an example. It is eight o’clock, the regular bedtime for a nine-year-old girl. Her mother wants her to go to bed; she wants to stay up until nine o’clock. A “competing” response would be to send her to bed without further discussion; Mom wins, she loses. An “accommodating” response would be to allow her to stay up until nine o’clock; Mom loses, she wins. If the mother wants to “avoid” the conflict, she might say, “Ask your father.” She thus avoids enforcing the rule and granting an exception to it; she doesn’t play. “Compromising” might mean that the child goes to bed at 8:30 p.m., or she goes to bed but can leave the lights on and read, or she stays up late tonight but goes to bed early tomorrow night, etc. The mother can employ any of these approaches, immediately and unilaterally, to resolve the bedtime conflict.

A “collaborating” response is harder to develop; how can the child simultaneously go to bed at eight o’clock and stay up until nine o’clock? To collaborate, we must understand the reasons behind the positions, not just the positions themselves. The mother

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wants her daughter to go to bed at eight o’clock because she has to get up at 6:00 a.m. and she needs ten hours of sleep or she becomes cranky and inattentive in school. The daughter wants to stay up until 9:00 p.m. because she desperately wants to watch a particular television program that airs from 8:00 p.m. to 9:00 p.m. Equipped with this information, they can now craft “win/win” solutions: she goes to bed at 8:00 p.m. and Mom videotapes the program so her daughter can see it tomorrow; or she stays up until 9:00 p.m. to see the program but she puts out her clothes, makes her lunch, and trades her morning chores with her sister so that she can sleep an hour later in the morning—she still gets ten hours of sleep. This is why collaborating takes time: the parties must communicate openly, giving the reasons behind their positions, each actively trying to understand and satisfy the concerns of the other.

None of these responses is always correct; each has advantages and disadvantages. We have a tendency to default to whichever strategy reflects our emotions or personality. Some people become relentlessly assertive when faced with conflict; they will always try to “win.” Some will always seek to accommodate others, even to their own significant



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detriment. Others will do almost anything to avoid conflict. Still others are always ready to compromise. Strategies that are guided by our personal feelings rather than the specifics of the situation are often dysfunctional. The key to effective conflict management is learning to use the appropriate strategy for each situation. The choice is determined by the substance of the conflict, the time available to resolve it and the relationship between the parties.

Managing Conflict

The first rule in managing conflict is to ascertain that an actual conflict exists. There are many situations where incomplete information, misunderstanding, or unwarranted assumptions create an apparent conflict when the parties involved do not actually

Incomplete information, misunderstanding, or unwarranted assumptions create an apparent conflict when the parties involved do not actually have incompatible or opposing interests.

have incompatible or opposing interests. Whenever you encounter what appears to be a conflict, the first response should be to clarify your position and that of the other party. It may become clear that no conflict exists. If

you do determine that an actual conflict exists, you may have gained enough information to make a deliberate choice of strategies.

When to Compete. The “I win/you lose” approach is not the exclusive province of competitive sports and games. There are times when you must insist on having it your way: when quick, decisive action is vital and the decision is yours to make; when enforcing unpopular rules; and when you know you are right. Using this approach, especially if there is little time for discussion, may damage your relationship with the other party. If this is your primary method of resolving conflict you may be perceived as dogmatic, unreasonable and inflexible. Sometimes you may be forced to use this approach to protect against people who take advantage of non-competitive behavior.

Giving in gracefully may be the right thing to do when your relationship with the other party is more important than the conflict at hand.

When to Accommodate. Giving in gracefully may be the right thing to do when your relationship with the other party is more important than the conflict at hand. Accommodating can be used to preserve harmony or to build up social credit for later issues. Managers or teachers may use this approach to aid in the development of subordinates or students. You may choose to accede to someone else’s wishes to show that you are reasonable and can learn from others. If you recognize that you are out-matched and losing, accommodating may be prudent. Most of us have had the experience of realizing, in the midst of an argument, that

we are wrong. Needless to say, when you know you are wrong, accommodating is the appropriate choice.

When to Avoid. Conflict should be avoided when there is no chance of satisfying your concerns or when the potential damage (to the relationship or to you) of confronting the conflict outweighs the benefits of resolution. Avoiding can be a useful temporizing strategy to let people, including you, calm down. It may be appropriate to avoid a conflict until more information can be gathered, either to clarify whether or not a conflict exists or to work toward a collaborative solution. Sometimes it is appropriate to choose avoiding when others can resolve the conflict more effectively. This is often true when you are a member of a team, particularly if you are a junior member, engaged in a conflict with a powerful external entity.

When to Collaborate. Identifying a “win/win” solution usually requires time and effort but yields tremendous dividends. Not only do you satisfy your own concerns, you create or enhance a positive relationship with the other party. Collaborating can allow you to test your own assumptions and often results in significant learning on all sides. This method of resolving conflict allows you to merge insights and experience to find an integrative solution. The process also allows both parties to gain commitment to the solution. This approach may be used to protect or enhance important relationships; it also may be used to work through hard feelings in the case of previous competitive, uncooperative or even hostile dealings. This approach to

resolving conflict, when successful, is by far the most rewarding. However, it does require that you truly value and are willing to pursue the interests of the other party, and that you forego an easy win or a quick compromise.

When to Compromise. While less satisfying than collaborating, compromising is usually quicker and easier. This approach may be used to find expedient solutions under time pressure or to achieve temporary settlements for complex issues. It may be an appropriate choice when the goals are moderately important: too important to avoid or accommodate, but insufficiently important to merit a collaborative effort. Compromising may be the only option when two opponents with equal power are strongly committed to mutually exclusive goals. It may also be the fallback strategy when competition or collaboration fails.

When faced with a conflict, the challenge is to consider, as dispassionately as we can, which approach is appropriate given the nature and importance of the conflict, the nature and importance of our relationship with the other party and the time available for resolution. If we can control our emotional reaction, we can think through the consequences of various choices. If we are aware of our default preference, we can monitor ourselves to make sure we make the best choice, not necessarily the one that comes most easily for us. Conflict management is an important professional skill, one that will also serve us well in our personal relationships. Like all skills, it can be learned and it improves with practice. ■

Two Cultures and the Revolution in Biotechnology



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The two cultures of science are not those of C. P. Snow who 40 years ago articulated the growing gulf between the humanists and ascendant scientists in the post-war period.¹ They are the two groups of scientists who work in academe and in industry. Bridging the considerable gulfs between these groups is important for the benefit of industry as well as for the support of university research.

One major problem is that basic science research faculty in general often undervalue the work done in industry.

One major problem is that basic science research faculty in general often undervalue the work done in industry and can make it difficult for their students and fellows to pursue careers there. When groups of graduate students and postdocs at a wide range of universities and research institutes are asked about where they see themselves in ten years, their answers are remarkably similar. Only a handful see themselves directing their own research program in an academic laboratory, and well over half plan to work in a pharmaceutical or biotech company.

We do a fair job educating students and postdocs about the various career opportunities available to them. Many institutions have career days where alumni or local colleagues describe their careers in industrial research, patent law, scientific editing, laboratory administration, and many other professions that require a strong background in science.

However, a critical problem exists between students/postdocs and their PIs. When asked if they would feel comfortable asking their PI for help or advice in seeking employment outside of academia,

The negative attitude is largely attributed to the fact that only a handful of academics have even a basic knowledge of what goes on in a biotech or pharmaceutical company.

students and postdocs respond with a universal and emphatic “no.” Part of this negativism results from the strong if outmoded notion that the research faculty are training people only for careers in academic research—in essence to become their successors. Another part may result from the historically strong but equally outmoded notion that the top students and postdocs go into academic careers and that only less qualified individuals take industrial jobs.

Industrial collaborations with academe are most likely to succeed when both sides have a real interest in the results of the project, and when the contact is PI to PI.

The negative attitude is largely attributed to the fact that only a handful of academics have even a basic knowledge of what goes on in a biotech or pharmaceutical company. Most have only vague notions of how research in a for-profit lab is organized and conducted and the kinds of career paths one can have there.

To solve this problem, companies themselves need to take the lead by holding research days or open houses to specifically

target the faculty, not the students and fellows they are trying to recruit. These events could include scientific talks focused on the company’s research. Tours of industri-

Companies should learn to seek not-for-profit labs in their fields of interest and develop long-term relationships with the key leaders.

al labs are also very useful. Most academics would be startled at the lab equipment in routine use in for-profit research labs, much of which is simply unavailable even in top academic labs. These can open the way for mutually profitable collaborations, assuming both sides can overcome the other gulfs that separate them. Interactions like these could also make faculty realize the many advantages of non-academic careers for their own students. They can result in significant

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research support for an academic laboratory, but also in true collaborative partnerships in which both sides derive the benefits from the beginning.

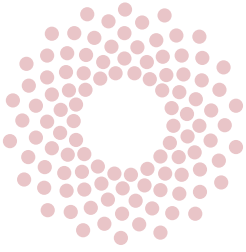
Industrial collaborations with academe are most likely to succeed when both sides



have a real interest in the results of the project, and when the contact is PI to PI. (In companies, PI's are often called group leaders.) While the company may very much want to know the result, it may not have the in-house expertise to work on the project or more likely, may not want to hire extra people just for a specialized short-term project. Companies should learn to seek not-for-profit labs in their fields of interest and develop long-term relationships with the key leaders. Companies need to lighten up and understand the free and open culture of research universities. All too frequently they try to place unreasonable restrictions on intellectual property and publications that conse-

quently prevent the important research from being conducted.

Academic leaders should realize that there are many potential advantages to industrial collaborations additional to research funding. Companies can provide reagents and equipment that are unavailable elsewhere. Also, the intellectual property conditions on a well-written contract do not generate significant restrictions and only create minimal delays in publishing the results. Finally, increases in these activities should help make it easier for fellows and students to learn more about industry, and to be less intimidated about approaching their PI for advice in non-academic careers. ■



2. DEALING WITH EVERYTHING AT ONCE

Dual(ing) Academic Careers

Effective Time Management

On Being a Scientist and Parent

How to “Get a Life” in the
Life Sciences

Dual(ing) Academic Careers



Liz Gavis
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When life partners both choose careers in academic science, tough issues arise. Balancing the conflicting demands of work, relationship, and sometimes children is daunting for everyone, but dual academic careers bring this challenge into particularly sharp focus. Because time is such a strong constraint, setting both career and relationship priorities is essential. Certainly there is no optimal strategy for every couple, but some strategy is required and the only way to reach one is by communicating to forge agreement on core principles.

While it is widely acknowledged that “there is no good time to have children,” the corollary that “any time is as good as any other” is just as true.

A primary factor in the equation for many couples is the decision to start a family. While it is widely acknowledged that “there is no good time to have children,” the corollary that “any time is as good as any other” is just as true. The integration of family with dual academic careers will require additional multi-tasking, whenever it occurs.

The first step in launching dual academic careers is landing two academic positions. There are at least two basic possibilities and many variations. Both partners can look for academic positions simultaneously, or one partner can find a position and the second can postpone the process, attempting at a later time to find something compatible. When possible, a synchronous strategy makes sense for one key reason: the job candidate holds the cards during the interval between receiving and accepting a job offer. A synchronous



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strategy can take advantage of this principle. Specifically, both partners carry out large-scale simultaneous but independent job searches. Each partner—in his or her dealings with prospective employers—maintains what amounts to a “Don’t ask, don’t tell” approach regarding the other partner. Job offers received by either person allow that person to bargain from a position of strength in attempting to place the partner. Some departments may, however unethically, hesitate to make a job offer to a candidate with a “spouse problem.” Increasingly, however, many institutions recognize the prevalence of this issue and, having made an offer to a candidate in this situation, will be eager to deal with it creatively. Some institutions may even see a benefit in being assured of acquiring two excellent faculty or may be able to join forces with a neighboring institution to the advantage of both.

To anticipate this process, both partners should apply, whenever possible, to searches at the same or neighboring institutions. This is worth doing even when the perceived match between applicant and job search is imperfect, because institutions may be able to bend the goals of a job search to fit the candidate, but be unable to offer a position to a candidate who did not apply at all. Including institutions that may not initially seem like top choices is essential to maximize the chance of overlapping offers; because preconceptions about institutions are often changed during interview visits anyway, too

narrow a focus may eliminate what could turn out to be a golden opportunity. Geographic areas rich in job opportunities within reasonable commuting distance of one another can be particularly promising for dual career couples. Obtaining positions in the same department has certain advantages: less commuting, opportunities for sharing equipment and supplies, and no need to play phone tag in arranging daycare pickup. The main caveat is that issues of independence may arise if both partners plan to dedicate their laboratories to similar research areas. In that case, and if the option is available, it is worth considering whether being in different departments is preferable.

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An asynchronous job search can be more difficult. The first partner to take a position has already committed to that institution, and although one hopes the institution has reason to want to retain him or her, the incentive can seem less urgent outside the context of the initial recruiting effort. In addition to efforts to add a second position locally, casting a wider net and being willing to consider moving together could be both necessary and desirable.

In the end, reality dictates that no matter how the job search is run, compromises will have to be made. Even if two offers at the same institution are secured, couples in very different research areas may find disparities in the offers or in the scientific environment

of a particular institution. Because compromise, especially if it entails substantial sacrifice, will weigh heavily on a relationship, open lines of communication are essential. It's hard to overestimate the importance of choosing a situation where the needs of both partners are taken into account. In cases where there is significant asymmetry in the compromise, it is easy for the favored partner to become comfortable, while the disfavored partner feels underappreciated. Therefore, it may be better to accept more equivalent positions in less desirable settings or for one partner to move in order to improve the other's prospects, than to create a situation in which one partner feels resentful.

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The transition from postdoc to an independent academic position is a big one. New tasks and responsibilities join research in constant competition for one's attention. Balancing research with teaching, committees, grant writing, mentoring, and travel are especially challenging for a dual career couple, particularly if children are also part of the mix. Indeed, many in this position have been heard to remark that they wish they had a spouse! But until polygamy becomes more widely accepted, other strategies are needed. The default approach among academic couples is to split everything 50/50—from shopping, child care, and taking out the

garbage to weekend work schedules, meeting travel, participating in department jobs, dinners with seminar speakers and faculty candidates, even exercise. There are inevitable exceptions, of course. One partner may need to borrow time from the other to meet a grant deadline. (Most dual-career couples scrupulously avoid trying to meet the same grant deadline, a grueling ordeal one couple refers to as "emotional PCR.") Nonetheless, an almost obsessive fairness in dividing up time and responsibilities is one good strategy for maintaining balance among conflicting demands.

Couples with children can only build academic careers on an underlying foundation of high-quality, reliable, and flexible child care. Therefore, time spent choosing the right situation is extremely worthwhile. Since the demands of two full-time jobs can become overwhelming at times, especially when one partner is traveling, the couple must inevitably take advantage of friends and relatives, daycare providers, and others who can be called into service. Such support networks can be life savers and are worth cultivating. Paying for help with house cleaning and participating in carpools provide other

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ways to optimize time. But, in the end, there will inevitably be days where things fall apart. On those days, one can be thankful that academic careers do provide a certain degree of flexibility.



Promotion and tenure are stressful issues for everyone. Although it might seem prudent for a couple to choose an institution where tenure is relatively assured, considerations of academic quality, colleagues, facilities, and financial support—all of which can contribute to launching a successful career—may be more important in the long run. Both tenure and biological clocks can seem to tick particularly fast for couples who plan to have children during this time. Many institutions now recognize that the pre-tenure years and the childbearing years overlap. They may allow faculty who have children during this period to postpone their tenure consideration, typically by one year. Since the laboratory continues to mature even in one's absence, this extra year can be extremely helpful in offsetting the inevitable time lost during the pre- and post-natal months.

Many dual-academic career couples comment on the benefit of being able to understand each other's work and relate to each other's needs. Both members of an academic couple have first-hand experience with the often-intense work schedules, the grant writ-

ing, the department politics; they can empathize vividly with bad news like paper rejections and experimental setbacks and even offer educated advice to help get things back on track. On the other hand, it is also important to be able to back off and take a break from work. When children start to

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complain that grants are the only thing their parents ever talk about, it's probably a sign that rebalancing is needed.

In the end, communication is everything. Partners who are friends, parents, and co-conspirators in the academic game can forge a very rewarding life together. Just not an uncomplicated one. ■

Effective Time Management



Suzanne Pfeffer
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Why is it so easy to become overwhelmed by all of the projects that face us each day? The world of email was supposed to make life more efficient. It has made communication and interaction much easier, but only encourages more communication and interaction. Below are a few effective approaches to time management for the busy researcher.

My Work versus Their Work

An important aspect of time management is prioritization. As a faculty member you will be asked to review manuscripts, serve on grant review panels, and serve on departmental, university, and extramural committees. As a graduate student or a postdoc, you may be asked to teach others a new technique or to guide a junior protégé. All of these activities are important, but if you fill your days with this category of work, your own projects will surely suffer. No one gets tenure or a research grant for excellence in committee service, and original research findings are prerequisite for a Ph.D. or successful postdoc experience.

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A useful approach for faculty is to reserve most work days (Monday through Friday, 9–6) for their own work—doing experiments or helping lab members do them, writing research papers, submitting grants, or preparing lectures for courses. Of course it is important to review manuscripts—this is an excellent way to keep up with the latest findings. It is important to serve on grant-review panels, after you are established. These can be rich and wonderful opportunities for scientific



interaction among a diverse set of colleagues, and the success of peer review depends upon broad participation. Try to review manuscripts and grant applications in the evenings or on weekends to ensure that work days are reserved, within reason, for your own work.

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The most important activities for graduate students and postdoctoral fellows are experiment planning and data generation. A deliberate approach is required to keep up with the literature, attend seminars and courses, and oversee the work of others while carrying out your own research project. At the end of each

Graduate students and postdoctoral fellows need to remember that their most important activities are experiment planning and data generation.

day, have a plan for what you hope to do the next morning. Write out your protocols, make up your solutions, and reserve centrifuges/microscopes etc. at least one day before. When you get to the lab in the morning, you will be ready to go and able to make the best use of the day. During incubations or while gels are running, think ahead about the next experiment or use this time to read a

research article or catch up on class assignments. Evenings and weekends are ideal times to catch up on reading, complete coursework, and plan ahead for upcoming experiments. The most effective students and postdocs take full advantage of their time in the lab and consider themselves professional experimentalists. Indeed, most cell biological discoveries are made by students and postdocs.

Lists Can Help

Lists help all of us keep track of commitments. By writing down what you need to take care of, you will be sure to accomplish more than you might otherwise. Also, some items require five minutes whereas others may require days. You might wish to keep a column reserved for the small things that you can cross off in between other activities.

Stay on Top of the Game

People who feel especially overwhelmed often face email overload. Their inboxes grow daily, and their ability to distinguish messages that require immediate action from those that don't degrades every day. Respond quickly to messages and throw out anything unessential and you will find email to be more manageable. It is also essential to organize your email using folders for differ-

Respond quickly to messages and throw out anything unessential and you will soon find email to be more manageable.

ent projects. Someone needs a plasmid? File it under collaborators. Faculty meeting? File it under department business. Email spam is an irritating time-waster and an unfortunate part of our current world. Create a filter and

remove your name from mailing lists to protect yourself whenever possible. By keeping your inbox list of messages short, you will have an easier time finding what you need to complete your own projects and to be able to help others. Make quick work of small requests so you have more time for more important projects.

For those still lucky enough to be able to work at the bench each day, staying on top of the game includes keeping your lab notebook in good order. Much time is saved when lab notebooks are maintained in a clear and organized manner. It is essential to put the gels/films/counts in the notebook and label and/or graph them out before doing the next

Get the most from each experiment by keeping pristine records.

experiment. Sometimes you will notice something in the data that you wouldn't have if you didn't take the time to fully document the experiment. Get the most from each experiment by keeping pristine records. When it comes time to write up the work for publication, the details will be essential and the writing will also be expedited.

Organize Your Workspace

Many people think more clearly when their office (or desk area) is clean. Letters and memos can't get lost under massive piles. A day spent clearing off the desk and organizing files is time well spent and will enhance the ability to tackle more. Lab workers often find that it is much easier to work and to generate clean results working at a clean lab bench. As mentioned earlier, keep your desk clean by keeping up with your lab notebook and keeping "idea lists" in a defined location.

All of us are more efficient on some days than others. It is important to acknowledge this and make progress on more mindless projects (doing the references on a manuscript or grant, for example, or updating your files) on a day when the more creative juices simply aren't flowing. Grad students and postdocs will find that a day spent planning experiments, writing protocols and preparing solutions can also be a day well spent. Then there are days that are best reserved for volunteering to defrost the lab freezer or to clean out the tissue culture incubators.

Take Care of Yourself

No one gets much work done if they haven't slept well or aren't feeling well. Work is important, but we all have more energy when we are able to maintain a regular and varied exercise program and we eat regular meals. Some people ride their bikes to the lab, which guarantees that they'll get exercise every day. If you find it hard to fit exercise into your schedule, use the stairs instead of elevators at work, or park your car at a location that requires you to walk a longer distance to get to the lab (if weather and safety issues permit). Also remember that more time at work does not equal more work accomplished. It is essential to get away from the lab or the office so that when you return, you feel fresh and ready to tackle all that awaits you. "Burn out" is endemic among biological researchers and educators, between grant writing and manuscript revising and lecture preparation and so on. Balance is essential and will help you accomplish more.

Good Time Management Includes Managing Deadlines

Many of us work best under the threat of a deadline. Yet last-minute efforts can't benefit from the input and comments of others, and they exhaust us emotionally and physically. If



you have a major grant to write, set aside a minimum of two weeks and do nothing else during that time. If the deadline is the first of the month, use the first two weeks of the previous month for your dedicated time. All writing projects benefit from a rest for a few days. When you return to them, you will have a fresh perspective and be able to improve on the ideas and language significantly. Writing deadlines can make one feel like they are being squeezed like a tube of toothpaste.

Know When to Say, “No”

It is always an honor to be asked to serve on a committee, review panel, or editorial board or to be asked to review manuscripts, write review articles, or give lectures. If you do a good job, you will be asked to do more. One has to find a balance between helping others and doing your own work. If you are a junior faculty member, wait until you have tenure before agreeing to serve on study sections and grant review panels. Even more valuable

is participating in research conferences where you are invited to present your own original research. Spend as much time as you can on your research program. The quality of your teaching is important, and your citizenship as demonstrated by committee service will be noted at the time of your promotion and when salaries are determined. But don't overdo it—keep a list of the committees on which you serve to remind yourself not to commit to more than you realize. Choose committee assignments that interest you so that the time you contribute is meaningful to you. At the same time, remember that others can serve in your place and that your own work must come first. This also holds true for students and postdocs. We all benefit from community service, and we should contribute to our communities locally, nationally, and internationally. But we have the most to contribute in all of these activities when we devote most of our time to the science that makes us true scientists. ■

On Being a Scientist and Parent



Ursula Goodenough
Washington University

Parent-scientists may hope to be remembered for their science, teaching, and/or public service, but the most enduring memories of their own are likely to be those of being a parent. As a mother of five and grandmother of three, I'm often asked to offer advice that might be helpful to those starting out. Herewith are some maxims.

Parent-scientists may hope to be remembered for their science, teaching, and/or public service, but the most enduring memories of their own are likely to be those of being a parent.

1. The key move is to embrace the following mantra: *Of course* I'm going to have kids and *of course* I'm going to have a scientific career. Neither is contingent or negotiable. They are both going to happen.

2. It turns out that kids aren't all that interested in what we do when we aren't with them, and are very adept at moving back and forth between parent time and nonparent time. If you're pipetting at the bench and missing your baby, it's actually pretty unlikely that your baby is missing you.

3. Like most of the rest of us, kids like to know what to expect. Try to find and maintain a family rhythm, even though there are of course times when things have to be arranged differently. A ritual time for us was the dinner meal—home-cooked, conversational, centered—which continued throughout adolescence. Another was Sunday-afternoon walks in the woods at a nearby nature preserve, coming to know the same trees and



glades in different seasons. These walks also continued throughout adolescence, albeit parental insistence was sometimes needed when other options beckoned. But by and large we all found the time to go because we all wanted to be there.

4. Your new babies are already persons and not blank slates whose personhoods you will somehow be creating. You get to know them by paying attention to who they are. Your job is to help them best become comfortable with and good at who they are.

It's much more important to encourage kids to be intense about what they're interested in than to try to influence what those interests are.

5. It's much more important to encourage kids to be intense about what they're interested in than to try to influence what those interests are. One son, for example, went through deep preoccupations with action figures, Ninja Turtles, Gameboys, skateboarding, rock climbing, and hanging out with friends. He's now an orchestral conductor. The common denominator is the passion.

6. Sometimes a parent–scientist can turn off the science and “just” be with the kids, but lots of times that doesn't happen. No reason to get hung up on this. Instead, figure out how to read *Winnie the Pooh* and think about your data at the same time. You can rest assured that your kids are probably thinking about *Winnie the Pooh* and something else as well. The core event is that you're reading *Pooh* together, snuggling and giggling.

Choosing the people and schools that your kids experience when you're at the lab is all-important.

7. Choosing the people and schools that your kids experience when you're at the lab is all-important. Make these choices carefully; find contexts that you feel deeply comfortable with, and be ready to switch if your decisions prove to be unwise. But it's not essential that these contexts be replicas of your own *modus operandi*. My kids spent much of their lives with a woman of limited formal education and of profound wisdom, intuition, and warmth. When she was present and we parents were absent, her *modus* prevailed, and everyone was greatly enriched.

Your bonds with your children will always be primary, and the additional love that they also experience with others has the effect of expanding their capacity to form meaningful relationships.

8. All working parents are vulnerable to anxiety that child-caretaker bonds might somehow interfere with child-parental bonds. But this turns out to be a misguided fear. Your bonds with your children will always be primary, and the additional love that they also experience with others has the effect of expanding their capacity to form meaningful relationships.

9. 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 30's to early 40's. But having babies earlier can work out fine also: it's just dicier to pull off.

[Don't] adopt the conceit that [your kids'] difficulties are somehow the consequence of your also having pursued your own career. As they say, get over it.

10. As in doing good science, it's essential in parenthood to reach out for input and collaboration from those who are helping you raise your kids, including family and friends, par-

ticularly when your kids are having difficulties (which they all have). What can most flummox this process is to adopt the conceit that the difficulties are somehow the consequence of your also having pursued your own career. As they say, get over it. Your career is not that big a deal in the big picture.

11. Keep in mind that your children are blessed by the fact that you are their parents, fired up with intellectual drive and curiosity. My parents were both academics, and even had I not chosen their career track, my memories are filled with their intense interactions and the colleagues who showed up for those animated after-dinner conversations. Bring your life to your kids, not with the intent that they follow in your footsteps, but because you want them to experience the lives of those in quest. They may not seem all that interested, but they'll take it with them. ■

How to “Get a Life” in the Life Sciences



William Wickner
Dartmouth College

For most of us humanoids, “a life” is a melange of friendship, love, loyalty, consideration, compromise, kids, a profession where you excel and find joy, hobbies, reading books, exercise, laughter, and eight hours of sleep a night. Can you find it in the life sciences? I think so.

The pathway begins with graduate school. Choose a research advisor who’s passionate about science, not too distracted by companies or administration, with a lab that’s happy, hard-working and productive, where folks get along well, and where graduates have gone on to “have a life.” There, choose a research project with an early “decision point” (not when it’s done, but when you know whether it’ll work), of general interest in biology,

Learn to enjoy criticism when offered in a positive spirit; the critic is helping you to hone your ideas, and this can actually be an avenue to developing friendships.

and at the heart of the lab’s direction. Develop some novel assets as a scientist: learn to enjoy criticism when offered in a positive spirit; the critic is helping you to hone your ideas, and this can actually be an avenue to developing friendships. Read with “an attitude,” not only critical but also appreciative. For each article, ask yourself what different direction you’d take in your lab. From this reading, from gazing wide-eyed at histology texts, and through late night bull sessions with friends, build a fantasy “stable” of hobby-horse ideas, and take ‘em out for frequent rides! Find a friend to be your partner in this fantasy game—it’s the groundwork for realities to follow.

Should you stick with it? Well, do you love bench science, teaching, and/or reading? If not, switch! In

What should you accomplish in grad school? Publish quality papers telling a coherent story. Learn to present science clearly, for audiences at different levels, with confidence and charm, orally and in writing.

your 20's, strive to find your passions, personal and professional. If you do love it, work hard in the lab (I like 6 a.m. to 6 p.m., five days a week; arrive knowing the experiments you'll do that day), but evenings and weekends are for dinner, family, friends, reading (science *and* novels), music, and hikes. What should you accomplish in grad school? Publish quality papers telling a coherent story. Learn to present science clearly, for audiences at different levels, with confidence and charm, orally and in writing. All the while, build the stable of hobby-horse ideas for your own future research.

Of organism, scientific problem, and technical approach (genetics, enzymology, structural biology, or informatics), keep one but change two between grad school and postdocship.

Postdocing. It's for everyone—your salary almost doubles, you sample another region, or country and culture, and no “hoops” of tests to jump through! Think about it early (by the end of year three of grad school), and plan to complement, not extend, your graduate training. Of organism, scientific problem, and

technical approach (genetics, enzymology, structural biology, or informatics), keep one but change two between grad school and postdocship. Change universities! Seek a productive lab doing exciting research where the postdocs go on to jobs you'd like. Ask your graduate department faculty about the personality and reputation of prospective postdoc advisors. Spend a few hours reading recent lab papers, write a serious and warm letter with a few new project ideas, include your CV and publications, and apply to one lab only at a time (and, tell this to the lab chief). During postdocship, develop a creative but practical plan for your own lab, built on the technical approaches you've mastered as a student and fellow but embarking into a new area, chosen from your “stable” of exciting ideas. For example, during graduate studies of the enzymology of yeast membrane trafficking, you may dream of understanding how Sec proteins work in neuronal networks. Your postdoctoral studies of worm apoptosis then teach you worm genetics and physiology, and you establish your own lab to unravel the connections and functions of the ~300 worm neurons, pioneering in worm enzymology, cell culture, and other frontier areas.

How to interview, for postdocships and for that dream job? Read a paper, and have questions and ideas, for each scientist you'll meet during the interview. Be confident but not arrogant; give a dynamite talk.

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during the interview. Be confident but not arrogant; give a dynamite talk. Ask each person about their work and spend most of the time talking about their science. Pay attention, ask germane questions, establish common areas of interest. Show enthusiasm, and that you'll "pull your oar." Say "please" and "thank you," and above all Never Negotiate the Job You Haven't Been Offered.

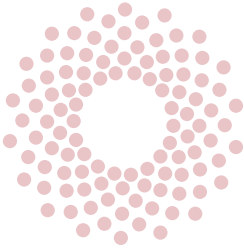
*Say "please" and "thank you,"
and above all Never Negotiate
the Job You Haven't Been
Offered.*

What careers lie ahead; in biotech and pharmaceutical companies, doing science of fundamental importance that also creates useful products; in academia, blending teaching with basic science, at research institutes if teaching is not for you, at liberal arts colleges or high schools if teaching is your passion, and possibly in a life of letters and ideas, be it law, business, administration, or journalism. The prime directive is that you must do what you're good

at and will find fulfilling (usually, the same thing). Let no one tell you otherwise.

If you do start your own lab, in academia or industry, remember that you're the best damn postdoc you'll likely see for a decade or more, and ruthlessly keep yourself at the bench! Seek one project, leading to one lovely paper, each year, and success will crown your efforts.

Are there special considerations for women in science? There are several. One is that the burdens of childbearing and early childrearing fall disproportionately on women. Furthermore, some folks are still being told 1950's fairy tales about women's "supportive roles" by their mom and dad. Does your Significant Other truly love you for you, and stand ready for the difficult give and take of a successful relationship? Find friends and loved ones with the right attitude. Above all, don't drop out, don't quit. Half the graduate students are women, but fewer of the postdoc applicants, and fewer yet of the job applicants. When offered a job, check how women have fared at that institution, and childcare policies and facilities if relevant. Be among those who stay with it, if you too find that science is a joyful part of your life. ■



3. SCIENTIFIC CITIZENSHIP

The Misconduct of Others:
Prevention Techniques for Researchers

Making a Difference:
The Three R's of Public Science Policy

Great Expectations
or Realistic Expectations?

The Misconduct of Others: Prevention Techniques for Researchers



Jane A. Steinberg
The National Institute
of Mental Health

Few people can distinguish between the smell of day-old fish and the paper in which it was wrapped. That's just how it is with scientific misconduct. The misconduct of those working with you may become yours. In the worst case, your lab is shut for the investigation, your publications are retracted, and your name becomes suspect. Even if *you* reported the suspected misconduct and the investigation is fair, the accuser and the accused may become intertwined as the investigation proceeds. All too often, the reporter and the reported blame each other, making the investigation protracted and contentious until the allegation is sustained or not.

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The good news is that you can protect yourself against the misconduct of others by prevention techniques that are consistent with good supervision.

The good news is that you can protect yourself against the misconduct of others.

Exactly what are you trying to prevent? Federal regulations define scientific misconduct as fabrication, falsification, plagiarism, or other practices that seriously deviate from those that are commonly accepted within the scientific community for proposing, conducting, or reporting research.¹ It does not include honest error or honest differences in interpretations or judgments of data. Other types of misconduct can occur in the



research setting, but these are addressed through other laws and regulations and are not considered *scientific* misconduct (e.g., theft, harassment, and discrimination).

Prevention Strategies

Some believe that if staff or colleagues want to dupe you, they will. This is not necessarily true; prevention can work. Simply let your staff and partners know that you personally verify data and any corrections. Then do it, and let them see you doing it.

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Ask questions about stray marks or erasures. If electronic data are written over or corrected, find out why. The expectation of monitoring lets potential fabricators know that they are likely to be caught without even mentioning misconduct.

Encourage the immediate entry of all information into notebooks, and double check data entered after a significant delay. Discuss tardy write-ups with the team and determine if the study should be repeated to minimize selective recall or reporting of procedures or results.

Arrange a consultation with your institution's computer expert to learn about data security options for your lab. Explore marking electronic lab notebook entries with date, time, and user identification. Regularly back-up these and other electronic files, then date and save the historic versions in a separate secure area. These procedures protect you against computer crashes and natural disasters, as well as simultaneously providing a

data trail to discourage or document inappropriate changes. Consider limiting access to certain electronic files so they may be read and used, but not copied or altered. These protections could avoid unauthorized changes and distribution. Similarly, don't let staff members install idiosyncratic or undocumented security options that could jeopardize your appropriate access. If that team member became incapacitated through illness or accident, you could be locked out of your own files.

Not all labs are ready for electronic notebooks, so the old standby of using notebooks with bound spines or binders with distinctive paper can make the substitution of pages on the sly very onerous. Careful individuals also keep dated copies of these notebooks in a second secure location.

Set a tone of respect for the research protocol. Avoid hyperbole and jokes about getting the results *no matter what*. Someone could confuse your humor with pressure to generate findings through falsification, skimping on animal or biohazard protections, improper analyses, or misleading interpretations of results.

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Inoculate staff against the temptation to find a "better" way to run the study mainstream. Let them know you want to hear their ideas for the next study, but that fidelity to the current design is essential. Remind them that the current design is the only one approved by the institution's animal care and use committee. Explain what an unrecognized or unreported shift in procedures does to the study's analysis and interpretation.

Watch for individuals who are working too quickly or too well. Most protocols have an average run time—is anyone collecting data at a suspiciously fast rate? If so, find out why. Some people just have the knack, but you may want confirmation.

Learn about Research Integrity

The Office of Research Integrity² provides easy-to-use guidance. On its website, you will find published reports of completed investigations. In reviewing these cases, notice that

Fabricators exist at all levels of science—data collectors, graduate students, colleagues, and supervisors.

fabricators exist at all levels of science—data collectors, graduate students, colleagues, and supervisors. There is also a wide range of sophistication in carrying out the fabrication. Each case report is a free lesson for you, which came at great personal and professional expense to the named individuals.

ORI staff use the website to explain investigational techniques, some of which may provide early detection of problems in your lab. For instance, there is a demonstration of statistical forensics using human biases in generating numbers as a telltale sign of

It turns out it isn't so easy to make up convincing data.

fabrication. It turns out it isn't so easy to make up convincing data. Also posted is guidance on making an allegation and on protecting yourself against an allegation.

Read these suggestions now so you can ensure that your first reaction to an allegation is the best one.

The website also links you to the emerging field of research on understanding scientific misconduct. There are reports on the perceptions of exonerated individuals regarding how they were treated during and after an investigation. You also can find application guidelines for grants in this area.

Another way to learn about misconduct at arm's distance is to say "yes" when asked to consult on an investigation. Whether conducted by your institution or another or by the ORI, you will see what is considered suspicious and how suspicions are handled. You will help decide what is fair to the person under suspicion, the individual making the allegation, and to science.

Promote Research Integrity

Finally, and most positively, promote research integrity. Do so by teaching it in your classes, through your mentoring, and in the lab. Explicitly teach the standards of conduct in research. Review cases of scientific fraud and the ramifications for the researchers, the field, and the public trust. Be sure that you explain what to do if misconduct is suspected at your institution.

Hold lab meetings to explain that some rules are not identical across labs or disciplines (e.g., authorship, ownership of data, and conflicts of interest) and present the rules that your lab follows. These shifting areas all require discussion at the beginning of a collaboration so new staff members know what to expect for their degree of contribution. Some entering graduate students may never have had such a discussion, resulting in unwarranted expectations about authorship or unlimited use of a data set. By making the meeting a discussion rather than a lecture about your lab's standards, you can learn



Shared expectations avoid misperceptions over breaches in authorship and data access, which although less serious than allegations of falsification, are much more prevalent and generate plenty of hard feelings.

about conventions from other labs and can incorporate desirable changes immediately. Such shared expectations avoid misperceptions over breaches in authorship and data

access, which, although less serious than allegations of falsification, are much more prevalent and generate plenty of hard feelings.

Documented scientific misconduct is rare, but a little goes a long way. With each finding of misconduct, researchers across science ask if it could happen in their lab. They look for easy tip-offs to wrongdoing, but by the time there is reason to be suspicious, the damage may be done. By the time someone has made an unauthorized copy of your data set, you are in the thick of it. The smart move is to incorporate preventive strategies into your everyday business practices so staff and colleagues know what is expected of them and of you. ■

Making a Difference: The Three R's of Public Science Policy



Lawrence S.B. Goldstein
University of California,
San Diego

Bioomedical research and its applications are having an unprecedented impact on our world and society. The issues raised are thought-provoking and controversial, not only among scientists, but even more so to the public who greet each new breakthrough with equal parts wonder, fear, hope, and mis-

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understanding. How can our nonscientist friends and lawmakers sort through the scientific debates, information, and ideas without specialized training? More important, how can we help them to make wise and informed decisions about how to proceed and where to invest valuable resources?

A big part of the answer is us. As professional scientists, we have a special role to play in educating the public about what we and our colleagues do, and its potential impact and value.

A big part of the answer is us. As professional scientists, we have a special role to play in educating the public about what we and our colleagues do and its potential impact and value. While many bemoan the state of scientific understanding at large, we must hold



ourselves partially responsible. Who else can, or will, explain what we do, why it has value, and what its possible uses and implications may be?

There are three principles that define why it makes sense for all practicing scientists to devote some personal effort to educating the public and our lawmakers about the science that they conduct. These are the three R's: Responsibility, Reputation, and Reward.

Responsibility

We each have a responsibility to the scientific community to help the public understand what we do, and to help build and maintain support for scientific research and education. In addition, we have a responsibility to the nonscientific public to explain why what we do has value if we expect them to pay for it either with tax dollars or charitable donations. Finally, we have a responsibility to explain how the results of our research might be used, particularly when controversial discoveries are unleashed on a sometimes unsuspecting public.

Reputation

Each of us, regardless of level of seniority, has a special reputation as an active scientist based on our experience and education. Thus, we all carry an earned respect and the

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benefit of the doubt on many science issues. For example, many congressional offices have never talked to a scientist and many staffers and Members of Congress have never met one. I continue, however, to be surprised

Each of us helps demonstrate that we are not mad scientists or Dr. Frankensteins, that we have children and families, lives and pursuits not so dissimilar from our neighbors, and that we approach science with restraint and ethical understanding.

and gratified by the welcome and respect we receive when we meet with these nonscientists. In addition, each of us helps demonstrate that we are not mad scientists or Dr. Frankensteins, that we have children and families, lives and pursuits not so dissimilar from our neighbors, and that we approach science with restraint and ethical understanding. Finally, all of us have special expertise, not only about our precise focus area, but also about much of biology in general, which we can use to inform and educate.

If you write an op-ed, you will be surprised at your neighbors' responses.

Reward

There are many individual rewards to involvement in science policy and public education. First, there is the satisfaction of having a personal impact on our lawmakers' opinions and votes. Second, there is the realization that our special knowledge and viewpoint can make a difference in society. For example, if you write an op-ed, you will be surprised at your neighbors' responses. They will appreciate it, you, and your profession.

Preparing oneself to discuss issues that are current (e.g., genetically modified organisms and stem cells) can have a positive impact on one's own research and teaching.

Finally, there is the impact on our own science. Preparing oneself to discuss issues that are current (e.g., genetically modified organisms and stem cells) can have a positive impact on one's own research and teaching. It helps us to stay current with related areas, to think about concerns of the public at large, and to think more broadly about how our basic research can be used to help understand human disease. Such meetings with nonexperts also sharpen teaching and speaking skills as one learns how to translate specialized knowledge into generally accessible concepts.

There are also some persistent myths about advocacy for biomedical research and science public policy. For example, sometimes, when science advocacy comes up in conversation with friends and colleagues, the concern is expressed that advocating for science has a negative impact on other priorities for tax dollars such as education or the environment. But, it is a mistake to assume that it is always a zero-sum game. Also, remember that you have specialized knowledge of scientific programs, but not necessarily about other social programs. These other programs have their own expert advocates. Advocating for science is not advocating against other programs and it is not taken that way. Our representatives are getting input from other sources, and it is their job to try to weigh the relative merits to society of each.

There is also the perception that scientific advocacy must take a lot of time. But it need not. One or two letters per year advocating for a particular position on funding or policy, the periodic thank you letter for supporting sound science policy, or a yearly congressional visit, especially in one's home district, doesn't take that much time. In addition, when compared to how much time it takes to write a grant, doesn't it make sense to spend a little bit of time helping to make sure that funds continue to be available? Finally, there are 435 congressional districts and 100 senators; each of us has one congressperson and two senators whom we can inform and engage as constituents. Thus, if we each do a little, our impact can be broad-based and extensive.

One also hears concerns on the order of: "I'm not senior (or famous) enough," or, "I'm only a junior faculty member/a postdoc/a student." But, we all vote, we all have the right of free speech, and congressional offices are always happy to hear from constituents with special knowledge or experi-

Think of the congressperson as a PI, with a staff of eight to ten young, smart, well-educated people comparable in age to graduate students and postdocs.

ence. A young graduate student generally has more scientific expertise than most congressional staffers or Members. It is quite valuable if they talk about what they know in a letter or congressional visit, why they are excited about what they do, and why it might be useful, even in the long-term. A sense of excitement about science can be infectious—use it!



Most congressional offices are small, and the staff have great influence. A comparison to a typical medium-sized lab is not off the mark. Think of the congressperson as a PI, with a staff of eight to ten young, smart, well-educated people comparable in age to graduate students and postdocs. The congressperson sets general policy and direction and vets the final language of bills and statements, but, the staff often write drafts, and have input into final language. When you write or appear, you are data! Your views, even if transmitted first to staff, inform the general policy that the office and Member will set. In addition, staff can be incredibly valuable, are easy to establish a long-term relationship with, and are often friendly, bright, knowledgeable people trying to do a good job in wildly chaotic circumstances. Ten or twenty letters on one subject from informed constituents are noticed—particularly if they are thoughtful, brief, and to the point.

What if your congressperson is not on one of the “right” committees such as Appropriations? That could be true today, but think long-term. Committee assignments change as Members retire or are defeated, or the majority control of committees shifts. My own congressman was not originally on the Appropriations subcommittee that handles

the NIH, but he is now, and several years of education by me and my colleagues about the value of biomedical research has paid off. He has gone from thinking that the NIH could possibly be privatized to thinking that it is a valuable government agency.

Finally, people sometimes say, “My congressman is too liberal/too conservative/already supportive.” In fact, Congressional service is a daily process of weighing costs and benefits of different programs and proposed laws. Issues and votes on cloning, stem cells, genetically modified organisms, and funding happen every year, and the fiscal tradeoffs and issues are shifting as well. Reminding your elected representatives that they have many constituents who care about biomedical research and science is always helpful.

How to get the biggest bang for your time? There are many simple and non time-consuming things you can do: join the Congressional Liaison Committee; take personal action by writing a letter, writing an op-ed, making a phone call, or paying a visit when in Washington or at home during a congressional recess. Don’t be afraid—the road out of the ivory tower is fascinating and rewarding, and your efforts will help all of us. ■

Great Expectations or Realistic Expectations?



Harvey F. Lodish
Whitehead Institute for
Biomedical Research

Research scientists must help our elected representatives help them. They must share anecdotes about how basic NIH-supported research on cultured mammalian cells and on model organisms such as yeasts and worms have led to major insights into human health. They must continue to advocate for Federal support for important biomedical research such as on human embryonic stem (ES) cells that will lead to advances in human health and new treatments for human disease.

What is more difficult to explain to elected representatives—and to the public at large—is the slow yet determined process by which science advances, and the multitude of steps that must intervene before a new drug or a new therapy can be released to the public. It is all too easy to suggest that practical applications will come immediately and to underrepresent the underlying basic science required.

When laypeople have a direct interest for themselves or for loved ones in a “breakthrough,” the belief that a cure is imminent can be particularly intense. Sometimes this optimism can be exploited for political reasons—remember Nixon’s “War on Cancer?”

Few nonscientists realize the slow pace of basic science and many are understandably impatient to have practical applications. When interested laypeople have a direct interest for themselves or for loved ones in a “breakthrough,” the belief that a cure is imminent can be particularly intense. Sometimes this optimism



can be exploited for political reasons—remember Nixon’s “War on Cancer?” No cures for cancer emerged during the “war.” But much basic science was initiated that ultimately led to the development of new types of drugs for specific cancers that we have seen in the past years.

For example, in trying to justify the enormous expense of the International Space Station, NASA claimed that by growing protein crystals under microgravity conditions, the quality of the resultant X-ray structures would be vastly improved. This, in turn, would greatly enhance the pace of drug discovery. But the scientific community recognized that, “No serious contributions to knowledge of protein structure or to drug discovery or design have yet been made in space. Thus, there is no justification for a NASA protein crystallization program.”¹

Enormous sums of money were wasted on an “applied” project that had no meaning. NASA could have used the money to support land-based basic science in areas such as plant development and detection of gravity by animals.

Enormous sums of money were wasted on an “applied” project that had no meaning. NASA could have used the money to support land-based basic science in areas such as plant development and detection of gravity by animals. Gene modified plants could provide for human needs during space exploration. An understanding of the cellular and developmental biology of the vestibular system, and of how humans perceive gravity,

could help astronauts during long flights. Sadly, these basic studies were deferred in preference to short-term “applications” that never materialized.

Will development of high-tech devices for detection of chemical or biological warfare agents really make us safer as a nation?

History may repeat itself. We are told that, while Federal support for basic research by NIH and NSF will be cut in real terms, the Departments of Defense and Homeland Security are expecting increases in funding for “research.”² Will development of high-tech devices for detection of chemical or biological warfare agents really make us safer as a nation? Would much of the Homeland Security research budget be better spent on basic research on the cellular immunology of host-pathogen interactions and on identifying new targets for antibiotics that could lead to totally new forms of therapies?

Sadly, it is not only government bureaucrats who are to blame for promoting unreasonable expectations. Scientists and clinicians (not to mention venture capitalists) share much of the responsibility for the premature rush to clinical trials of gene therapies without understanding the underlying basic science. Retroviruses have long been known to integrate more-or-less randomly in the cell’s DNA; powerful LTR enhancers often activate transcription of nearby genes. As a supposed therapy for Severe Combined Immune Deficiency (SCID), hematopoietic stem and progenitor cells were infected with a retroviral vector encoding the missing protein. Was it really a surprise that two of the first patients developed a leukemia due to

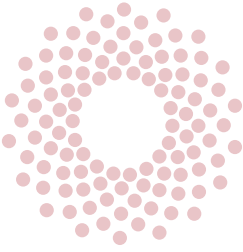
insertion—in a single cell—of the retrovirus near a particular oncogene? Perhaps more to the point, despite over a decade of hype about the potential for gene therapy for treatment of literally dozens of infectious and other diseases, not one has yet entered the marketplace.

This brings us to human embryonic stem cells. Indeed they have the potential to generate any human cell type or tissue, and undoubtedly they will be the foundation of new effective treatment for a host of plagues, including diabetes, blood cell disorders and neurodegenerative diseases. But we must keep clear in our own mind—and make the point when we discuss this in public—that there are immense gaps in cell and developmental biology that need to be filled before these cells can be converted into therapies. Human ES cells are thought to be polypotent in large measure because they can form multiple types of differentiated cells in culture or in a mouse transplant. But coaxing ES cells to differentiate into a specific type of cells, and assuring that these cells are “normal,” are formidable tasks. Some progress has been made—particular combinations of growth factors and surfaces can induce mouse ES cell lines to become functional motor neurons. Ectopic expression of a certain transcription factor in mouse ES cells will induce formation of hematopoietic stem cells that can repopulate the blood system of an irradiated mouse.

We also have a responsibility to let the public know what a long-term proposition this is. This can be delicate, especially when dealing with individuals and families who are desperate and hopeful.

ES cells can also generate cells that secrete insulin, but coaxing them to make normal amounts of insulin and to secrete insulin normally in response to changes in glucose levels has yet to be achieved. Is the problem the absence of the correct extracellular matrix protein or hormone signal or appropriate cell-cell contact? What is known of these multiple factors in normal development of pancreatic islets?

The scientific community is largely optimistic that we indeed will be conducting trials of human ES-derived islet cells for diabetes and hematopoietic stem cells for several cancers in the foreseeable future. As with many advances in human therapies, the key discoveries likely will come from areas of biological research that at present seem unrelated. Scientists have a responsibility to let the public know what a long-term proposition this is; this can be delicate, especially when dealing with individuals and families who are desperate and hopeful. ■



4. WRITING AND PUBLISHING

Me Write Pretty One Day:
How to Write a Good Scientific Paper

How to Read and Respond
to a Journal Rejection Letter

The Role of an Editor:
A Delicate Balancing Act

What Happened to My Figures?!

Me Write Pretty One Day: How to Write a Good Scientific Paper



William A. Wells
Rockefeller University Press

The scientific literature is exploding in quantity even as it stands still in literary quality. Following are a few small steps that the individual can take to make his or her writing clear, straightforward, and digestible.

Nonexperts will retain at most a single message. Make sure you have one, and then repeat it over and over again—at the end of the Abstract, in the Introduction, in the Results, and in the Discussion.

So....What Was Your Point?

The first step with any manuscript is to define your bottom line. Be realistic about how much the average reader will take away from an article. Nonexperts will retain at most a single message. Make sure you have one, then repeat it over and over again—at the end of the *Abstract*, in the *Introduction*, in the *Results*, and in the *Discussion*. In contrast, everything but this single sentence belongs in one section (*Introduction*, *Results*, or *Discussion*) only.

To uncover your bottom line, ask some questions: What was the mystery that you wanted to answer at the start? Have you answered it? What first got you excited about this area of research? With any luck, it was more than the idea that proteins X and Y might bind to each other—there was probably a bigger idea that motivated and intrigued you. Make sure you convey that reason and that excitement.

What is new? Break up the story into “It was previously shown that...” and “Now it is shown that....”



Is there a significant difference between the two statements? Justify the interest of your work verbally to someone outside of your field. Your explanation should be compelling on a general, conceptual level, not grounded in minutiae with which your volunteer has no familiarity or interest.

If you think your discovery might (in the future) prove to be the explanation for mystery X, don't make the reader figure out the identity of mystery X.

Does the reader need help understanding the significance? If you think your discovery might (in the future) prove to be the explanation for mystery X, don't make the reader figure out the identity of mystery X. State it explicitly, make clear that the link is only speculation, and explain any basis for making the speculation. Remember that your readers are busy in their own fields, and will not necessarily make the jumps in logic that are glaringly obvious to you. Make the jumps for them.

Show; don't tell. Not "Our results are exciting..." but "Our results double the number of known penguin species...." If your readers don't think that is exciting, they won't be convinced by you stating that it is.

Show; don't tell. Not "Our results are exciting..." but "Our results double the number of known penguin species...." If your readers

don't think that is exciting, they won't be convinced by you stating that it is.

Finally, include different levels at which your results are significant (e.g., [a] we have found a stem cell repressor, and [b] this may be one of many repressors for maintaining a generally dormant state in stem cells). This is particularly important for papers that you are trying to get into top-tier journals.

Everyone, even a scientist, thinks in narrative. Science is a story. Tell it.

The Anatomy of a Paper

Now that you have your bottom line, you need a roadmap for writing the paper. Remember throughout that everyone, even a scientist, thinks in narrative. Science is a story. Tell it.

To draft a paper, simply work out what the figures and tables would look like.

To draft a paper, simply work out what the figures and tables would look like. Give each figure a simple, declarative title in the form of a sentence. Most of the content of the paper should be evident from reading these few sentences alone. When the sentences look as if they both tell a story and have a bottom line, it's time to start writing.

A good paper is not a random accumulation of facts. Give your paper a narrative structure that links from one finding to another. This can be the logical order of why one experiment was done in response to another, or you can describe from the

beginning to the end of a pathway. Build up this structure by writing notes, in any order, then rearranging them so that there are logical links.

Start by drafting a title that is strong, direct, and as big-picture as the data can justify. But don't claim more than you have shown.

An abstract can and must pack in many elements: background, a question, what was done, what was found, the conclusion/answer, and implications. Make it clear where the background ends and the new work begins.

Arrange *Results* either chronologically (as they unfolded in the lab) or put the most important result first and secondary results later. The latter organization works best when organizing each paragraph.

Describe the data with only enough interpretation so that the reader can see what logical path the writer is taking—how one experiment prompts the next—and understand what spin the writer is trying to put on the data so that the reader can agree or disagree with this spin.

Start the *Discussion* with a brief one-paragraph summary of the main results: first state the answer to the question, then concisely add a broad-brush version of the supporting evidence. Organize subsequent topics from most to least important (i.e., start with topics most closely related to the answer). The first sentence of each paragraph should indicate the structure of the discussion.

Do NOT just repeat the *Results* (or *Introduction*) section, but discuss how the results affect the field. Reveal any large areas that remain a complete mystery.

The *Introduction* sets up the background for what we are about to learn (the bottom line) and why it matters. Funnel from known (the big picture significance of the field) to unknown (the specific gaps in knowledge) to the specific question being asked by you. The

introduction is not a literature review but a means to set up the question.

How to Write Clearly

Now that the text is down in rough form, tackle style issues. Think about each element used to construct the paper. Sentences should have an active construction, address one thought at a time, and generally be kept short and to the point. Treat each paragraph as a thought, with a single, clear message.

Many authors mistakenly feel that they have to build the entire case before telling us the conclusion.

More general style issues include signposts, flow, editing, and specificity. *Signposts* tell the reader where you're going with the argument that follows. Many authors mistakenly feel that they have to build the entire case before telling us the conclusion. They list all their evidence before stating: "Thus, $X = Y$." But this leaves readers scratching their heads for sentence upon sentence. Put a preview first.

Don't presume that the reader will do any work. Do the work for them.

Flow comes about when the writer makes connections between the end of each sentence, paragraph or section and the next. Make all transitions so there are no gaps in logic. Don't presume that the reader will do any work. Do the work for them.

The main route to clarity is to *cut, cut, cut*. Chop out everything from single words to



The main route to clarity is to cut, cut, cut. Chop out everything from single words to entire thoughts.

entire thoughts. “In spite of the fact that...” becomes “Although....” Only after chopping out text will the average reader make it through your words without drowning.

Specificity means using only words with precise meanings. Replace lazy phrases such as

“gives important insight into...” with words that actually mean something. Use the specific (dog not animal) but simple (girl not female child; used not utilized) and necessary (“X was examined and found to vary” becomes “X varied”).

Stuffy writing is frequently used to disguise intellectual fuzziness. Think about what you really want to say. Be exact.

There is one Golden Rule when dealing with journals: be polite to editors, no matter how you are provoked. Editors are trying to do a good job, and screaming at them will not advance your cause, and could well damage it. Be forceful, but civil. And good luck! ■

How to Read and Respond to a Journal Rejection Letter



Vivian Siegel
Public Library of Science



Zena Werb
University of California,
San Francisco

After putting your best work and thoughts and efforts into a manuscript and sending it off for publication, the day of decision arrives. As you open the letter a wave of anger sweeps through your body. Your paper has been **rejected!** Or has it?

WAIT 24 HOURS. It is almost impossible to read a rejection letter or critical reviews objectively while still smarting from the rejection. It is important to be (relatively) calm when trying to understand the nature of the rejection.

The Decision

First read the letter carefully. Was the rejection editorial (without review) or was your manuscript rejected after review by several experts? Here are some translations:

The paper is not acceptable in its present form: This essentially means that the manuscript is likely to be accepted, subject to satisfactory revisions. Most journals have the *pro forma* policy to reject manuscripts that require more than cosmetic corrections or shortening. The journal may be interested in your study, but will not commit itself until the editors and reviewers see the added data or corrections. This type of rejection letter will usually say that should you choose to resubmit, the manuscript would need to be received within a reasonable period of time (usually 2–3 months) to be considered as a revision.

Only a few journals have the policy of publishing all manuscripts that are scientifically sound.

The paper did not get a high enough priority: Only a few journals have the policy of publishing all manuscripts that are scientifically sound. Most scientific



journals publish a predetermined and limited number of pages annually. As a result, they set priorities, based on the perceived interests of their readership. If the rejection was editorial, then the manuscript was viewed as not being a likely candidate for acceptance even if reviewed favorably. With electronic submission, the editorial rejection can occur within a few hours, and thus allows you to turn it around quickly for another journal.

The study is interesting but too preliminary: Here the editor indicates that the manuscript is interesting, but is not a complete story. This is an opening for a revised manuscript. The main question is whether you actually have the data. Were you saving the data for another manuscript, perhaps with other authors, or is this the first step in a long series of studies? Will the complete story take five more years of work?

What is perceived as a serious problem may require showing data that you omitted, or a simple experiment. If you can address these issues, the paper may be reconsidered.

The study is interesting but is technically flawed: Here the editor indicates that the reviewers have serious reservations about some of the data. What is perceived as a serious problem may require showing data that you omitted or a simple experiment. If you can address these issues, the paper may be reconsidered.

The work is more appropriate for a specialized journal: This statement says that the manuscript seems specialized for the journal in question. This also means that a revision is unlikely to be considered.

The reviewers' comments will help you prepare the manuscript for another journal:

This statement implicitly indicates that the journal will not consider a revised manuscript.

The Critique

The reason for writing papers is to communicate your science. The most important thing to communicate is the excitement and the significance of the work in a broad context. Next, the question being addressed must be considered to be interesting and matched to the journal. The reviewers' comments indicate whether they were able to understand the logic and believe the conclusions of the study and whether they find those conclusions interesting and significant. Most studies have some imperfections. The question is the nature and severity of those flaws.

The study is descriptive: This is the death knell of reviews. All research by its nature describes observations. When this is used as criticism, the reviewers are indicating that the study reads as a collection of data that do not come together into a clear, hypothesis-driven study.

Most studies have some imperfections. The question is the nature and severity of those flaws.

The study is incremental: All science builds on the work of others. But how far do you need to go to be publishable? If the study repeats experiments in a slightly different cell type with essentially the same outcome, it may not be of great interest. Did you research the literature thoroughly to find out if your study is an original contribution?

The manuscript lacks important controls: With limitations on manuscript length, control experiments are often left out. If these are critical they should have been part of the manuscript. If it is important to show these controls, they may be supplied as supplemental data for the reviewers and later published online.

The data are not convincing: You have not provided enough compelling data to convince the reviewer of your conclusions. Did you use several ways to come to the conclusion? Did you do the experiment sufficient times to get statistical validity? Is the quality of the data (gels, photographs, and scatter in the data points) good enough to be convincing?

If the reviewers misread your manuscript or missed a point, chances are that your writing style confused them.

Are the criticisms fair? Poor writing, poor organization of the manuscript, inadequate knowledge of the literature, poor quality or poorly labeled figures and tables, repetition, spelling and grammar errors, inconclusive results, and lack of controls are also reasons that the reviewers may not find your study

If your conclusions go against conventional wisdom, then you need to explain and convince why your view is the valid one.

compelling. If the reviewers misread your manuscript or missed a point, chances are that your writing style confused them. If your conclusions go against conventional

wisdom, then you need to explain and convince the reviewers why your view is the valid one.

The Response

Now consider whether to fight the rejection or to move on. Do the *Title*, *Abstract*, and *Introduction* communicate the points that you

If you disagree with the reviewer, the burden is on you to convince them, not to dismiss them.

think are the most significant about your work? Can you respond to all the reasonable criticisms? Some of the responses will result in additions, deletions, or changes in the manuscript. Other responses are only directed to the editor or reviewers. Merely arguing about the criticisms does little good. If you disagree with the reviewer, the burden is on you to convince the reviewer, not to dismiss him or her. If the reviewer misinterpreted your study, the way you wrote about it is the likely culprit.

Contacting the editor. Journals will reconsider rejected manuscripts if you can make compelling arguments. If, after reading the letter and evaluating the reviews, you feel that you can respond in a way that may make the manuscript acceptable, it is a good idea to contact the editor in writing, asking if the journal will reconsider the paper on the grounds that you can respond to the critique, and send with it your rewritten *Abstract* and a brief list of the changes that you intend to make.

The Next Time

Did You Target the Right Journal for the Study? Often authors choose journals based on their citation index rather than a more rational analysis of suitability. Where are comparable studies in your field pub-



lished? Is the study of broad interest or more specialized? Be realistic in targeting specific journals.

Did the Manuscript Conform to the Style of the Journal to which it Had Been Submitted? Nothing annoys reviewers more than a sloppy manuscript. If you cannot be bothered to make sure you write the manuscript according to the journal style guide, or

Nothing annoys reviewers more than a sloppy manuscript.

if you are submitting a manuscript previously rejected by another journal and did not make the effort to change the style to that of the current journal, you are sending a negative message to the reviewers.

Did the Title and Abstract Communicate the Major Findings Accurately? Once a paper has been rejected, it is time to critically evaluate whether you really communicated your enthusiasm for your own study. Your letter of response will often outline the major points of your study better than your original summary. Rewrite the *Abstract* with this in mind.

Did You Accurately Point Out What Was Novel in Your Study that Makes it a Significant Advance over Previous Work? Often in their desire to be comprehensive, authors make it sound as if previous studies have already shown what their study now shows. It takes care in writing to make clear what is new about your study.

Did You Accurately Point Out Controls and Shortcomings of the Observations? Just as you do not want to understate your study, you do not want to hype it either, especially at the cost of ignoring controls and alternative explanations for the data. The data should never lie. Interpretations may change.

*The data should never lie.
Interpretations may change.*

Did You Submit the Work Prematurely? Rushing into publication means that the study may not be complete or the manuscript may not have had the time to pass the “shelf test.” If you can let the manuscript sit for a week or so, a fresh view may reveal flaws that should be changed.

Did You Submit a “Least Publishable Unit?” The pressure for productivity (for grant renewal, promotions, etc.) means that you need to publish with reasonable frequency. Cutting studies into multiple manuscripts can be risky. Reviewers still expect each manuscript to be a complete study. Short papers are not necessarily minimal studies.

Exclusive self-citation carries with it the danger that uncited competitors may review your manuscript.

Did You Accurately Cite Previous Literature? Those who do not know the past are doomed to repeat it. You need to cite literature fairly. Exclusive self-citation carries with it the danger that uncited competitors may review your manuscript.

Did You Have Colleagues or a Scientific Editor Read and Critique the Manuscript? You should send your best effort to journals. The review process should not be an alternative to careful writing and editing of your manuscript.

Did You Get a Presubmission Decision?

Journals that can publish only some of the scientifically valid manuscripts that they receive will usually give you an indication if a manuscript is of interest if you send a letter outlining the point of your study and the abstract. Since you can do this while your paper is still in preparation, you can find out if the paper is likely to be viewed as low priority without losing time.

Did You Suggest Appropriate Reviewers?

A recurring complaint of the review process is that the reviewers do not have the expert-

ise to judge the work. One way to help overcome this problem is to suggest two to five scientists who would be appropriate reviewers. Chances are that the editors will use at least one of your suggestions.

Did You Assess the Value and Impact of Your Research Correctly?

Did you target the paper to the correct level of journal in your field? If you overvalue your work, it will always be rejected. If you undervalue your work, you may be publishing in less visible journals than you deserve. In between, sometimes you will prevail, but not always. ■

The Role of an Editor: A Delicate Balancing Act



Randy Schekman
University of California,
Berkeley

Academic and professional journal editors are honest and hard-working people who have busy days and much more important things to do than to hatch plots to suppress the careers of eager, young authors. Why is it, then, that a colleague who on the one hand is a collaborator or friend becomes an

Journal editors are honest and hard-working people who have busy days and much more important things to do than to hatch plots to suppress the careers of eager, young authors.

opponent to be vanquished when he/she conveys bad tidings of critical referee reports on a manuscript for publication? In fact, in spite of near universal grouching, particularly about the most selective journals, the system works quite well to promote the publication of the fruits of our labor.

Perhaps a few words of advice to budding authors, referees, and editorial board members will help smooth some of the wrinkles that add unnecessarily to the burden of publication.

Editorial Advice to the Author

Even a perfect article, one that reports an original observation clearly and concisely, suffers if an editor is unable to understand the significance of the work. An editor will almost always rely on the title and abstract of a manuscript to make a preliminary decision about the appropriateness of the work for the journal in question and to choose referees. The title and abstract must convey the experimental approach, key results, and novel conclusions of the work. Excessively long and

An editor will almost always rely on the title and abstract of a manuscript to make a preliminary decision about the appropriateness of the work for the journal in question and to choose referees.

comprehensive titles and abstracts make the editor's job more difficult.

Help guide the editor to the most appropriate members of the editorial board and referees. Do not assume that an editor is familiar with all research areas covered in his/her journal. A short list of expert board members and referees is an essential part of a good

A short list of expert board members and referees is an essential part of a good introductory letter.

introductory letter. Potential conflicts of interest should be mentioned, but a long list of referees to be excluded (or even all experts from a particular country!) alerts the editor to potential problems with a submission.

Advice to a Monitoring Editor

Not-for-profit journals usually employ busy academics to serve as monitoring editors whose charge is to establish whether a manuscript is appropriate for the journal, to select expert referees, and to render a final editorial decision on the fate of the work. Some papers are rejected without review when the monitoring editor decides that the work is not

within the scope of a journal or if it seems unlikely that a manuscript will pass muster with critical referees. Many journals, including *Molecular Biology of the Cell*, have the policy of not publishing work that describes a gene or protein in no greater depth than previously published work on an ortholog from another organism. Similarly, many journals will not publish the modification of an existing technique if the application does not reach a novel conclusion. Obviously, for the most competitive journals, the criteria become quite subjective. Prospective authors should consult an editor in advance of submitting a manuscript to such a journal to establish if the work has a chance of success. It is the monitoring editor's responsibility to spare the author and potential reviewers wasted time and effort in considering a manuscript that is inappropriate for the journal.

Referees also have day jobs, and it is the monitoring editor's role to identify appropriate and responsible reviewers. Most colleagues are honest and fair and can be counted on for a timely return of a constructive critique. Editors will often cultivate groups of such cooperative reviewers who are appropriate for the areas for which the editor is responsible. Unfortunately, some colleagues cannot be counted on for fair and impartial judgments. Typical antisocial behaviors include

Some of the most competitive journals have the unfortunate habit of consulting far too many referees.

excessive delays in returning critiques, vague and judgmental decisions, impossible and excessively detailed demands, and even the occasional breach of confidentiality where the



referee transmits privileged information to a colleague or student. Referees who display such behavior must be avoided.

Some of the most competitive journals have the unfortunate habit of consulting too many referees. Whereas two opinions should suffice, three or more are sought by editors who seem unwilling to exercise independent judgment in weighing the merits of two divergent opinions. This has the effect of increasing the burden on responsible reviewers who are deluged with requests, and it increases the prospect that an antisocial referee will be consulted.

Conscientious editors will interpret and not merely repeat the bottom line of a referee.

When the critiques are in, the monitoring editor must weigh the opinions and make a determination of the prospects for publishing an amended version of the work. Some decisions are clearly positive or negative, but most rely on the editor's judgment. Many reviewers prioritize their criticisms. The editor must determine if the most serious flaws in a manuscript can be rectified by experiments that are well within the scope of the author's laboratory. Although some decisions rest on one or more flaws identified by both reviewers, usually this is not the case, and one reviewer may identify a serious issue not considered by the other. For this reason, a conscientious editor will read and weigh the merits of each opinion, and then decide which will form the basis of a final decision. Some difficult decisions are best left to the day after the critiques are first considered. A good rule of thumb is that both referees should be consulted when the revisions take more than three months to complete.

The decision letter is an opportunity for the monitoring editor to place reviewers' criticisms in the context of a field or the scope of the journal. Conscientious editors will interpret and not merely repeat the bottom line of a referee. Key criticisms should be highlighted and an honest appraisal of the prospects for favorable consideration of an amended manuscript should be spelled out. Authors are not well served by false encouragement. If a manuscript is in principle publishable, but not in the journal under consideration, the editor should suggest an alternative venue.

In a minority of cases, the author chooses to contest the decision of a monitoring editor. These cases can usually be handled by a polite response from the monitoring editor or, in the event of an irreconcilable difference, through the intervention of a senior editor. Experienced authors avoid invective in posing questions to the editor. In some cases the editor may choose to forward comments directly to the reviewer; thus, it is wise to avoid questioning the integrity or intelli-

It is wise to avoid questioning the integrity or intelligence of someone whose judgment you wish to challenge.

gence of someone whose judgment you wish to challenge. Some authors' first reaction is to phone the editor to secure some promise of compromise. However, a written record of communications between an author and an editor is an essential element of any successful negotiation.

Authors and editors are often friends and colleagues. A healthy relationship ensures the vigor of our peer review system. ■

What Happened to My Figures?!



Liana Holmberg
Public Library of Science

After all the work you put into your research and getting your article published, it's a shock to crack open that journal and find the printed figures bear little resemblance to the images you thought you submitted. Here are some suggestions to help minimize such unpleasant surprises.

A Few Tips to Take the Headache Out of Graphics Prep

Do Your Homework. Before you start preparing your figures, read the graphics specifications published by the journals you're most likely to submit to. Specs vary from journal to journal, and they are often available online and can be quite instructive. Some important things to look for are resolution requirements for each type of graphic, preferred file formats, and page dimensions.

Most of the best graphics programs perform similar tasks at comparable quality: the important thing is to learn to use what you have well.

Learn to Use Your Software. Even if it means reading the dreaded manual. Whether it's Illustrator, Corel-Draw, or something else, most of the best graphics programs perform similar tasks at comparable quality: the important thing is to learn to use what you have well. Any program worth the price will have instructions for converting your graphics to the file formats required by publishers. Learning to use professional graphics-prep software can be time consuming, but if you use another kind of program because you're more familiar with it, you'll be disappointed. Programs like Microsoft Word automatically downsample your images and embed



Learning to use professional graphics-prep software can be time consuming, but if you use another kind of program because you're more familiar with it, you'll be disappointed.

them in the document as screen-resolution graphics (usually 72 dots per inch [dpi]). That means the images are now at a resolution too low for professional off-set printing. Many people run into similar trouble when they make figures in PowerPoint. PowerPoint has a “Compress Pictures” wizard that downsamples the embedded figures to a lower resolution (96-200 dpi) in order to decrease the file size. If you use this feature, make a low-res copy for presentations and keep another version for publishing that has the figures embedded at their highest resolution.

Programs like Microsoft Word automatically downsample your images and embed them in the document as screen-resolution graphics (usually 72 dots per inch [dpi]). That means the images are now at a resolution too low for professional off-set printing.

Keep Your Originals. Some file formats, like JPEGs, are “lossy,” which means that every time you re-save a JPEG, you lose resolution. Always keep an unadulterated, high

resolution original version of each element of your figures; when you want to manipulate the image, make a copy first.

Size for Print. More than likely, your figures will be reduced to fit the column width of the journal, so it's a good idea to create figures as near to that size as possible. Be sure your fonts are neither too big nor too small and the visual information is readable at that size—and don't forget to embed the fonts. Also, consider how your figures will look as a group, and size the elements relative to one another. For example, make sure stains have the same dimensions from one figure to the next.

Plan Ahead. Be aware that converting graphics from one format to another can cause color changes, among other problems. It's best to choose the correct software for the type of image you want and create it in that software from the start.

Image Types

The three most common image types are halftones, line art, and combination figures. Each type is processed differently during printing and therefore has different specifications.

Halftones. The best example of a halftone is a photograph, but halftones include any image that uses continuous shading or blending of colors or grays, such as gels, stains, microarrays, brain scans, and molecular structures. Most publishers require that halftone images have a resolution of 300 dpi. Some software will measure ppi (pixels per inch) rather than dpi, but for all intents and purposes ppi and dpi are interchangeable. To prepare and manipulate halftone images, use Photoshop or a comparable photo-editing program, and save the files in TIFF format.

Line Art. The distinguishing feature of line art is that it has sharp, clean lines and geometrical shapes, usually against a white background, such as tables, charts, graphs, and gene sequences. Line art can be color or black

and white; color fills are solid, without gradation or fades. To prepare and manipulate line art graphics, use Illustrator or a comparable vector drawing program, and save the files in EPS format. Line art resolution should be very high—around 1200 dpi—in order to maintain the crisp edges of the lines and shapes. Note that text placed in an image is for all practical purposes line art, which brings us to...

Combination Figures. These are the most common type of scientific figure because most images combine halftones with text. While the former only needs to be at 300 dpi resolution, the latter needs 1200 dpi—otherwise text ends up looking soft, and lines can be faint and/or pixilated. Most publishers split the difference and require a resolution between 600 and 900 dpi. Depending on what type of image dominates the figure, you'll want to prepare it in the program that best handles that type—Photoshop for halftones, Illustrator for line art—and save it in the corresponding file format.

The two biggest problems encountered when converting graphics from one file format to another are loss of resolution and changes in color output.

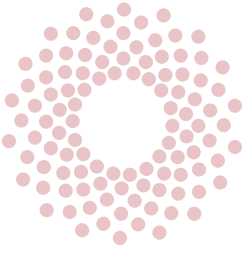
Color

The two biggest problems encountered when converting graphics from one file format to another are loss of resolution and changes in color output. The first can be ameliorated by using the steps described above; the second deserves further discussion. Color reproduc-

tion is a fuzzy science, and what you see in your office is not necessarily what you get in print, since colors vary widely from one monitor to the next, from one printer to another. One thing you can do to preserve the colors of your original file is to put the image through as few conversion steps as possible. Once again, that means planning ahead and knowing before you make the image what kind of output you want in the end.

CMYK versus RGB. If the journal you intend to publish in is a print journal, then choose a CMYK color space for your graphics; if it's an online journal, choose RGB; if it's both, find out from the journal which format is preferred. Switching back and forth between CMYK and RGB will cause the colors to change, sometimes dramatically. Similarly, changing from one file format to another can cause color changes. For example, opening an EPS of a microarray in Photoshop can result in a loss of several degrees of green—and thus some of your visual data. You can reduce the risk of color loss by sending high-quality images in a file format that is as close as possible to their native format, carefully reviewing your proofs for accurate color, and saving your original, unadulterated images in case you need to remake the figure from scratch or send the originals to the publisher for them to remake or use to match color.

Perhaps Most Important: Ask Questions. Scientific publishing is a service industry, and once your paper is accepted by a journal, the production staff should be available to help you with the technical details of preparing figures that meet the journal's specifications. You need to prepare the figures, but the publisher has a responsibility to ensure their print quality, so don't be shy about asking for technical assistance. ■



5. POSTDOC ISSUES

To Eurodoc or Not Eurodoc

Making the Most of
Your Postdoctoral Experience

Pursuing Science
across the Pacific Ocean

To Eurodoc or Not Eurodoc?



Sigrid Reinsch
National Aeronautics and
Space Administration

Why go abroad for training when there are so many opportunities here in the United States? Perhaps you would like to finally capitalize on your wild success with high school French and can't seem to nip the urge for wanderlust. Maybe you gravitate naturally to Europeans in a crowd.

Whatever the reasons, you can buck the trend of the European "brain-drain." European scientists are frustrated by the tendency for European postdocs to head to the United States—often permanently. European governments and scientists believe this adversely affects the quality of European science. The European

European labs are happy to host American postdocs, especially those with a good pedigree. Having a native English speaker in the lab can also boost the overall productivity of the lab simply by having a ready editor for manuscripts. Be prepared to serve as such.

Union has several organizations whose mission is to increase pan-European mobility so that scientists will choose other European countries for training alternatives rather than the United States. Does this brain-drain mean that European postdoc training is "worse" than in the United States? The Eurodocs I queried believed their European training was as good as that of their U.S.-trained counterparts, and claimed innumerable benefits from their overall experience.

Planning Your Eurodoc

It's relatively easy to plan a European postdoc. E-mail makes communication with potential sponsors rapid



and inexpensive, and the Internet facilitates an in-depth investigation into the lab, the institute, the successes of former lab members, and the local amenities. European labs are happy to host American postdocs, especially those with a good pedigree. Having a native English speaker in the lab can also boost the overall productivity of the lab simply by having a ready editor for manuscripts. Be prepared to serve as such.

A European tour may be especially important if you are including a spouse and children in your adventure.

Choosing a Sponsor

The same tactics apply when choosing a mentor in Europe as when choosing one in the United States.¹ Successful Eurodocs consistently indicate that they seek internationally known labs. They choose sponsors with a demonstrated ability to recruit and train foreign postdocs. Consider how many foreign postdocs are currently in the lab. Assess the potential sponsor's track record for helping them to become independent. Find out how the lab is funded. Is there technical support for postdocs? How about teaching opportunities? Contact former postdocs for recommendations. If your ultimate goal is to head your own lab, you will need to know how your sponsor deals with postdocs when they leave; is it easy to take reagents and projects?

If you are considering several potential European sponsors, you probably want more direct exposure to facilitate your decision. A European tour may be especially important if you are including a spouse and/or children in your adventure. This might seem prohibitively expensive, but outside funding is

sometimes available. One way to do this is to prepare a seminar that highlights your graduate work. Diplomatically inquire whether the institute would provide partial reimbursement if you give a formal seminar during your visit to the institute. A sponsor may consider funding a part of the trip and providing accommodations. You can fund the entire trip with several sponsors.

Not All Institutes Are Created Equal

Choose an institute with a large international presence. Some examples are the European Molecular Biology Labs (EMBL) in Heidelberg, universities like Cambridge or Basel, or national institutes (Pasteur, Max Planck) that regularly train foreign scientists from Europe and other countries. Such institutes may greatly ease and streamline help with immigration, visas, housing, banking and language courses. Some operate with English as the official scientific language: this is a must for those individuals that carry foreign language null alleles.

If you are going to a top lab and have a decent project with the backing of your sponsor, your chances of obtaining an internationally portable fellowship are very good.

Funding

It is easy to find sponsors that have funding for a postdoc position, but it is always preferable to have your own funding in hand. If you are going to a top lab and have a decent project with the backing of your sponsor, your chances of obtaining an internationally

portable fellowship are very good.² In addition to fellowships, find out whether the institution provides additional funds for foreign nationals. Such funding may include “topping-up funds” so that all postdocs at the institute are funded at the same level. Additional funds may also be available to help support spouses and/or children. Apply for as many fellowships as possible to increase your chances and options. Some provide much higher levels of funding or longer tenures than others.

Protection of personal time pervades the society here: spending time with your kids and not at work is accepted, encouraged, and made easy in many ways both concrete and intangible.

Bringing Along the Family

A European adventure can be enriched by bringing your family. Find contacts at your institute for questions on childcare, schools, work options for your spouse, and support. Make sure you understand local school and daycare schedules and holiday times before you go, as these factors may affect your decision.

Children learn foreign languages and assimilate into foreign society quickly. They can open doors to social interactions within your host country. If they attend public schools, this will force you to learn enough of the local language to help with homework, host birthday parties, attend parent/teacher conferences and doctor visits.

Protection of personal time pervades the society here: spending time with your kids and not at work is accepted, encouraged, and made easy in many ways both concrete and intangible.³

Use this experience to develop world contacts for future jobs, sabbatical experiences and especially for collaborations.

Make Connections

One of the greatest lifelong benefits of a Eurodoc is international connections. Use this experience to develop world contacts for future jobs, sabbatical experiences and especially for collaborations. You never know where you will end up, so it is very useful to make as many contacts as possible. You will establish many friendships as well. Your global understanding will ultimately make you a better mentor when you start your own lab. Your international colleagues will more readily recommend you as mentor to their own protégés that seek a United States position. Attend and present at European meetings as often as possible. Investigate other European institutes and present your work. Be vocal and visible within your own institute so that scientists get to know you and your strengths. In the end you will find yourself more self-reliant, independent, and better connected with world leaders than your North American-trained colleagues.

Keep the Home Embers Burning

Just as important as developing international connections is not to let your colleagues in the United States forget you. Attend the ASCB Annual Meeting. As you near the time of your return, also go to smaller meetings in the United States. Write regularly to your North American scientific colleagues to keep them abreast of your training successes or for advice.



While you might initially feel overwhelmed by differences in simple things like food choices or shop schedules, adaptation doesn't take long.

Enjoy the View

Take some time to get involved in local activities so that you can mingle with your European community. Most of all, enjoy your European life. Sports, dance, singing groups, and community or neighborhood events provide easy access to your European hosts. While you might initially feel overwhelmed by differences in simple things like food choices or shop schedules, adaptation doesn't take long; you may ultimately celebrate the differences and miss them dearly once you leave. It can be refreshing to see the value Europeans put on their free time and on nature. The attitude that you can only work effectively if you also take time out for other activities seems much more healthy than the U.S. attitude of work, work, work (regardless of how mindless it becomes). Europeans also tend to gravitate toward nonsynthetic foods and some level of self-propulsion (walking/biking) instead of the American penchant for fast food and driving everywhere.⁴

The Transition Home

An easy transition back to the United States is a second postdoc. This allows a less stressful return to the United States and a more leisurely search for an independent position. But if you are ready for independence and are a competitive candidate with an impressive CV and publications record, you will succeed in the U.S. job market. If not, then applying to endless ads in *Science* and *Nature* is definitely

not the route. Creating contacts is the most important step either in small meetings or by going on your own "job tour." Contact a few of the world experts in your field, ask to visit their labs and give a seminar, and mention that if there are positions available, you would be interested in applying.⁵

Or Settling in Europe?

The European experience can be especially attractive to women scientists with children. There is an idea in the United States that the European lifestyle does not support a woman working. Rather the opposite may be the case. For example, because you don't have the commuting lifestyle in Europe, life is simpler. One can take their child by bike to school. The European lifestyle is by nature very supportive.⁶ People may be offered independence and promotion to tenure earlier in the U.K. than they would have been in the United States.⁷

The postdoc years are often the ideal time in someone's life and career to spend a significant amount of time abroad.

And Finally...

Faculty who served as Eurodocs often tell students that if they have the slightest inkling to do a postdoc abroad, they should. They can find a superb mentor and it would likely be a broadening experience. The postdoc years are often the ideal time in someone's life and career to spend a significant amount of time abroad.⁸

While a European postdoc is sure to expand your mind and your horizons, one otherwise fabulously successful Eurodoc came away disappointed on one front: "I thought I would get to hang out with cool Italians, but they wanted nothing to do with me..." ■

Making the Most of Your Postdoctoral Experience



Thea D. Tlsty
University of California,
San Francisco

“Ahhh, when I was a postdoc...” sighs many a senior scientist, dreaming of what they remember as a simpler time. While many have forgotten the pressures and uncertainties, it is true that the time following graduate school can be one of the best times of a scientific career. Ideally, graduate students have learned some of the basic skills of research and are entering a period of refining those skills and preparing for entry into a career path. While there are many different career paths that trained scientists can enter today, a common set of skills lies at the heart of preparing for most of them. In general, a working knowledge and mastery of scientific process and practices are crucial to careers as diverse as journal editor, teacher, grants administrator, principal investigator/professor, career scientist, scientific reporter, and public policy administrator.

The postdoctoral fellowship is an apprenticeship and should be tailored to the specific needs of a particular career.

The postdoctoral fellowship is an apprenticeship and should be tailored to the specific needs of a particular career. While it is not necessary to know the exact career destination, since many of the skills are applicable to a broad range of opportunities, it is helpful to have a career goal identified so that the postdoctoral experience will be successful and productive.

It is also helpful to identify the areas where additional experience is needed and to arrange for the fellowship to address those areas. This requires an accurate assessment of goals accomplished during graduate



study and what additional goals are necessary for the chosen career path. In the best of all worlds, graduate students learn the successful practices of asking a scientific question, designing and executing a set of experiments to obtain the answer, reporting results to the scientific community, and identifying future areas of pursuit. However, if any aspect of this experience is lacking, the postdoctoral fellowship is where this is remedied and refined.

In the best of all worlds, graduate students learn the successful practices of asking a scientific question, designing and executing a set of experiments to obtain the answer, reporting results to the scientific community, and identifying future areas of pursuit.

Choosing the proper postdoctoral environment is important for a successful postdoctoral experience. Individuals who work best with a minimal amount of guidance or who prefer a small lab group should find situations that meet those needs. Those whose future plans include teaching should find a setting where that experience can be obtained. In most cases, it is beneficial to change fields and institutions for postgraduate education for exposure to different approaches to science and new groups of people and ideas. Often, advancements in science are made when two previously uncoupled areas come together. Adding new approaches and perspectives to the graduate

experience optimizes a new scientist's abilities to contribute to new areas of research.

A postdoctoral fellow should extend the scientific way of thinking and problem solving learned in graduate school to a new problem and level of involvement. In choosing experimental projects, it is often beneficial to choose two projects, each of which provide different educational experiences. One project may be a continuation of ongoing work in the new laboratory, while the second project extends the work in directions that provide an opportunity for novel creative approaches.

In the first type of project, a new scientist quickly learns the basic techniques in the laboratory and has an opportunity to develop teamwork skills. This "bread and butter" type of project should be designed to generate useful data no matter what the outcome of technically solid, individual experiments. As this work comes to fruition, it provides the opportunity to work with the senior scientists of the group in all aspects of publishing a manuscript, such as choosing the appropriate journal, preparing the draft and final version of the manuscript, communicating with journal editors, responding to reviewers' critiques, and proofreading final galley.

In addition to providing experience in scientific writing, this "bread and butter" project also provides opportunities for oral or poster presentations at department, local or national meetings. Lessons in seminar preparation and presentation that were not absorbed as a graduate student can be addressed as a postgraduate researcher. Participation in a unit of work that contributes to a larger ongoing study in the laboratory also positions the new scientist to aid in the preparation of grant applications that include this work. Lessons in grantsmanship as a fellow are invaluable for those individuals who plan to develop their own laboratories.

The second type of project should be designed to develop the skills of determining which scientific questions are important, timely and approachable. Not all questions can be addressed with present techniques or contemporary insights. How does one determine when to pursue a line of investigation and when to terminate experiments if they are not producing interpretable data? Developing a “nose” for important questions and novel approaches is a more risky line of experimentation because these scouting efforts can terminate in a dead end. However, scientists who wish to lead an area of investigation rather than simply follow approaches that others have opened must hone these skills for the future. This skill is also essential for scientists in careers other than bench science. For example, journal editors and scientific reporters need to be able to recognize blossoming areas of inquiry, just as the applicant for scientific funding needs to identify new areas of research. This type of project often requires a more extended period of time before it is productive and, therefore, is not optimal for exercising the basic skills obtained in the “bread and butter” project. For those individuals interested in pursuing a career as an independent investigator, tack-

ling this type of project often identifies future areas of expertise and research.

Preparation for the future does not end with addressing the technical aspects of science. As with most careers, the social aspects of a profession are also of great importance. Science is increasingly a team endeavor, requiring the input of many colleagues to accomplish a goal. The postdoctoral fellowship period is a time when many aspects of scientific interactions can be practiced. If graduate work did not offer the opportunity to work with others in the laboratory or teach techniques to others, the fellowship is an excellent time to extend those experiences. In addition to the interactions within the laboratory group, networking with other laboratory groups within and among institutions is important. Discussions and interactions with other groups lay the basis for future letters of recommendation, opportunities, friendships and potential mentors.

Obtaining a graduate degree opens the door to many professions, some of which may not even exist at the present time. Acquiring a basic set of skills as an investigator will position a new scientist for these career opportunities and provide a solid platform to launch an exciting future. ■

ELEVEN GOALS FOR A SUCCESSFUL POSTDOCTORAL EXPERIENCE

- 1 Demonstrate productivity and creativity.
- 2 Refine your scientific way of thinking and problem-solving.
- 3 Learn skills in writing papers and shepherding them to publication.
- 4 Learn oral presentation skills.
- 5 Extend technical skills.
- 6 Learn grantsmanship.
- 7 Learn teaching and supervisory skills.
- 8 Learn how to work effectively with others within the group.
- 9 Learn how to collaborate with peers.
- 10 Learn how to network.
- 11 Stay balanced and have fun.

Pursuing Science across the Pacific Ocean



Liqun Luo
Stanford University

Scientists born and educated in Asia have contributed significantly to life sciences research in the United States. Read any leading journal and one will find first authors—and increasingly senior authors—whose names are hard to pronounce for native English speakers. Applications to graduate school, postdoctoral and faculty positions are increas-

Read any leading journal and one will find first authors—and increasingly senior authors—whose names are hard to pronounce for native English speakers.

ingly coming from Asian-born scientists. A significant proportion of this surge is contributed by scientists born in the People's Republic of China, which opened the door to scientific as well as student exchange about 20 years ago. Given that one in five people living on this planet is born in China and assuming a roughly proportional distribution of talent and interest in biological research, it is not surprising that the sudden availability of this talent pool should contribute to the above phenomenon.

By many measures, scientists born and educated in Asia, usually through college, have been successful as a group in the development of their scientific careers in the United States (or going back to Asia after they are trained in the United States). However, behind these successes are many difficulties that Asian-born scientists have to overcome in pursuing science across the Pacific Ocean. In this essay I will focus on the special challenges facing scientists from China, although many of these challenges also apply to those from other Asian countries.

Often multiple interviews are required at American embassies or consulates, and even then visa requests are frequently declined.

First, Chinese students need to find an appropriate graduate school to accept them for advanced education. Most top graduate schools need to interview their applicants before offering a place. This can be difficult to arrange for applicants from China. In addition, many schools have limited slots for international students because of NIH training grant restrictions. Having benefited from talented Asian students, some U.S. universities have started to send professors to Asia to interview candidates there, which is a good idea.

The culture of the educational system in China is quite different from the United States: what the textbooks say is regarded as absolute truth; respecting authority (professors) is an important virtue.

After they get admitted, Chinese students must overcome visa problems. This has become much more problematic since 9/11. Often multiple interviews are required at American embassies or consulates, and even then, visa requests are frequently declined. For those that are successful in gaining permission to study in U.S. graduate schools, Asian students have to face many challenges including language, communication and socialization

skills, and learning through critical evaluation of existing knowledge, probably in increasing order of difficulty. The last is especially problematic for many Chinese students, because the culture of the educational system in China is quite different from the United States: what the textbooks say is regarded as absolute truth; respecting authority (professors) is an important virtue. Asian students are not used to group discussions and critiquing textbooks, lectures, published papers, or what professors have to say. In addition, a general lack of laboratory training in the undergraduate curriculum in China makes students' laboratory rotations disorienting.

A kind gesture or word from a fellow student or professor can encourage a student immeasurably and may well change the destiny of their life.

The help they receive from their American classmates and professors is invaluable. For students who are newly exposed to the environment and culture, an off-hand, careless remark could be devastating at such a fragile stage. On the other hand, a kind gesture or word from a fellow student or professor can encourage a student immeasurably and may well change the destiny of his or her life.

The many students who are successful as graduate students move on to postdoctoral fellowships, and many of them then to faculty or other senior positions. Often the limiting factors are presentation skills and the ability to engage in interesting and effective scientific exchanges with their colleagues, both of which are important determinants in evaluations for these higher positions. These deficiencies stem from the original differ-



The limiting factors are presentation skills and the ability to engage in interesting and effective scientific exchanges with ... colleagues.

ences in language, culture, social and communication skills, and become all the more prominent as one's career advances. Some get through this bottleneck by truly exceptional research accomplishments, others by consciously training themselves throughout graduate school and postdoc years. It cannot be overemphasized how important communication skills are, both oral and written. This of course is true for all scientists, but for Chinese scientists it takes extraordinary effort to train in these skills. From the perspective of faculty search committees, an open-mindedness to including colleagues raised in different cultures could increase diversity and exploit the talent pool from all over the world, both essential to keeping U.S. scientific research at the forefront.

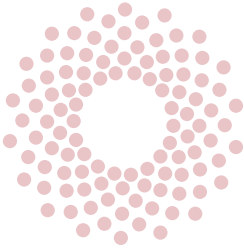
After securing a faculty position, the endless tasks a professor has to deal with—teaching, grant writing, recruiting graduate students and postdocs, then not only training them in science but also sometimes being their psychological counselor—are amplified by whatever deficiencies have not been overcome since moving across the Pacific. An important new challenge at this stage is that social interactions with peers and leaders in the field become more important for name recognition (an area in which Chinese people in the United States are at an inherent disadvantage), successful grant and award applications, and promotion. There is more objectivity in science than in some other professions, yet one cannot deny the advantage

gained by being proactive about promoting one's own research and being in the right social circle. These advantages are often less accessible to Chinese-born scientists, again because of their socialization skills, cultural barriers and their upbringing (modesty is a great virtue; pride is a vice).

Social interactions with peers and leaders in the field become more important for name recognition (an area in which Chinese people in the United States are at an inherent disadvantage), successful grant and award applications, and promotion.

Despite these challenges, many Asian-born scientists nevertheless achieve highly desired success, contributing to landmark scientific discoveries. Time will tell if they will also play leadership roles in their institutions and professional societies. Asian-born scientists at different levels also face the challenge of how they can contribute to scientific research and education in the country where they themselves grew up and were educated. Some choose to go back altogether to lead research laboratories and institutions there. Others spend considerable time supervising research groups in their home countries. Yet others actively participate in advising their home government on strategic planning, resource allocation and research management, including development of peer-review systems. Finally, some choose to focus on the young: they return to teach not only cutting edge research but also critical thinking and the social and communication

skills that are key success factors in U.S. science. All these efforts take considerable time, but the hope is that such efforts will make it easier for the next generation of Asian-born and educated scientists to pursue research careers, whether in the United States or in their home countries. ■



6. CAREER TRANSITION

The Art of the Interview

Salary Negotiation

What Else Can I Do?:
Exploring Opportunities
in Business and Management

Late Career Opportunities
and Challenges

The Art of the Interview



Elizabeth Marincola
The American Society
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Scientists interviewing for jobs have a natural inclination to focus on the “scientific information exchange.” As important as this is, general interview protocol and behavior are also critical. The following offers general advice about some subtle but important aspects of winning an interview, making the interview successful, and maximizing the chance that a successful interview becomes a job offer.

Think of the initial contact as an opportunity for the reviewer to exclude your candidacy.

The Initial Contact

Think of the initial contact as an opportunity for the reviewer to *exclude* your candidacy. Act on the assumption that the employer receives many, many more indications of interest than the number of people the company or organization has the resources to pursue. For

There’s much more room for individual differences and imperfections in the context of considering a whole person than in the context of a description of a human on paper in whom the employer has no vested interest.

this reason, a small misstep at this stage can lead to a dead end. This does not mean that your prospective employer expects you to be perfect—it just means that there’s much more room for individual differences and



imperfections in the context of considering a whole person than in the context of a description of a human on paper in whom the employer has no vested interest.

Write to the contact person listed on the announcement. If you know someone other than the contact person at the company, you may send a copy of your correspondence to the person you know with a personal note saying that you're applying for a position at their company and that their support would be appreciated. One way to inform the official contact that you've also sent your CV to someone else is to add a P.S. to your cover letter that says, "I have taken the liberty of sending a copy of this correspondence to Jane Doe, who was my colleague at the University of Alabama." Do not blind-side a potential employer by unnecessarily suppressing relevant information.

Generic letters that indicate that the candidate is looking, for example, for a position "that utilizes my skills in research" scream, "form letter!" and are not worth sending.

Take time to write a letter that clearly references the particular job for which you are applying. Generic letters that indicate that the candidate is looking, for example, for a position "that utilizes my skills in research" scream, "form letter!" and are not worth sending. Touch upon your most impressive credentials, but do not repeat your CV in the text of the cover letter. The letter should typically be three paragraphs: the first states simply that you are applying for the position; the second states briefly the nature of your inter-

est and most relevant and impressive qualifications, and the third asks for consideration and can indicate for example how you are best reached. The cover letter should fit easily, using 12-point type, on one page, and should leave ample white space at top, bottom and at the margins. In a cover letter, less is more.

In a cover letter, less is more.

Proofread the cover letter three times, then ask a trusted friend, colleague, or relative to proofread it. Grammatical or typographical errors in the cover letter, like a cover letter that is unnecessarily long, are often grounds for exclusion.

If you're sending a paper letter, sign your name in ink (do not use an electronic signature). Enclose your CV. Do not include a list of references unless requested.

A good analogy is dating behavior. People generally like to be pursued, but not too aggressively. Don't devalue yourself or appear desperate.

Arranging an Interview

It is more preferable for the employer to contact you for an interview than for you to follow your letter with an additional request for an interview. However, if you hear nothing for two weeks after you send the initial letter or email, you may follow up with a phone call or email inquiring, cordially, if you can schedule an interview. Do not be defensive, accusatory, or impatient.

A good analogy is dating behavior. People generally like to be pursued, but not too aggressively. Don't devalue yourself or appear desperate.

All it takes is for a trusted support person to comment to the principal, "Boy, he sounds like such a jerk!" for your candidacy to end, even for an otherwise strong candidate.

It is typical for an interview to be scheduled by an administrative or clerical person. Be respectful, accommodating and professional with anyone who contacts you. Bear in mind that sometimes interviews must be rescheduled or there can be other inconveniences or annoyances in the logistical arrangements. All it takes is for a trusted support person to comment to the principal, "Boy, he sounds like such a jerk!" for your candidacy to end, even for an otherwise strong candidate.

The most important possible thing you can do is your homework.

The Interview

The most important possible thing you can do is your homework. Go to the organization's website and spend some time there. You should be aware of the general parameters of the organization: its products and services, its corporate goals, the size of its staff, and its revenues. If it's a

start-up, learn how it is financed: through venture capital? Is it publicly traded? If it's a nonprofit, where does it get its revenues? Publications? Membership dues? All this information is available on the organization's site.

Be on time for the interview, which means you should allow enough travel time to be early (this does *not* follow dating protocol!). Prepare questions in your mind but don't read them. Many questions may be answered in the course of the conversation: don't repeat them. When you ask a question, listen to the answer, and ask follow-up questions to demonstrate that you are engaged in the conversation, not just reeling off a list of prepared questions. Don't take exhaustive notes

The interview should feel like a conversation, not an interrogation—the candidate has to contribute to making the interviewer relaxed, not just the other way around.

at an interview because it can inhibit the interviewer and make you appear distrustful. The interview should feel like a conversation, not an interrogation—the candidate has to contribute to making the interviewer relaxed, not just the other way around. It is essential to ask intelligent questions about the organization, but don't wear out your welcome: be sensitive to the other person's answers becoming briefer and glances at their watch. If you find yourself asking about Casual Friday policy, you have prolonged the interview too long. The interviewer should like you more at the end of an interview than at the beginning.



The interviewer should like you more at the end of an interview than at the beginning.

Everyone has “a life.” You should neither offer up the details of it nor apologize for it if it comes out in the interview. For example, you may not wish to mention your spouse or children in an initial interview, because the interview is about you, not about your family. But if the question of children emerges (employers will often try to steer a conversation in that direction rather than asking direct questions, which can be illegal), you can comment matter-of-factly. For example, if the interviewer says, “I have two sons but I always wanted a daughter,” you could respond, “Yes, I can testify that daughters are wonderful, since I have one and I am one!”

After the Interview

Within two days after the interview, write a letter or email to thank the interviewer. If you are seriously interested in the position, say that you are and what you learned in the interview about the job that appeals to you. If there were pending issues from the interview, address them in the follow-up letter. This is a good time to send references, even if you were not asked for them. Make sure that references have consented to speaking to prospective employers on your behalf and that their contact information is current. The contact information you provide should be approved by the references—for example, do not give a home phone number unless a reference asks you to.

Even if you are not offered the position you wanted, having been through the interview is in your interest, because you will be more prepared for the next one. ■

Salary Negotiation



Julie Theriot
Stanford University
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Many young scientists entering the job market for the first time are unprepared to negotiate their salary. Graduate and postdoctoral stipends are usually fixed by the department or institution, so the first independent job offer may also be the first occasion for scientists to question their own financial worth. Many people in this position feel so flattered to have gotten a job offer that they decline to negotiate their salary at all.

Starting Salary Is Important

Usually yearly raises are based on existing salary. The first opportunity to negotiate a substantial raise may not be until a major promotion, three to seven years in the future. When an applicant is considering whether she can live with a particular starting salary offer, she should account for the long-term financial impact of only modest increases over several years.

This issue is not mitigated when changing jobs. Most companies will base an offer on an applicant's existing salary. Furthermore, aggregate salary information is frequently used to compare competing institutions and to expose discriminatory practices. In a sense, it is the duty as well as the right of a new employee to negotiate an appropriate starting salary.

In negotiations as well as interviews, knowledge is strength. The well-prepared applicant will have gathered information in advance of the negotiation.

An applicant must consider a salary offer in the context of the whole job offer package, including the challenge of the work and the work environment.



Negotiate from a Position of Strength

The recruit starts with a strong hand, because she was selected from among many applicants. It is in the best interest of the employer to meet the applicant's reasonable requests to succeed in recruitment. However, other applicants may have been attractive; the employer may withdraw the unaccepted offer if the applicant's requests are unreasonable.

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A starting salary must sustain a reasonable lifestyle for several years.

Know What You Need

Before beginning negotiations, the applicant must consider what she needs, as opposed to what she wants. A starting salary must sustain a reasonable lifestyle for several years. For applicants used to accumulating debt through years of low-salaried training, it is useful to calculate realistic financial needs, including student loan repayments, housing, utilities, transportation, child care, food, entertainment, vacations, insurance, and taxes. Also it may be advisable to save for retirement and future family expenditures. Regular expenses will vary substantially depending on the location of the job; the arrival of children will cause significant, long-term increases in living expenses. Although employers generally do not consider an applicant's individual financial needs, the applicant should be aware if her obligations prevent her from considering a low-paying but otherwise rewarding job.

Consider Salary Alternatives

People have different needs and priorities, which may include buying a house, quality day care, future wealth, or travel.

Recruits should consider potential benefits in lieu of higher salary.

Recruits should consider potential benefits in lieu of higher salary. Universities located in high-cost areas frequently can assist new faculty in buying homes through low-interest loans or co-investment. Pharmaceutical and biotechnology companies are less likely to offer real estate loans but more likely to offer signing or relocation bonuses that may be applied to a down-payment. Some employers may offer on-site or subsidized child care, and most offer family medical insurance. Some companies may be willing to sweeten a salary offer with stock options. Others may offer extra vacation or sabbatical time. The relative value of these benefits is individual, depending on an applicant's priorities and goals, and should be weighed along with the salary. Frequently, an employer will have more latitude to add benefits than increase salary.

Frequently, an employer will have more latitude to add benefits than increase salary.

A stock option is the right to purchase a share of company stock at a fixed price at some future time. Stock offers should be researched seriously, including restrictions on exercising options and tax consequences. If the company's stock is worth more than the

cost of the option at the time of purchase, this amounts to cash. But most stock options vest over periods of time ranging from months to years. If the stock value falls below the option price, or if the company fails, the options are valueless. If the employee leaves the company, she loses the unvested options. The value of stock options for companies that are privately held (i.e., not traded in stock exchanges) is particularly hard to measure.

Consider Stability and Terms

Most academic job offers require that some part of the applicant's salary be paid by external grants. This portion can range from 100% at "soft money" institutions to 25% or less at universities that expect the applicant to cover only "summer salary," to 0% at the NIH. At many institutions, this fraction may be reduced in the first years to help a new P.I. get started.

An offer of \$60K as a nine-month base salary represents a larger commitment on the part of the institution than an offer of \$90K that is entirely soft money.

An offer of \$60k as a nine-month base salary represents a larger commitment on the part of the institution than an offer of \$90k that is entirely soft money. To weigh the relative merits of these offers, the applicant must consider the likelihood of attracting sufficient grant money to cover the higher salary, especially in a grant climate where roughly 25% of new NIH grants are funded. Since most NIH grants are now modular, any grant money that is earmarked for the P.I.'s salary will decrease the amount of grant money available for graduate and postdoctoral stipends, supplies, and equipment.

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Similarly, in industry long-term stability must be weighed against short-term gain. Small start-up biotechnology companies may offer attractive salary and stock options, but if the company fails, stock options become valueless. Pharmaceutical companies will typically offer lower salaries and fewer stock options, but are less likely to lay off scientists or fail.

Publicly available data can provide useful benchmarks for negotiation.

Be Informed

Publicly available data can provide useful benchmarks for negotiation. All public universities and many private universities publish average faculty salaries. Search the Internet or campus newspapers. The university's human resources department can help direct the applicant to this information.

Nationwide salary surveys are available. Consult them.¹

Know the Rules

The well-prepared applicant has a good sense of what she wants and what she is likely to get. Actual salary negotiation depends on the policies and limitations of the specific employer. The best source of information is a



The best source of information is a sympathetic colleague at the institution.

sympathetic colleague at the institution. Some places, especially public universities, have essentially non-negotiable salary scales based on rank. An applicant need not waste time negotiating salary there and should focus instead on negotiable variables or a higher starting rank. Some public universities and many private ones have an X or scale component of salary, distinguished from the Y or off-scale component. The Y component is usually negotiable.

Know the person empowered to negotiate on behalf of the institution. This could be the dean, the department chair, or someone else. The applicant should seek to negotiate directly with the person making the offer, but it is useful to know whether that person has the sole authority to negotiate salary. Similarly in companies, salary ranges may be set by directors or vice presidents, but group leaders may have some freedom to negotiate.

The applicant should also learn the rules of advancement. At some companies scientists may expect to be promoted frequently, with salary increase with each promotion. Others base salary increases solely on productivity. Some employers may offer a better title for lower salary, but the applicant should beware of a low-paid Assistant Director position at a company that has 50 Ph.D. employees of whom 30 are Assistant Directors.

Don't Be Rushed

The first offer is an opening bid. The salary offer may be made in a one-on-one conversation, ending with, "What do you think about that amount?" Unless the offer is generous

beyond the applicant's wildest imaginings, it is best not to respond immediately. It is appropriate for the applicant to express appreciation, and say, "I need a little time to consider the offer [and/or] think about it in light of my other offers [and/or] discuss it with my partner." Even if an applicant eventually accepts the offer, clear and calm-headed consideration is preferable to a rush judgment in a flush of flattery.

Use Competing Offers

An applicant's bargaining power is enhanced by a tangible competing offer. It is appropriate to let the prospective employer know about the competition to give the prospective employer the chance to sweeten their offer. It is easier for an institution to justify a higher salary to match a competing offer than to make the case on merit alone.

Some high-salary offers from industry do not influence negotiations with academic departments because the jobs are not comparable. Likewise, a top-rated academic department may not respond to a more lucrative offer from a less prestigious institution. An applicant should provide competing offer information to her first-choice employer rather than to make an explicit demand that the offer be matched.

An applicant should never exaggerate or lie about the existence or value of competing offers. The scientific community is like a gossipy small town where everyone knows everyone else's business, and this will inevitably come to light eventually. Some employers will not respond to a competing offer unless they see it written. Furthermore, it is counterproductive to cultivate offers merely to up the ante for the first-choice offer, a practice which is almost always transparent: the first-choice employer feels manipulated and the second-choice employer feels used. Long-term professional good-

will and personal integrity should not be sacrificed for what may be a modest short-term gain.

An applicant should never exaggerate or lie about the existence or value of competing offers. The scientific community is like a gossipy small town where everyone knows everyone else's business.

Value the Goodwill of Your Colleagues-To-Be

In the long run, honesty about needs, goals, and priorities is the best policy for salary negotiations. The salary negotiator is often a department chair or project leader who is limited by institutional policy. This individual is strongly invested in recruiting the top

applicant and can intercede on behalf of the candidate only if she knows the applicant's actual needs and priorities. If an applicant would like to accept a job offer but cannot because her partner has been unable to find a job, the employer may be able to help. If the applicant is enthusiastic about the job but shell-shocked by property values, the employer may be able to swing assistance. However, an applicant should only make special requests if she intends to accept the offer if they are met.

Accepting an Offer

When you have considered all the issues and negotiated a good starting salary at a place where you are eager to begin work, accept the offer and don't look back. The negotiation process is idiosyncratic and never completely fair. It is likely that you will learn that a colleague at your level is making more money than you. As long as you entered the negotiation well-prepared and feel good about the process and the outcome, you did well. ■

What Else Can I Do?: Exploring Opportunities in Business and Management



Kathleen Gwynn
Kirsch Foundation

The logical answer to “What are you going to do when you finish your doctorate?” is research and, possibly, teaching. But you may wonder—as you look for the right postdoc position or later in your career—“what else is out there?”

The good news is that there are options, although few paths are as clear as that of research in academia or industry. Despite the hardships and pitfalls you can encounter in securing a full-time research position, you know the drill through your mentors and advisors who know how to work the system and help you with recommendations and connections.

If you are contemplating a career in business or management, connections may not be as readily available. Ask yourself: How do I know whether it’s a good fit for me? How do I get the training or education I need? Can I make it without formal training?

Your scientific education and training has demanded analytical skills, project planning and strong intellectual aptitude. These are easily transferable to the business world.

Management and Business

“Business” and “management” are often used interchangeably. “Management” is the art and science of judiciously using resources to accomplish an end; it often assumes that you are leading a team or group of people to accomplish a goal. “Business” refers to a commercial enterprise that expects to be profitable. You can be in business without being a manager. You can be a manager without working at a commercial enterprise.

What does it take to be successful?

One hears about “soft” and “hard” skills when it comes to management and business, respectively. The “hard” skills needed for business include data analysis, project planning, budgeting, accounting, and the use of other tools that are best acquired in an academic setting. Your scientific education and training has demanded analytical skills, project planning and strong intellectual aptitude. These are easily transferable to the business world.

“Soft” skills, which are important for management, include the ability to communicate effectively, to inspire or lead a team of people, to listen, and to work effectively with others to accomplish a common goal.

“Soft” skills, which are important for management, include the ability to communicate effectively, to inspire or lead a team of people, to listen, and to work effectively with others to accomplish a common goal. “Soft” skills are primarily personal traits that can be honed, but not taught.

If you enjoy working with others and have these “soft” skills, and want to move beyond the research lab, then management, whether in business, academia, philanthropy, or the non-profit world, may be a great choice for you. If making a profit for yourself or your company sounds exciting, then business could be a good match.

From Here to There

Several options for pursuing management as a career exist. They range from taking the plunge into a full-time MBA program to tak-

ing an occasional seminar, to making the leap without the benefit of formal training.

A full-time MBA program works best if you want to switch from research to business. You will learn the required tools, develop a network (similar to that in the research world), and gain access to on-campus recruiters and a career placement center. A summer position between the two years of school enables you to add a business job to your resume (in this world it’s not called a “CV”), furthering your ability to secure a permanent position. As a critical side benefit, most MBA programs also help you to hone your “soft” skills.

Unlike graduate school in science, professional schools, including business school, require a significant, front-end financial investment.

Unlike graduate school in science, professional schools, including business school, require a significant, front-end financial investment. Unless you are independently wealthy, you will have to assume significant debt, as scholarships are rare at graduate business schools. Starting salaries for MBAs, however, often are double or triple the salary of an academic, so this should be taken into account.

If you are curious about the business world, but not willing to make the sacrifice required of a full-time MBA program, consider part-time programs that meet in the evenings and/or over the weekend. This option is effective if you want to minimize the financial burden or are unsure that you want to leave research. You will miss the interaction among classmates and the intensity of a full-time program, but you will have access to career place-



ment services and, most importantly, you will learn the necessary business skills. Of course, you will also continue to earn an income and advance in your current position.

Even if you want to remain in the research world, taking occasional management courses, or enrolling in seminars offered by organizations such as the American Management Association¹ may be smart. Successful researchers in academia, industry or other settings must manage a lab with significant grants and staff. You could also be asked to serve as a Chair, on the Board of a biotech start-up, or as an officer of your scientific society. In these circumstances, good business and management skills will serve you and your institution well.

The Direct Route

Pharmaceutical companies and health- and medicine-related businesses and foundations seek individuals who have academic credentials in the life sciences. These venues can offer the opportunity to go directly from your doctoral program or the bench to a position in a corporation or foundation.

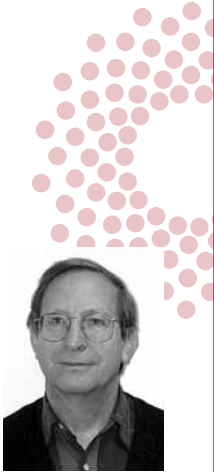
If you wish to move up the management ranks in the corporate world without the

benefit of an MBA, you are likely to start out in research. From there, you can explore professional development through in-house training or the Human Resources Department. As project manager positions become available, your research skills, combined with on-site management training, should lead to promotions.

Foundations that are committed to medical research often seek program officers who understand basic science. Program officers must track and interpret research activities so as to identify and fund the most promising opportunities. Foundations expect you to be an expert and to have numerous connections throughout your field. This ensures that you stay current with developments and help craft new grant initiatives. Foundations are less likely to provide in-house training, but may support your effort to pursue a part-time MBA program or seminars to shore up your scientific knowledge with business and management acumen.

The culture of business and management may seem foreign to many basic scientists, but the skills, intelligence and intensity required have much in common with the culture of science. ■

Late Career Opportunities and Challenges



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.¹

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 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.

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.² 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.

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. 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 out-growing 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 sig-

nificant personal reward. Recent research on interactive learning suggests ways to engage students, even in large lecture courses, helping them learn more effectively.³ 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.⁴ 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.⁵ 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,⁶ 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 viewpoints 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 Third 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,⁷ the Peace Corps⁸ and several non-government organizations⁹ can also help.

It is easy to view the winding down of one's professional activities as a loss of privilege and power. Certainly some valuable things will go, but constructive additions can compensate.

The second issue related to volunteering is freedom. It is easy to view the winding down of one's 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.

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

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.

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 metamor-

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.

phosis and ecdysis that will allow the spreading of new-found wings.

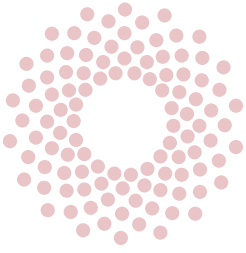
Underlying the issue of late career transition is the fact that although our country's



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 under-paid, 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. ■



7. GRANTS

Study Section Service:
An Introduction

Responding to the
NIH Summary Statement

Study Section Service: An Introduction



Frank Solomon
Massachusetts Institute
of Technology

By several criteria, life sciences research in the United States has been phenomenally successful over the past 40 years. Some analyses ascribe at least part of that success to the peer review system for awarding research support. The core of the peer review

Study section review is a human endeavor. Its quality depends entirely on the wisdom, commitment and integrity of the people who serve.

system is the study section—a committee of scientists that evaluates the research in each proposal. But of course study section review is a human endeavor. Its quality depends entirely on the wisdom, commitment, and integrity of the people who serve. Their task is to distinguish good and valuable science independent of whether it comes from new investigators or established ones, representing large programs or small, in fields fashionable at the time or relatively obscure.

The ways of serving effectively—getting the most out of the experience and in turn making the most significant contribution to peer review—are happily congruent with the ways of making study sections work well.

At the beginning of their careers, most scientists view study section as a mysterious body, powerful and distant, in a position to make fateful decisions.

Especially over the past several years, the NIH has worked to dispel some of that mystery and to make the review process more transparent. Still, the best way to learn how study sections work is to serve on one. The ways of serving effectively—getting the most out of the experience and in turn making the most significant contribution to peer review—are happily congruent with the ways of making study sections work well.

The Mechanics

Different study sections operate differently, but the following description will fit many of them. Most study sections are organized around relatively contiguous areas of research, and its members are selected for their relevant expertise. Ideally, panel members will share sufficient common knowledge that they will be able to assess proposals in areas that are at least fairly closely related. That said, the range of proposals each study section must consider requires considerable breadth.

A term on study section is usually four years. The NIH officer assigned to the study section, the Scientific Review Administrator (SRA), is a fixture. The chair, selected by the SRA from among the roughly twenty members, usually serves in that role for the last two years of the term.

NIH study sections meet three times a year (somewhere near Washington, DC, in most cases). Each meeting may deal with 70 to 100 or more proposals. Principal investigators can indicate which study section they want to review their proposal, based on experience—their own or their colleagues’—and the membership rosters are posted by the NIH Center for Scientific Review for each study section.¹ Those lists are not a guarantee; at any given session, some regular members may be absent, and substitutes not on the roster may be present.

Commonly, the SRA assigns primary responsibility for each proposal to two members, who write detailed reviews in a form and tone suitable for transmission to the applicant. A third person, the reader, may write a shorter set of comments. These write-ups are prepared before the study section meets. The SRA identifies formal conflicts—when the applicant is at the same institution as a prospective reviewer, for example—but it is up to the reviewer to notify the SRA of other conflicts that may interfere with objective evaluation.

Study sections meet for about 12 hours—one full day until dinner time and then as much time as needed on the second day. Nearly everyone arrives the night before the first session, and the proceedings conclude in time to allow people on the West Coast to get home that evening.

The sessions are intense. The review of each proposal begins, once the members with conflicts leave the room, with a report from the reviewers and the reader. Frequently, each reviewer will declare a level of enthusiasm for the proposal, and then present the findings and analyses that justify that opinion. There follows a discussion involving everyone on the panel. Of course, proposals that are unanimously viewed as terrific, or as deeply flawed, do not require a lot of discussion. But for the many proposals that are somewhere between those poles, or about which there are significantly divergent opinions among the reviewers or other members, a full discussion is necessary for the system to work. The discussion can help resolve differences among the reviewers, sometimes by going back and forth between themselves, sometimes in response to questions asked by other members. It is not uncommon for reviewers to change their positions significantly as a result of these discussions, helping the panel to reach a consensus view. Some differences simply do not resolve.

Either way, how this discussion is conducted is crucial to the success of the study section. It is the preamble to a confidential vote—a number attached to the proposal by each member (it would take another article to do justice to the voting process) which is the basis for the priority score. Each member votes on each proposal regardless of expertise. Different study sections—and in fact different chairs, who are responsible for the pace

Chairs, who are responsible for the pace of the meeting, have different ideas about how these discussions should be regulated, ranging from the Stopwatch School to the Socratic School.

of the meeting—have different ideas about how these discussions should be regulated, ranging from the Stopwatch School to the Socratic School. The essential point is that a complete explication of the issues and concerns provides a more informed, better justified basis for voting.

The Reviewer's Work Load

A study section with twenty members and eighty proposals will require that each of its members writes an average of eight full reviews and serves as reader on four other proposals—a “light” to “average” load, in most people's experience. Reading twelve grants carefully is not trivial: each proposal is twenty-five single-spaced pages of usually dense scientific prose. But the importance of the job requires reviewers to read every word and to try to understand every thought. For beginners, it may take six to eight hours to read a proposal, but that

The importance of the job requires reviewers to read every word and to try to understand every thought.

time goes down with experience. Writing a thoughtful review takes another couple of hours. On top of all this work, reviewers frequently read proposals that are not their primary responsibility, for example because they're interested in the field.

Effective Service

Becoming an effective and valuable member of a study section is an acquired skill. Some of the same qualities that help us in our work pertain: the ability to analyze complex situations, to identify important questions, to design well-controlled experiments, and so on. But peer review of grants also calls upon other qualities from reviewers:

- **Generosity** with respect to time and attention demanded from already busy lives, to be sure, but also in allowing for science that is substantially different from what the reviewer practices.
- **Listening** to one's co-reviewer on a particular proposal, or to the disagreeing reviewers discussing a proposal that is distant from one's own field. Some people make a point of listening for what they consider to be crucial determinants. For example, how will this proposal, if funded, advance the field?
- **Fairness:** the ability of study sections to assess all proposals in an even-handed manner, so that differences in scores are meaningful, depends absolutely upon the



fairness of the members. Each scientist brings to the table a sense of what constitutes excellence—in hypotheses, experimental design, and impact. Applying those standards throughout, and keeping in check one's biases—personal and scientific—allow the study section to establish high and firm standards as a group.

- **Clarity:** reviews that convey effectively the reviewer's analysis are extremely important. Reviews of high quality that are consistent with the score that the proposal receives enhance confidence in the system.
- **Persuasiveness:** the ability to articulate crisply the qualities of a grant that underlie one's opinion of it matter in the meeting. The majority of study section members must rely upon the reviewers for a guide to both the proposal and the field it represents.

What's in It for the Study Section Member?

Most of those who have served as members agree that they have enjoyed multiple benefits from study section service:

- **The opportunity to contribute in a significant way to the research enterprise.** By putting themselves in a position to be an advocate for interesting and well-done science, they help lift the standards and performance of their fields.
- **The opportunity to learn how to write a better grant.** Reading others' proposals, good and bad, allows people to see what works and what doesn't, how to present data, how to keep reviewers engaged, what sorts of traps to avoid. The common expe-

Reading others' proposals, good and bad, allows people to see what works and what doesn't, how to present data, how to keep reviewers engaged, what sorts of traps to avoid.

rience is that study section members' proposals get better and easier to write as a result of their service.

- **The chance to participate in an intellectual experience of a high order.** The analysis of a scientific program, and its relationship to a field, calls upon the reviewers' intellect and training in a way that too few other activities do. Members also can learn a lot of science in a short time.
- **The opportunity to form relationships with new colleagues that carry on throughout one's career.**

Which Study Section and When?

People usually join study section after being invited to serve at a session or two as an *ad hoc* member. The invitation comes from the SRA (SRAs are notoriously on the prowl for willing talent) acting on names received from members of the study section past and present and other scientists in the field. These sessions give the study section and the potential member a chance to find out if they're compatible. It's a good idea to pick a study section that deals primarily with science relevant to one's own interests. All those hours in a meeting talking about things that you don't know or care about will make

what is constitutively a demanding experience thoroughly unbearable.

People on study section can feel exposed, and many members have been blamed or (much less often) credited—rightly or wrongly—by a colleague for the disposition of a proposal.

When in your career to join is a delicate question. Evaluations of grants have a much larger impact than reviews of papers. But study section members are much more visible than anonymous journal reviewers. Rosters of study sections are available on the net, and the author of a proposal will inevitably guess (rightly or wrongly) which two or three members are the most likely

reviewers. So people on study section can feel exposed, and many members have been blamed or (much less often) credited—again, rightly or wrongly—by a colleague for the disposition of a proposal. These circumstances frankly make study section service problematic for junior people. Add to that the time it takes and the level of judgment and experience required. That's why many advise waiting until tenure to join a study section, save for exceptional cases. That's a shame, because the learning part is especially beneficial to young people, but it's probably sound advice.

There are many other aspects of study sections that are important: how the reviews are turned into numerical scores; what can go wrong in study section, and why, and who is responsible for making things right; the ethics of reviewing; and more. Dedicated, thoughtful members make all the difference. ■

Responding to the NIH Summary Statement



Sally Ann Amero
*The National Institutes
of Health*



Marcia Steinberg
*The National Institutes
of Health*

We've all been there, probably more times than anyone will admit. You spent months reading the literature, staring at your computer, and imposing on your family and friends before submitting your grant application to the National Institutes of Health. Several weeks later, you receive a notice from the NIH, confirming receipt of the application and listing its assignments.¹ All seems fine, until a few months later.

The seasoned applicant knows that the NIH sends letters to Principal Investigators soon after a study section meeting,² usually within two weeks. The letter indicates whether the study section voted to streamline ("unscore") the application or to assign it a numerical priority score³; if they chose the latter, the priority score and perhaps the percentile ranking will be given.

If Your Application Got an Outstanding Priority Score and Percentile Ranking

Congratulations, you stand an excellent chance of receiving a grant award! However, you should not make commitments based on your expectation of funding support, because your application will be further reviewed by an NIH Institute or Center Advisory Committee for relevance to established priorities and public health needs, and the funding decision will be influenced by the recommendation of this committee and the level of funds currently available at the given Institute or Center. Therefore, you should wait for the summary statement and actual notice of award, and check with your Program Officer before making commitments.

If Your Application Got an Unfavorable Score and Percentile Ranking

If your application received an unfavorable score, you will need to formulate an action plan that is based on logic, sound advice and knowledge of the NIH peer

Particularly noteworthy are the five major review criteria—Significance, Approach, Innovation, Investigator, and Environment—that are used in the evaluation of most research applications submitted to NIH.

review system. The Center for Scientific Review homepage⁴ is an excellent place to start. It contains the policies, procedures, and review guidelines that NIH study sections follow, and are sent to the reviewers with the applications under review. Particularly noteworthy are the five major review criteria—(1) Significance, (2) Approach, (3) Innovation, (4) Investigator, and (5) Environment—that are used in the evaluation of the vast majority of research applications that are submitted to the NIH, as are the special guidelines that are used in the evaluation of research applications from new investigators. Equally important are the documents that describe the format of a study section meeting and the responsibilities of the assigned reviewers.

It is critical to understand the different responsibilities of review staff and program staff at NIH, and where your application goes within the NIH.

It is critical to understand the different responsibilities of review staff and program staff at the NIH, and where an application goes within the NIH. The initial phase of

receipt and referral is managed by a Referral Officer in the Center for Scientific Review. Referral officers make initial decisions concerning the assignment of the application to an appropriate study section for initial peer review and to an appropriate Institute or Center for funding consideration.

The next phase, peer review by a study section and preparation of the summary statement, is managed by a Scientific Review Administrator (SRA). Most SRAs and their study sections reside in the Center for Scientific Review, but some reside in the Institutes and Centers. After the initial peer review, your application is in the hands of a Program Officer, all of whom reside in an Institute or Center.

Questions concerning study section assessments for a pending grant application, or the likelihood for funding, should be directed to the appropriate Program Officer—the individual listed in the upper left corner of the summary statement and on the priority score notification letter. After the meeting of the study section, the SRA is no longer your point of contact concerning the application, but he or she can discuss matters of general review policy and procedure. It may be tempting to contact a reviewer to find out “the real story” of how your application was discussed. *You should not do so.* Reviewers understand the need for complete confidentiality regarding the discussions in the study section.

You should not attempt to discuss your application, the manner in which it was reviewed, or an appropriate course of action until you have the summary statement in hand and have given it adequate consideration. The summary statement is mailed to the Principal Investigator within six to eight weeks after the study section meeting. The summary statement includes a resume and summary of discussion written by the SRA, the (largely unedited) reviewers’ cri-



You should not attempt to discuss your application, the manner in which it was reviewed or an appropriate course of action until you have the summary statement in hand and have given it adequate consideration.

tiques, a budget recommendation, a meeting roster, and contact information for the appropriate Program Officer in the assigned Institute or Center.

If Your Application Was Not Funded

If your application was not funded, you have two options. If the summary statement outlines specific points that can be addressed succinctly, then fixing those weaknesses and submitting an amended application for the next deadline is advisable. For amended applications, reviewers are given the prior summary statement and they are instructed to comment on both the applicant's response to the previous review and the degree to

A key factor in crafting a successful amended application is addressing the reviewers' criticisms.

which the application is improved, so a key factor in crafting a successful amended application is addressing the reviewers' criticisms. This does not necessarily mean accepting them; sometimes reviewers' criticisms can be handled by providing additional information

or a more thorough explanation. In most cases, the amended application will be sent to the same study section, although different reviewers may be assigned to review it. If the applicant requests another study section in a cover letter and the new study section has the expertise required to review the application, the request is generally honored.

Scores are often improved in subsequent submissions (for a given project, one can make three submissions). However, changing the application according to the prior study section's comments does not guarantee funding. Sometimes the second set of reviewers uncover weaknesses not found during the first review. Therefore, it is common for even an amended application to receive an unfavorable score; it may even score more poorly than did the original.

In order to be effective, an appeal letter should address specific issues or comments in the summary statement that can be documented, rather than differences of scientific opinion.

If you believe that a substantive factual error has been made in the review process, your second option is to initiate a formal appeal by writing a letter to the Program Officer. Your concern will be discussed at NIH and your letter may be sent to the Advisory Council or Board of the funding Institute or Center, seeking their recommendation for an appropriate course of action. In order to be effective, an appeal letter should address specific issues or comments in the summary statement that can be documented, rather than differences of scientific opinion.

The Advisory Council or Board may uphold the study section's review or recommend that the review be done over (deferral). NIH operates on a schedule of three review cycles a year, and the Advisory Council or Board meetings occur late in each review cycle. Therefore, a recommendation by Council for re-review is likely to result in deferral of the application for re-review in the next review cycle. Only infrequently does the Advisory Council or Board recommend funding without re-review.

An important difference exists between the two options in the document that is re-reviewed: deferral entails the re-review of the original application without revision, whereas submitting an amended application gives the applicant the opportunity to address the comments of the study section. The review schedule for the two options is often the same.

If revising the application a second time did not work, it's probably time to overhaul the project or to turn in a new direction.

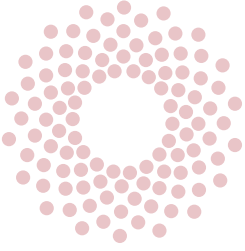
What's My Next Move?

If revising the application a second time did not work, it's probably time to overhaul the project or to turn in a new direction. Be prepared to ask yourself some hard questions: Are the research questions I'm addressing

important? What if my ideas don't work? Am I working in the wrong place? Am I bored with this? Also, be prepared to back up and take some baby steps. Small awards from local funding agencies or internal funding from your institution can give you an opportunity to demonstrate your abilities and to produce important preliminary data. Finally, take advantage of every resource available to you that can help you succeed. Ask your Program Officer to steer you toward special NIH initiatives that may be appropriate for you; ask your SRA to discuss appropriate review venues for your new ideas; and ask a trusted, senior colleague or former mentor to discuss your outline and later to proofread

An outstanding presentation probably can't rescue a mediocre project but a mediocre presentation can kill an outstanding project.

your application. If your institution offers an internal pre-review service, use it. If your institution offers a course on grant writing skills, take it. If you need assurances and approvals, get them. An outstanding presentation probably can't rescue a mediocre project but a mediocre presentation can kill an outstanding project, especially if it is difficult to understand or if it is incomplete. Don't leave anything to chance—now is your time to shine. ■



8. ACADEMIC CAREERS

Teaching Is Good for Research

Academic Careers without Tenure

Teaching Is Good for Research



Harvey F. Lodish
Whitehead Institute for
Biomedical Research

Few would argue with the premise that research is an important part of teaching and that many of our greatest teachers have also been top researchers. Students are taught the experimental underpinnings of key results and concepts, often illustrating actual experimental data to establish a point. The latest results and methods are incorporated in class lectures and problem sets; discussions on genomics, DNA “chip” microarray technology, and bioinformatics commonly interdigitate lectures on cell-cell signaling pathways, protein traffic, and the cytoskeleton. In laboratory courses students learn how to carry out some of the newest experimental techniques. In many, many ways, research informs teaching.

By requiring faculty to master new and unfamiliar areas of biology, teaching naturally leads into totally new areas of investigation and enhances one’s research program.

But what of the converse premise—that teaching is good for the development of one’s research program? By requiring faculty to master new and unfamiliar areas of biology, teaching naturally leads into new areas of investigation and enhances one’s research program. Also, in many medical schools and research institutes both in the United States and abroad, research faculty rarely teach undergraduates or even graduate students, while at the same institutions faculty in other colleges or administrative groups handle the bulk of the graduate and certainly the undergraduate instruction.



Many non-teachers seemingly have been unable to refocus their research into new areas when the old areas had become stale.

It is troubling that faculty at most medical schools in the United States do little or no teaching, especially at the undergraduate level, even when many are among the most inspiring and creative lecturers. Many who teach give only a few lectures and only in their area of specialty. Indeed, those who do not teach are vulnerable to

Standing in front of a group of students and presenting complex materials simply and concisely is a skill that can help one give the fantastic research lecture that lands a top job.

research programs that become narrow and routine. Teachers know that preparing for and teaching a topic to a group of students forces one to read up and learn new concepts and information. As life science is becoming more interdisciplinary, there is the need to have a much broader appreciation of many related subjects, and teaching is a good way to acquire this. Lacking exposure to the questions by students, and perhaps more importantly lacking the perspective obtained by reading broadly and deeply outside of one's particular field, many nonteachers seemingly have been unable to refocus their research into new areas when the old areas had become stale.

There are lessons here for young scientists beginning a research career. First, gain as much teaching experience as possible. Often the best research lectures are given by experienced teachers. Standing in front of a group of students and presenting complex materials simply and concisely is a skill that can help one give the fantastic research lecture that lands a top job.

If you do not have to teach, volunteer to organize a seminar course in a field near but not part of your own.

Once beginning researchers have a faculty job, they should teach. If they do not have to teach, they should volunteer to organize a seminar course in a field near but not part of their own. Reading and criticizing papers in a field not one's own, as part of a seminar course, is a great way to learn a new set of technologies or concepts. Or they should volunteer to teach part of a core graduate course in their department or develop and co-teach a new course with a colleague in a nearby field. Among other benefits, they may find common interests for collaborations and also get exposure to students who may decide to work with them.

Teaching can inform research as much as research can inform teaching.

Thus teaching can inform research as much as research can inform teaching. Also, each of us has benefited from inspiring teachers and thus each of us has acquired the obligation to teach at whatever level we can in order to train and inspire the generations of scientists who will follow us. ■

Academic Careers without Tenure



Caroline M. Kane
University of California,
Berkeley

Tenure (Webster's Ninth Collegiate Dictionary): a status granted after a trial period to a teacher protecting him from summary dismissal.

Universities and colleges maintain a variety of categories among faculty, and each has its own expectations, responsibilities, privileges, job security, and respect. Institutions of higher education have neither the resources nor the desire to hire all members of the faculty into positions that might require funds in perpetuity (tenured), and yet they have a great need for faculty in teaching, research, and service to carry out the mission of the institution successfully.

What are the advantages and disadvantages to the scientist who signs on to a career without tenure at an academic institution? Is tenure a dinosaur that should be allowed to achieve extinction? When one is considering a position at an academic institution, what aspects are differentially negotiable for tenured and nontenured faculty?

The most remarkable finding among colleagues across institutions is that they feel that the respect among colleagues in one's field off the home campus is unrelated to a campus job title.

There are many job titles outside the traditional Assistant, Associate and Full Professor at academic institutions, and they can be confusing to students, staff and even other faculty at the same institution. Adjunct Professor, Specialist, Research Faculty, Lecturer, Instructor, Professor in Residence: other titles and per-



sonnel categories might be specific to individual institutions, and each title comes with its own rules, responsibilities and privileges.

What advantages accrue to scientists at academic institutions when they do not enjoy traditional job titles? The most remarkable finding among colleagues across institutions is that they feel that the respect among colleagues in one's field off the home campus is unrelated to a campus job title. On campus, many important aspects are reported positively: the opportunity to conduct research, teach and participate in department policy discussions is often blind to a title. While there is no tenure, such positions, when full or nearly full time, usually have the benefits of traditional faculty, including health insurance and contribution to retirement. These benefits accord significant financial advantages in any employment situation. These positions can sometimes allow for part-time assignments which can be a particular attraction when raising a family, caring for a sick parent or dealing with other significant personal needs.

A common perception is that nontraditional faculty enjoy the advantage of being free of the crushing burden of grant writing. This is sometimes the case.

A common perception is that nontraditional faculty enjoy the advantage of being free of the crushing burden of grant writing. This is sometimes the case. However, this "advantage" may be illusory if the same person finds her- or himself being the ghost writer for the person who is officially the Principal

Investigator. Many times, there is a strong contribution to the grant without assuming the majority role in the writing, and this collaboration with the Principal Investigator can be particularly productive.

Faculty in these positions enjoy the opportunity to put extra effort into teaching; indeed some positions, such as lecturer and instructor, have no research responsibilities.

Association with the institution is widely regarded as a very positive feature, offering the opportunity to work with graduate students, postdoctoral fellows and visiting faculty, regardless of whether it's within one's independent laboratory or in someone else's. It is also generally perceived that faculty in these positions enjoy the opportunity to put extra effort into teaching; indeed some positions, such as lecturer and instructor, have no research responsibilities and often no administrative responsibilities outside those associated with classes. This is because expecta-

The biggest single burden nontraditional faculty endure compared to other faculty is lack of job security.

tions are usually different from those of traditional faculty whose advancement is nearly entirely based on research output, regardless of protestation to the contrary. Many faculty without employment security derive satisfac-

tion from and are very successful in their research contributions.

The biggest single burden nontraditional faculty endure compared to other faculty is lack of job security. Contracts for these positions are typically one to three years, and sometimes less, since salary funds are usually soft money, dependent upon grant funding. While more and more academic institutions are moving away from tenure and toward such rolling contracts, these colleges and universities remain the exception rather than the rule. There is also often ambiguity in evaluating one's success in these nontraditional positions, although it almost always reflects a combination of the usual research,

Institutions utilize extensive latitude in evaluating performance in these positions, and sometimes this vagueness can be intentional in order to be able to eliminate positions or to justify maintaining a scientist in a nonpermanent status.

teaching and service. Nonetheless, institutions utilize extensive latitude in evaluating performance in these positions, and sometimes this vagueness can be intentional in order to be able to eliminate positions or to justify maintaining a scientist in a nonpermanent status, depending upon the immediate needs of a department or institution. Nontraditional faculty indisputably enjoy less salary and research support than their tenured colleagues.

There is an undeniable perception, if not reality, that one gets less respect for accom-

The unspoken sense is that even if one is doing a good job at teaching, service and even research, if one were just "better," one would have a permanent position.

plishments at one's home institution. The unspoken sense is that even if one is doing a good job at teaching, service and even research, if one were just "better," one would have a permanent position. Moreover, the feeling of inclusion depends on the department, and perhaps on the title itself. One nontenured faculty member indicated that he is "virtually invisible" to his department despite being on the faculty for over eight years. An interesting research topic would be a comparison of the impact of individuals from different job categories on both the success of the educational institution and one's research field.

These positions are sometimes considered "way stations" on the road to a "real career." This misconception overlooks the depth and breadth of excellence and commitment of the cadre of professionals in these roles. Many scientists have chosen these jobs for all the advantages outlined above, and their intention is to advance within these nontraditional ranks, enjoying the independence and satisfaction of the significant contributions they are making. Others however are indeed hired with the misleading understanding that as a traditional position opens up, they will be first in line for full consideration.

The most important advice for scientists considering impermanent positions is, "Look before you leap." Often one may be told, "We will try to move you into a more secure posi-

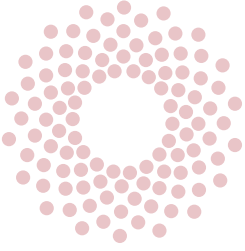


tion.” Analyze the history of the department’s achieving that. Be ready to be your own advocate and to initiate interactions

Often one may be told, “We will try to move you into a more secure position.” Analyze the history of the department’s achieving that.

with others in your department or across your campus. Learn clearly, preferably in writing, how you will be evaluated for promotion and how the department or campus

may come to your assistance if you have a temporary lapse in grant funding. How committed is the department to assuring the research space and resources for you to advance professionally? What specific responsibilities are required of you each academic year? Ask how your opinions will be counted in departmental decisions on policy, hiring, and retention of other faculty, traditional or not. In addition, ask the Dean or other upper level administrator how the position is significant for the campus. Answers will vary, and the decision to accept the position or not will depend upon personal circumstance. Going in with eyes open and with supporters to promote professional development are essential. ■



9. EFFECTIVE PRESENTATION

Do's and Don't's
of Poster Presentation

You Don't Have
to Shout to Be Heard

Do's and Don't's of Poster Presentation



Steven M. Block
Stanford University

This guide offers advice on preparing a good scientific poster. As with all communication, which is an art form, there is no single recipe for success. There are many alternative, creative ways to display and convey scientific information pictorially. Occasionally, breaking with tradition can pay off, but not always. It's generally best to leave experimentation to the laboratory, and stick with tried-and-true methods for poster presentations. Remember that when it comes to posters, style, format, color, readability, attractiveness and showmanship all count.

DON'T make your poster up on just one or two large boards. These are a clumsy nuisance to lug around. They put large strains on poster pins and often fall down. They frequently don't fit well into the poster space provided. They don't lend themselves well to re-arrangement, alignment or last-minute modifications.

DO make up your poster in a large number of separate sections, all of comparable size. The handiest method is to mount each standard-sized piece of paper individually on a colored board of its own, of slightly larger dimensions, about 9.5" x 12". This frames each poster segment with a nice border and makes for a versatile poster that can be put up anywhere, yet knocks down easily to fit into a briefcase or backpack for transport.

Titles with colons in them are a bore. Titles that are too cute are even more of a bore.

DON'T write an overlong title. Save it for your abstract. Titles that use excess jargon are a bore. Titles with colons in them are a bore. Titles that are too cute are even more of a bore.



DO keep your title short, snappy, and on target. The title needs to highlight your subject matter, but need not state all your conclusions. Some good titles simply ask questions. Others answer them.

DON'T make the title type size too large or too small.

DO make your title large enough to be read easily from a considerable distance (25–50 ft.), without exceeding the width of your poster area. It should never occupy more than two lines. If things don't fit, shorten the title—don't reduce the type size! Format your title using title case, which means initial capitals followed by lowercase letters.

DON'T leave people wondering about who did this work.

DO put the names of all the authors and institutional affiliations just below (or next to) your title. It's a nice touch to supply first names, rather than initials. Don't use the same large type size as you did for the title: use something smaller and more discreet. This is not the cult of personality.

Never, ever, use 10- or 12-point type. Don't use it in your text. Don't use it for captions. Don't use it for figure legends, annotations, footnotes or subscripts. Don't use it anywhere.

DON'T use too small a type size for your poster. This is the single most common error!! Never, ever, use 10- or 12-point type. Don't use it in your text. Don't use it for captions. Don't use it for figure legends, annotations, footnotes or subscripts. Don't use it any-

where. Don't ever use small type on a poster! Remember, no one ever complained that someone's poster was too easy to read.

Not enough space to fit all your text? Shorten your text!

DO use a type size that can be read easily at a distance of 4 feet or more. You do want a large crowd to develop around your poster, don't you? Think of 14-pt. type as being suitable only for the "fine print" and work your way up (never down) from there. A type size of 20 pt. is about right for text (18 pt., if necessary). Not enough space to fit all your text? Shorten your text!

DON'T pick a font that's a pain to read. Please, don't get too creative in your typeface selections: to struggle through a poster in **Gothic** or **Broadway** or **Tekton** or anything garish is painful. Less obvious is the fact that sans-serif fonts, **Helvetica** and **Arial** being the most common offenders, are more difficult to read, and certain letters are ambiguous (l = lower case 'l' and l = upper case 'l'). Serifs help guide the eye along the line and have been shown in numerous studies to improve readability and comprehension. Equally hard to read are most monospaced fonts, such as **Courier**. Generally speaking, it's better to leave Helvetica to Cell Press, reserving its use in posters for short text items such as titles and graph labels, and reserve monospaced fonts for use in nucleotide sequence alignments.

DO use a high-quality laser or inkjet printer to print your poster: no dot matrix printers, no typewriters, no handwriting. Select a highly legible font with serifs and a large "x-height." The x-height of a typeface is a typographer's term for the relative height of the

lowercase ‘x’ compared with an uppercase letter, such as ‘A,’ or a lowercase letter with ascenders, such as ‘b.’ A large x-height makes for easy reading from a distance. Good ol’ **Times Roman** (A a B b C c D d E e G g P p Q q X x Y y Z z) and its look-alike clones such as **Times New Roman** represent the standard choice. But if you seek a different look, consider **Baskerville** (A a B b C c D d E e G g P p Q q X x Y y Z z), **Century Schoolbook** (A a B b C c D d E e G g P p Q q X x Y y Z z), **Palatino** (A a B b C c D d E e G g P p Q q X x Y y Z z), or anything else with proven legibility. Also, consider adjusting the kerning (the letter spacing) for improved readability. This is particularly helpful when using large font sizes.

DON’T vary type sizes or typefaces excessively throughout the poster. For example, don’t use something different for every bit of text and graphics.

DO design your poster as if you were designing the layout for a magazine or newspaper. Select fonts and sizes that work together well. Strive for consistency, uniformity and a clean, readable look.

Consider numbering your individual poster pieces (1, 2, 3, ...) so that the reading sequence is obvious to all.

DON’T make your reader jump all over the poster area to follow your presentation. Don’t segregate your text, figures, and legends in separate areas.

DO lay out the poster segments in a logical order, so that reading proceeds in some kind of linear fashion from one segment to the next, moving sequentially in a raster pattern.

The best way to set up this pattern is columnar format, so the reader proceeds vertically first, from top to bottom, then left to right. This has the advantage that several people can read your poster at the same time, walking through it from left to right, without having to exchange places. Consider numbering your individual poster pieces (1, 2, 3, ...) so that the reading sequence is obvious to all. And always make sure that all figure legends are located immediately adjacent to the relevant figures.

Forget paisley, tie-dye, stripes, polka dots, and batik. In graphics, use color with deliberation.

DON’T use gratuitous colors. Colors attract attention, but can also detract from your message when misused. Fluorescent (neon) color borders just don’t cut it for posters. Neither do excessive variations in color (the “rainbow look”). Forget paisley, tie-dye, stripes, polka dots, and batik. In graphics, use color with deliberation.

DO use colors in your poster, but in a way that helps to convey additional meaning. For color borders, select something that draws attention but doesn’t overwhelm. For color artwork, make sure that the colors actually mean something and serve to make useful distinctions. If pseudocoloring is necessary, give thought to the color scale being used, making sure that it is tasteful, sensible, and, above all, intuitive. Also, be mindful of color contrast when choosing colors: never place isoluminous colors in close proximity (dark red on navy blue, chartreuse on light grey, etc.), and remember that a lot of people out there happen to be red/green colorblind.



Remember that a lot of people out there happen to be red/green color-blind. Please remember this advice when you create color slides and transparencies, as well!

Please remember this advice when you create color slides and transparencies, as well!

DON'T write your poster as one long, meandering thread.

DO break your poster up into sections, much like a scientific article. Label each section with titles. Always start with an abstract, and write it to be easily read and digested, in contrast to the abstracts found in some scientific journals. You should not attempt to include everything possible in 150 words or less. Make sure that your abstract contains a clear statement of your conclusions. Other sections should describe the *Strategy*, *Methods*, and *Results* (although you need not call these sec-

Display all your graphs, pictures, photos, illustrations, etc. in context. Write clear, short legends for every figure.

tions by those names). Display all your graphs, pictures, photos, illustrations, etc., in context. Write clear, short legends for every figure. Follow up with a *Conclusions* section. You may wish to add an “*Executive Summary*” at the end: many successful posters provide a bulleted list of conclusions, questions answered/raised, or both.

DON'T ever expect anyone to spend more than 3–5 minutes at your poster. If you can't convey your message clearly in less time than this, chances are you haven't done the job properly.

DO get right to the heart of the matter, and remember the all-important “KISS Principle”: Keep It Simple, Stupid! In clear, brief, jargon-free terms, your poster must explain the scientific problem in mind (what's the question?), its significance (why should we care?), how your particular experiment addresses the problem (what's your strategy?), the experiments performed (what did you actually do?), the results obtained (what did you actually find?), the conclusions (what do you think it all means?), and, optionally, caveats (any reservations?), and future prospects (where do you go from here?).

DON'T write your poster as if it were a scientific paper. It's not. Don't waste lots of precious space on messy experimental details (*Materials and Methods* should be abbreviated) or on irrelevant minutia. Don't display every gel, every sequence, every genotype. Don't ever supply long tables: no one has the time or inclination to wade through these. And don't ever lift long sections of text directly from some manuscript and use these as a part of your poster. A poster is not a worked-over manuscript.

DO recall that a poster should be telegraphic in style and very accessible. Avoid jargon. Eschew obfuscation. Write plainly, simply, briefly—never cryptically. A little informality can help, but don't get too cute. Stress experimental strategy, key results, and conclusions. Don't get bogged down in little stuff. Convey the Big Picture.

DON'T leave prospective readers hanging or assume they're all experts. They're not, especially at a broad meeting like the ASCB,

where people from different fields will be viewing your poster.

DO consider adding a helpful tutorial section to your poster. For example, consider one or more of these additions to the “standard fare”: a brief, possibly annotated bibliography; a short account describing some special apparatus or technique; a synopsis of the historical background of a particular scientific problem; a pictorial glossary describing some jargon terms (e.g., a definition of *synthetic lethality* with an illustration of alternative ways it can develop); a website for supplementary material; photographs of your setup; or anything else that would help teach your readers what they need to know to

Sidebars help to communicate the message.

understand and appreciate your work. Use graphics! Many of the items above are what an editor would call a *sidebar* to the main story. Sidebars help to communicate the message. Remember that you are the single best advocate of your own work.

DON'T leave out acknowledgments.

DO remember that it never hurts to give credit where it's due. Write up a short *Acknowledgment* section, including your sources of financial support and everyone who helped you to get the work done. No one was ever accused of being too generous here.

DON'T leave out the references.

DO provide routes into the literature and supply a context for your work. Poster references need not be as extensive as those in papers. If your poster work, or work closely related to it, has already been published, display the citation(s). Footnotes are permissible

but not preferable, so if they're necessary, keep them brief. People hate having to jump around while reading posters. A website for more information is useful.

DON'T leave everything until the last minute! Avoid resorting to handwritten text (no felt-tip pens!) or using white-out. Don't hold everything together with tape. Be professional.

DO start putting your poster together early. Get the *Title*, *Acknowledgments*, *Bibliography*, and other standard items out of the way first, so you aren't unnecessarily stuck at the last minute with these details. Experiment with layout, type fonts, sizes, and colors early. Buy your posterboard, pushpins, etc., early. Pre-cut posterboard pieces. Make any graphics that you know in advance are destined for your poster early. Buy a can of spray mount (artist's adhesive) so you can dry mount all the poster segments. The best kind to get is the type that allows you to reposition the artwork without damaging it.

DON'T stand directly in front of your poster at the session or get too close to it. Don't become so engrossed in conversation with any single individual that you (or they) accidentally prevent others from viewing your poster.

DO try to stay close by, but off to the side just a bit, so that passersby can see things and so that you don't block the vision of people already gathered 'round.

DON'T be an eager beaver and badger the nice people who come to read your poster.

DO give them some space. Allow them to drink it all in. If they engage you with a question, that is your opening to offer to take them through the poster or discuss matters of mutual scientific interest. Conversely, don't ignore people who look interested: you can have a beer with your buddies later.



DON'T pull a disappearing act.

DO stick around. It's your poster, your work! Be there for the full scheduled presentation time. This is especially important at the ASCB Annual Meeting where there's so much going on that interested viewers may be ducking out of other things just to catch the end of your poster presentation.

Don't ignore people who look interested: you can have a beer with your buddies later.

DON'T forget ancillary materials.

DO come prepared to your poster, armed with reprints of any of your own relevant papers that you might have, plus extra copies of any material you may wish to share. Have ready some business cards if you have them,

or prepare in advance slips of paper with your coordinates. Bring a pad of paper with a hard back for writing and some pens. Posters are a terrific way to get scientific suggestions and meet like-minded individuals! Don't forget to bring plenty of push-pins.

DON'T hesitate to provide supporting materials, if these can help. But don't overdo it.

DO consider using some kind of attention-getting gimmick, but beware that it doesn't backfire! A video set-up can be ordered through the ASCB, or you can supply your own laptop computer. Some interesting posters provide physical models or various kinds of three-dimensional display. Still others display actual data traces, or computer-based simulations, or something else that makes them stand out from the crowd. But if you do this, be sure your "hook" is legitimate and that it doesn't detract from the science, or trivialize it. ■

You Don't Have to Shout to Be Heard



W. Sue Shafer
University of California,
San Francisco

Richard L. Shafer
Retired, The National
Institutes of Health

How can I get my point across? Everyone confronts this question. Women particularly may worry about being heard. They wonder if they can exert authority or get things accomplished without using macho behavior.

“Christiana” suggests a neat new idea to the product development group, only to have it ignored. Later on, when “Frank” suggests it, he gets credit and compliments for it.

Do things like this really happen? Observe and analyze behaviors in meetings you attend, and you’ll agree that it happens too often.

Going to Meetings

Many of us attend one or more recurring meetings, such as a lab meeting, a product development meeting, or a policy meeting. Next time, try to map out the interactions you see, and measure the meeting’s effectiveness:

- Is the leader in control of the meeting? Do you like the way the meeting is run?
- How many participants speak up? Are there a few dominant personalities who hog all the air time?
- Do people interrupt each other? Do men interrupt more than women do? Women more than men?
- Does everyone get to contribute? Are ideas freely shared and acknowledged?

If you like the way the meeting is working, try to think about why. Who is making it happen and what is she or he doing? Who is effective and why?

If you don’t like the dynamics of the meeting, try to pinpoint the causes. What would you do to change them? How would you do it?

One-time meetings pose another opportunity to analyze and understand the meeting culture around you. As you develop your skills of observation and analysis, you’ll adjust your style more quickly to these one-time events.



These two golden rules will make the meetings you attend more constructive for you: Be courteous and Be substantive.

Making Meetings Better

Two golden rules will make the meetings you attend more constructive for you: *Be courteous* and *Be substantive*.

Be courteous

- Make sure you know the name of everyone attending. Ask for a round of introductions if people don't know each other.
- Use others' names when speaking to them or referring to their statements.
- Be brief. Speak only to add something new. Don't speak only to be heard.

Listen to the person speaking. Don't be planning your next statement while someone else is talking.

- Listen to the person speaking. Don't be planning your next statement while someone else is talking.
- Look at the speaker.
- Speak in friendly terms to others. Never yell at other participants. If someone yells at you, try to reply quietly, in a friendly voice, perhaps with a bit of humor.

After a well-run meeting, compliment its leader. Reinforce what you liked about it.

Be Substantive

- Speak only when you have something to say.
- Acknowledge the ideas of others, even if you want to build on them instead of use them as-is.

Acknowledge the ideas of others, even if you want to build on them instead of use them as-is.

- If you disagree with an idea, acknowledge it and the person who offered it, while stating your differences.
- Ask for clarification if you do not understand what someone is suggesting. Be firm in your dealings with those who try to run over you.
- If someone "steals" your idea, reclaim it. "That's just what I was trying to say earlier...you've made it much clearer."

If you model these behaviors for others, you might raise the entire meeting's effectiveness.

Leading Better Meetings

If you regularly lead meetings, analyze how your meeting looks to the participants. Ask the same questions as participants might, but answer them from your leader's perspective.

The same golden rules apply to those who lead meetings: *Be courteous* and *Be substantive*.

Be courteous

- Prepare in advance by sending out an agenda. If appropriate, send out a roster of attendees, including their first and last names, titles and organizational affiliations.
- Start and end on time. Keep your meetings to a reasonable and previously agreed upon length. Schedule the time to fit the tasks to be accomplished.

-
- Be sure all participants know each others' names, and if appropriate, areas of expertise. If they don't, introduce them to one another. Use their names as you speak to them.
 - Look at and listen to speakers. Ask for clarification when needed.
 - Assure that all have a chance to speak, and assure that no one speaks just to be heard. Be sensitive to women and men whose ideas might get lost.

Be sensitive to women and men whose ideas might get lost.

Be Substantive

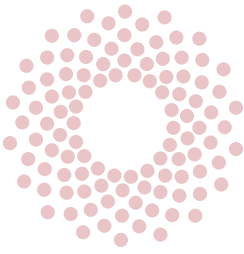
- Clarify your own objective(s) before your meeting. Begin the meeting by stating the objective(s) as clearly as you can manage. Highlight and acknowledge any murky areas.
- Describe the ground rules for how you'll use the meeting to accomplish its objective. Describe your plans for keeping the meeting on task.
- Don't try to accomplish in big meetings things that should be handled privately. For example, telling another scientist that she/he doesn't fit in the project you are planning is best done in private, even if it first becomes clear to you in the course of your bigger meeting.

- Use subgroups to accomplish appropriate tasks, when subgroups can do so more efficiently.
- Encourage participants to speak briefly when adding new ideas or expanding on those already offered.
- Encourage participants who disagree with one another's ideas to debate the ideas, without attacking one another personally.
- End your meetings with a summary of what has been accomplished and a list of action items with due dates.
- Thank the participants for their help and contributions.

The Real World

People who are knowledgeable in some area make it easier for others to respect them, especially if they convey the knowledge in a friendly fashion.... A man will display at least a small amount of deference to his female conversational partner—by looking at her when she is speaking—if she knows more about the topic under discussion than he does.¹

Depending on the environment, it can be hard or easy to be heard and to be effective. Your self-confidence, firmness, consideration for others, and clear sense of purpose will make it easier. Your success and effectiveness in being heard will build one more step toward a world where women contribute their talents without hindrance. ■



ENDNOTES

1. THE LAB COMMUNITY

Confronting the Social Context of Science

¹C. Perrow. *Normal Accidents: Living With High-Risk Technologies* (Basic Books, New York, 1984).

²D. Vaughan. *The Challenger Launch Decision: Risky Technology, Culture and Deviance at NASA* (University of Chicago Press, Chicago, 1996).

³E. A. Cohen and J. Gooch. *Military Misfortunes: The Anatomy of Failure in War* (Vintage, New York, 1991).

Two Cultures and the Revolution in Biotechnology

¹C. P. Snow. *The Two Cultures*. (Cambridge University Press, New York, 1959).

3. SCIENTIFIC CITIZENSHIP

The Misconduct of Others: Prevention Techniques for Researchers

This article is modified from one published by the author in the American Psychological Society's *Observer*. Reproduced with permission.

¹*Code of Federal Regulations*. 42 C.F.R. Part 50 subpart A, section 102.

²<http://ori.hhs.gov>.

Making a Difference: The Three R's of Public Science Policy

¹<http://www.jscpp.org>.

Great Expectations or Realistic Expectations?

¹<http://www.ascb.org/publicpolicy/nasareport.html>.

²<http://www.aaas.org/spp/rd/proj05u.htm>.

4. WRITING AND PUBLISHING

Me Write Pretty One Day: How to Write a Good Scientific Paper

Some of the content of this article is based on an earlier guide by R. Ward and K. LaMarco.

5. POSTDOC ISSUES

To Eurodoc or Not Eurodoc

¹For general tips, see <http://pingu.salk.edu/%7Eeforsburg/bio.html>.

²Funding sources include the NIH, Damon Runyon-Walter Winchell Cancer Research Fund, Human Frontiers, National Science Foundation, American Cancer Society, and the French Muscular Dystrophy Association (AFM). Grantsnet (<http://www.grantsnet.org/>) provides information about fellowships without international restrictions. Speak with your sponsor about institutional, national or European fellowships for which you are eligible.

³Janet Chenevert (Ville Franche).

⁴Christine Blaumueller (European Molecular Biology Laboratory).

⁵Kelly McNagy (University of British Columbia).

⁶Karla Neugebauer (Max Planck Institute).

⁷Laura Machesky (University of Birmingham).

⁸Judy White (University of Virginia).

6. CAREER TRANSITION

Salary Negotiation

¹Abbott, Langer and Associates publishes *Compensation in the Life Sciences* that tabulates salaries for life scientists in all sectors as a function of rank, type of work, type of organization, and geographical location. Radford Surveys publishes a similar report for the biotechnology sector. The American Association of University Professors (AAUP) publishes an *Annual Report on the Economic Status of the Profession*. Similarly, the American Association of Medical Colleges tracks salaries for basic scientists at U.S. medical schools.

What Else Can I Do?: Exploring Opportunities in Business and Management

Author served as Director of MBA Admissions at the Graduate School of Business at Stanford University from 1981 to 1985.

¹www.amanet.org.

Late Career Opportunities and Challenges

¹For an audiotape of a 2001 American Society for Cell Biology Annual Meeting panel on Late Career Options, see <http://ascb.org/audio/audio01mtg.html>.

²For an analysis of the policies found in many American universities, see <http://www.aaup.org/Issues/retirement/retrpt.htm>.

³J. Handelsman et al., *Science* 304: 521-522 (2004).

⁴See, for example, <http://umperg.physics.umass.edu/library/UMPERG-2001-12>.

⁵See, for example, <http://www.nas.edu/rise/>.

⁶<http://www.tiaa-cref.org/>.

⁷<http://www.iie.org/>.

⁸<http://www.peacecorps.gov/>.

⁹<http://www.crossculturalsolutions.org/> or <http://www.learn.org/>.



7. GRANTS

Study Section Service: An Introduction

¹<http://www.csr.nih.gov/>.

Responding to the NIH Summary Statement

¹ As soon as possible after the receipt date, usually within 6 weeks, the PHS will send the Principal Investigator/Program Director and the applicant organization the application's assignment number; the name, address, and telephone number of the Scientific Review Administrator of the Scientific Review Group (SRG) to which the application has been assigned; and the assigned Institute contact and phone number. If this information is not received within that time, contact the Division of Receipt and Referral, Center for Scientific Review (CSR), National Institutes of Health, Bethesda, MD 20892-7720 (301-435-0715). If there is a change in the assignment, another notification will be sent.

² Most applications submitted to the Public Health System, which includes NIH, are reviewed through a two-tier system. The first level of review is performed by the Scientific Review Group (SRG), which is often called the study section or review committee and is managed by the Scientific Review Administrator (SRA). The purpose of the SRG is to evaluate the scientific and technical merit of applications. The SRG does not make funding decisions. The second level of review usually is performed by the Advisory Council or Board of the potential awarding component (Institute, Center, or other unit). Council or Board recommendations are based not only on considerations of scientific merit, as judged by the SRGs, but also on the relevance of the proposed study to an Institute's programs and priorities. Program Officers, on the other hand, are NIH officials in the various Institutes and Centers responsible for presenting applications to the Advisory Council or Board.

³ The review of most research applications includes a process called streamlining, in which only those applications deemed to be amongst the top half of those being reviewed are discussed and assigned a priority score. The remainder are generally not discussed and not scored. Each scored application is assigned a single, global score that reflects the overall impact that the project could have on the field based on consideration of the five review criteria (significance, approach, innovation, investigator, and environment), with the emphasis on each criterion varying from one application to another, depending on the nature of the application and its relative strengths. The best possible priority score is 100 and the worst is 500. Individual reviewers mark scores to two significant figures (e.g., 2.2), and the individual scores are averaged and then multiplied by 100 to yield a single overall score for each scored application (e.g., 220).

⁴<http://www.csr.nih.gov/review/policy.htm>.

9. EFFECTIVE PRESENTATION

Do's and Don't's of Poster Presentation

Based on an article by the author that appeared in *Biophysical Journal* 71: 3527–3529 (1996). Reprinted with permission.

You Don't Have to Shout to Be Heard

¹ Virginia Valian. *Why So Slow? The Advancement of Women*. (MIT Press, Cambridge, MA, 1999).



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