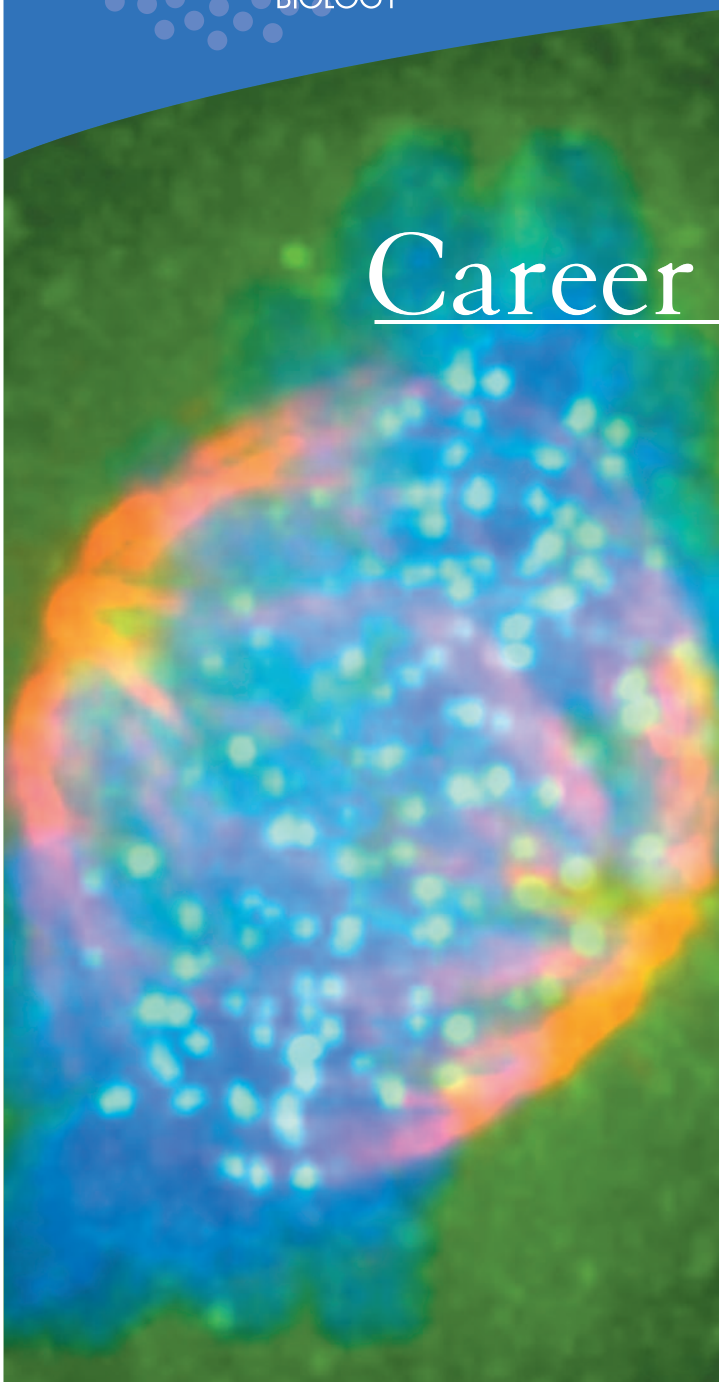
THE AMERICAN SOCIETY FOR CELL BIOLOGY



Career Advice for Life Scientists II

Women in Cell Biology

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Introduction to Career Advice for Life Scientists II

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Executive Director, The American Society for Cell Biology

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 chairwomanship 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 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 information 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.

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.

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.

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.

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 contexts[3] 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

Lynne Richardson
Mt. Sinai School of Medicine

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 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.

To collaborate, we must understand the reasons behind the positions, not just the positions themselves.

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

We have a tendency to default to whichever strategy reflects our emotions or personality.

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 noncompetitive 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 outmatched 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

Harvey F. Lodish
Whitehead Institute for Biomedical Research

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

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. The intellectual property restrictions on a well-written contract generate no restrictions and only minimal delays in publishing the results.

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 consequently 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

Liz Gavis
Princeton University

Fred Hughson
Princeton University

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 multitasking, 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.

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.

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.

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.

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 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.

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

When children start to 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
Stanford University

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 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.

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

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 different 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

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

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 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.

Get the most from each experiment by keeping pristine records.

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, particularly 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.

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. 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.

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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

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 backup 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 midstream. 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 Integrity[2] 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 breeches 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 breeches 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

Biomedical 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 misunderstanding. 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?

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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 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 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.

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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 sharpens 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 experience. 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!

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.

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,[1] 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]

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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

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.

Non-experts 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.

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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 published? 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 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.

Nothing annoys reviewers more than a sloppy manuscript.

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 expertise 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 grouchiness, 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 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.

A short list of expert board members and referees is an essential part of a good introductory letter.

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 excessive delays in returning critiques, vague and judgmental decisions, impossible and excessively detailed demands, and even the occasional breach of confidentiality where the

Some of the most competitive journals have the unfortunate habit of consulting far too many referees.

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 intelligence 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.

It is wise to avoid questioning the integrity or intelligence of someone whose judgment you wish to challenge.

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, CorelDraw, 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. Beware 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 reproduction 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?

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 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.

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.

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 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 penchants 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 galleys.

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 post graduate 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, tackling 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 increasingly 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.

Read any leading journal and one will find first authors—and increasingly senior authors—whose names are hard to pronounce for native English speakers.

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

Elizabeth Marincola
The American Society for Cell Biology

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 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

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.

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 interest 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
Medical Center

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.

In negotiations as well as interviews, knowledge is strength. The well-prepared applicant will have gathered information in advance of the negotiation.

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.

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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.

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.

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.

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 goodwill and personal integrity should not be sacrificed for what may be a modest short-term gain.

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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 taking 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.

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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 placement 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 Association[1] 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 significant 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 a 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 Corps[8] and several non-government organizations[9] 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 flexibility is the chance to explore: activities, fields, and ideas for which there has previously been no time. Retired people often talk about their opportunities for travel, reading, attending lectures, music, and sociability. For someone who has led an intensely focused life in science, such "opportunity" may sound foreign, even terrifying. This is why a gradual transition may be important for capitalizing on the opportunities of late career development. As one ages, life will change, of this there is no question. With luck, the changes will not be crippling ill health but instead the chance to explore and enjoy things one cares about and finds worthwhile. Emerging from a total focus on a specific field of science can include elements of metamorphosis and ecdysis that will allow the spreading of new-found wings.

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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 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.

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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 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.

The importance of the job requires reviewers to read every word and to try to understand every thought.

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 experience is that study section members' proposals get better and easier to write as a result of their service.

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 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 score[3]; 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 homepage[4] 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 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. ■

An outstanding presentation probably can't rescue a mediocre project but a mediocre presentation can kill an outstanding project.

8. ACADEMIC CAREERS

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 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.

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.

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 personnel 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 satisfaction 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 position." Analyze the history of the department's achieving that. Be ready to be your own advocate and to initiate interactions 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. ■

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.

9. EFFECTIVE PRESENTATION

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 anywhere. 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 I = upper case 'I'). 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 Xx 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 sections 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.

Display all your graphs, pictures, photos, illustrations, etc. in context. Write clear, short legends for every figure.

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 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.

Sidebars help to communicate the message.

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. Precut 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.

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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

[1] C. Perrow. *Normal Accidents: Living With High-Risk Technologies* (Basic Books, New York, 1984).

[2] D. Vaughan. *The Challenger Launch Decision: Risky Technology, Culture and Deviance at NASA* (University of Chicago Press, Chicago, 1996).

[3] E. A. Cohen and J. Gooch. *Military Misfortunes: The Anatomy of Failure in War* (Vintage, New York, 1991).

Two Cultures and the Revolution in Biotechnology

[1] C. 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

[1] For general tips, see http://pingu.salk.edu/%7Eforsburg/bio.html.

[2] Funding 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.

[3] Janet Chenevert (Ville Franche).

[4] Christine Blaumueller (European Molecular Biology Laboratory).

[5] Kelly McNagy (University of British Columbia).

[6] Karla Neugebauer (Max Planck Institute).

[7] Laura Machesky (University of Birmingham).

[8] Judy White (University of Virginia).

6. CAREER TRANSITION

Salary Negotiation

[1] Abbott, 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.

[1] www.amanet.org.

Late Career Opportunities and Challenges

[1] For an audiotape of a 2001 American Society for Cell Biology Annual Meeting panel on Late Career Options, see http://ascb.org/audio/audio01mtg.html.

[2] For an analysis of the policies found in many American universities, see http://www.aaup.org/Issues/retirement/retrpt.htm.

[3] J. Handelsman et al., *Science* 304: 521-522 (2004).

[4] See, for example, http://umperg.physics.umass.edu/library/UMPERG-2001-12.

[5] See, 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.iearn.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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