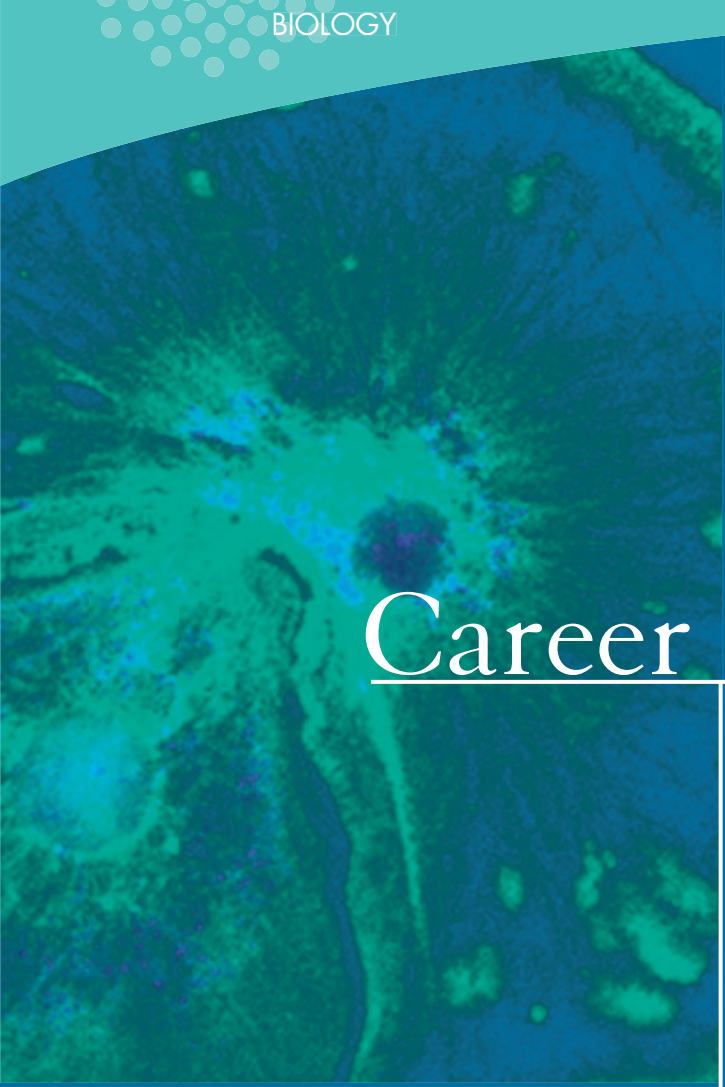
THE AMERICAN SOCIETY FOR CELL BIOLOGY



Career Advice for Life Scientists

Women in Cell Biology

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Introduction to Career Advice for Life Scientists

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The American Society for Cell Biology
1998-2003

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The American Society for Cell Biology
1994-1997

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

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

In the subsequent thirty years, women in cell biology and The Women in Cell Biology have achieved sufficient progress as to make early concerns seem almost quaint. But the challenges faced by women in science today are, while more subtle, still real, and still attracting the commitment of dedicated cell biologists. We are proud of contributing to that history.

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

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

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

At risk of inadvertently excluding deserving colleagues, we can't let the presses roll without acknowledging the many people who together have conspired to make the American Society for Cell Biology Women in Cell Biology Committee and its column widely imitated and praised. Virginia Walbot, Mary Clutter and Mary Lake Polan were that small critical mass from Yale that lighted the spark in 1971; Susan Goldhor and Elizabeth Harris were early editors of the "Women in Cell Biology Newsletter," whose job included gathering $1 and $5 contributions from colleagues to keep it going; chairs before the WICB became an official ASCB Committee were Ellen Dirksen, Nina Allen, Kathryn Vogel, Patricia Calarco, Mina Bissell, Jane Peterson, Susan Gerbi, Mary Lou King and Ursula Goodenough (33% of whom—Gerbi, Goodenough and Bissell—were later elected President of the ASCB); Dorothy Skinner, who served as the conscience of the ASCB Council in the early years; Laura Williams and Maureen Brandon, dedicated editors of the *ASCB Newsletter* WICB column (Laura did much of the research that contributed to this history); Emma Shelton, Dorothea Wilson and Elizabeth Marincola, ASCB Executive Directors who helped nurture women's activities through the Society, and Rosemary Simpson and Trina Armstrong, ASCB executive staff whose passion for the goals of the women in cell biology has been critical in turning ideas into action. Finally, but not least, we thank Joyce Rudick and Vivian Pinn from the NIH Office of Research on Women's Health for the ORWH's sponsorship of this publication. ■

1. THE HEAD GAME

The Impostor Phenomenon

Saying "No"

Unwritten Rules for Advancing Your Career

The Impostor Phenomenon

Sue Wick
University of Minnesota

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

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

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

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

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

Numerous doctoral theses and research papers have examined the type of person who tends to fall prey to the Impostor Phenomenon, and several psychological testing instruments have been devised to measure the degree of manifestation. While originally suspected as a problem primarily afflicting women, subsequent studies have made it clear that similar numbers of men also experience impostor feelings. In some professions, men experience more severe cases of Impostor Syndrome. For example, within a group of faculty members, men scored higher for the Impostor Phenomenon than women did, whereas groups of college students showed the opposite results. People in non-professional occupations likewise are susceptible to the impostor phenomenon.

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

Some characteristics and tendencies are generally correlated with people who feel like impostors. Such people may have feelings of depression, anxiety, fear of failure and of being discovered as a fraud; a propensity to feel shame, low self-esteem, and introversion as determined by the Myers-Briggs Personality Type Indicator. (Introversion, as defined by Myers-Briggs testing, is a characteristic of many scientists.) Those who feel like impostors often believe that many decisions affecting them are made by other people (and they may be right—Ph.D. qualifying exam committees or tenure and promotion committees, perhaps?) Those who experience the Impostor Phenomenon are likely to see intelligence as a fixed entity and not a malleable quality. They are very achievement-oriented. They are motivated in academic settings by the need to look smart; when faced with learning difficulties, they become anxious, shameful, and concerned about looking bad compared to others.

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

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

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

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

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

The good news is that the self-deprecating and debilitating feelings associated with the impostor phenomenon appear to decrease as a person remains in a particular position or attains a higher rank—that is, unless the person perceives job uncertainty, ambiguous job expectations, or a high degree of challenge in their position and does not have a high tolerance for these situations. Studies report that, at least for some people, having a mentor is helpful for overcoming the sense of fraudulence. (Presumably, having a mentor who understands the impostor phenomenon would be optimal.) Clance and her co-workers suggest that the most positive results are obtained through regular meetings with a group of people who can give honest feedback about their perceptions of your abilities. Such groups can be very good at pointing out when your self-perception about talents and achievements is distorted, i.e., out of line with what they observe. Thus, they can help you learn to acknowledge your competence. Making the effort to find an effective mentor and assemble a support group for yourself may be the key not only to survival but also to improving your self esteem during your grad school experience, job probationary period, or even the middle or advanced stages of your career.

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

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

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

- document both positive feedback and your doubts about its authenticity. This exercise "will demonstrate how you discount the opinions of other people," says Clance;

- examine the messages that you may have received about yourself from your family and others. Understanding where your negative self-image comes from can empower you to break free, and

- imagine telling your peers and superiors how you have fooled them. Realize how ridiculous you would sound. ■

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Saying "No"

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

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

When to Say "Yes"

The road to Hell is paved with good intentions. Saying "Yes" always has a cost, even when there is a benefit. Develop a clear concept of your reasons for saying "Yes" or "No" to requests. First ask, "do I have the time?" There are time-consuming activities that need to be done for career advancement, personal interest, or other positive motives. Set career objectives and priorities, realizing the inherent obligations. However, recognize that there is a fine line between entitlement and helping out. Try to avoid being exploited.

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

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

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

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

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

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

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

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

Interest. Define your specific interests when setting priorities. If you are passionate about encouraging girls to get interested in science, mentoring graduate students, or interacting with politicians, then say "Yes" to activities that have these goals, even at the expense of other requests.

Why to Say "Yes"

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

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

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

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

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

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

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

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

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

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

Picking up the slack. Do others take advantage of your inability to say "No" to dump unpopular tasks on you, such as clearing out 50-year-old department files, or teaching a third introductory course so that the department does not have to hire another lecturer? If no one else is willing to do these things, perhaps they are not worth doing.

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

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

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

When to Say "No"

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

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

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

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

How to Say "No"

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

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

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

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

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

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

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

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

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

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

It is OK to change a "Yes" answer to a "No" answer.

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

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Unwritten Rules for Advancing Your Career

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

Mentors are Key Sources of Information

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

Meeting Expectations

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

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

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

Promote Yourself

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

Territoriality

Never assume that ideas, space or equipment have common ownership. The microcentrifuge in the third floor cold room might belong to the senior research scientist on the fourth floor. The empty shelf in that same cold room may have been cleared by the chair's graduate students to store precious clinical samples arriving the next day. If a colleague shares unpublished data, ask permission before citing it in your manuscript. Always ask before acting: a reputation as a trusted colleague may depend on it.

Managing Employees and Students

Most scientists are not trained in management techniques, so learning skills to manage students and staff may feel like trial by fire. However, classes and books on general management skills that apply to any work situation are easily available. The most efficient way to learn management skills may be to observe and speak with scientific and business colleagues who appear to have admirable management styles. From these discussions, young scientists need to develop their own standards and expectations for their employees that are then stated and written clearly and reinforced frequently. Be aware that students and staff may not have the same career goals as their supervisors, so their expectations may need to be determined as well. These are essential skills for a scientist, since one's career advancement is often

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

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

directly proportional to the productivity of staff and students.

Conflict Resolution

Like management techniques, conflict resolution is an essential skill for which scientists are not trained specifically. Books or workshops on conflict resolution are available, but a few simple rules may be enough to defuse most situations. Use time, space and/or humor to place distance between dissenting individuals. Obtain another perspective of the problem by speaking to someone who is familiar with the individuals. If necessary, bring in a neutral party to help resolve the issue. Young scientists would be wise to choose their battles carefully to avoid being labeled contentious.

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

Use All Available Resources

Secretaries, administrative assistants and staff members of an organization are often vast storehouses of information. They can often help with questions about the general atmosphere of a department, appropriate dress or behavior, personalities of other organization members, and what senior people can "get away with" while junior people cannot. For questions that are too sensitive to broach with local colleagues, speaking to mentors at other institutions by phone or e-mail is an excellent solution. In addition, the internet may be a quick way to obtain information about management or conflict resolution skills, to name a couple.

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

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

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

2. TEACHING & LEARNING

The Scholarship of Teaching

Teaching Science in High School

Getting the Most from Your Graduate Experience

The Scholarship of Teaching

Christopher Dobson
Front Range Community College

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

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

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

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

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

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

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

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

Traits that characterize the mindset of a scholarly approach include inquiry, reflection and receptiveness. Inquisitive scholars continually question teaching methods with the purpose of improving student learning. They actively reflect on their teaching, openly inviting constructive criticism from peers. Scholars are receptive to new ideas and demonstrate a willingness to try new teaching techniques.

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

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

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

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

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

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

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

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

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

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

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Teaching Science in High School

William Wallace
Georgetown Day High School

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

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Why Would a Scientist Want to Teach?

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

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

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

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

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

What is it Like to Teach?

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

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

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

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

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

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

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

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

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

How to Get a Teaching Position

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

Public schools require a more complicated application process because they require teaching certification. Each state has its own qualifications for determining certification. Myra Thayer of the Fairfax County Public Schools states that the certification process examines competence in both science content (for example, an understanding of all the concepts of biology) and pedagogy (teaching skills). While scientists will have less difficulty in proving competence in science content (although a cell biologist will need to know a more diverse view of biology, such as population ecology and evolution), usually they will need to take classes in educational techniques. Completing the necessary classes takes approximately four semesters, and includes topics such as child psychology and instructional methods. Perhaps most important, classes will include a teaching internship with a master teacher in a local school. Many public school systems work closely with local colleges to offer an education program that is certifiable in that school district. For example, the Fairfax schools cooperate with George Mason University, which offers classes in the evening to interfere as little as possible with a candidate's day job. Eventually, a competence test (called a Praxis Examination) must be passed for certification.

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

How to Get Started

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

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

mentor a student through a research project in the laboratory. This mentorship should be an active intellectual involvement of the student in the research, not simply having the student "shadow" in the lab. The project should include a beginning (framing a biological question and hypothesis), a middle (performing the experiments to test the hypothesis), and an end (writing a report that summarizes the entire project). The student does not need to win the Nobel Prize with the project, nor even produce a publication, but it is cheating the student if a project does not contain these elements. Other ways that a scientist can get experience teaching at the high school level include helping a local school system with the biology curriculum, or teaching a course in contemporary methods in cellular or molecular biology for high school teachers.

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

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

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

Getting the Most from Your Graduate Experience

Leana Topper
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Chapel Hill

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

The Technical Challenge

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

Organization

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

preparations that need to be done a week in advance. Planning experiments on a daily basis will help to avoid frustration and indecision. Planning for the long term is more difficult and requires more flexibility, but can be as simple as listing which parts of a project should be accomplished in the next three months. Without clear planning, it is all too easy to lose direction and, as a result, a sense of self-worth.

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

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

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Getting Involved

Most graduate programs have some type of student organization. For departments without this type of council, students can speak to faculty and the department chair about forming one and funding it. Students with access to this resource should use it. The academic gatherings provided through this type of organization offer a forum to give presentations and an opportunity to ask questions in an atmosphere that is more relaxed than a typical department seminar or meeting presentation. Also, discussions among peers help hone critical thinking and scientific thinking skills. These groups may also sponsor social events—a great way to build friendships. The best support during graduate school will most likely come from peers. Moreover, classmates can be valuable allies in the future.

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

Mentoring

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

Instructing others on techniques can expand the instructor's knowledge, while discussing thesis projects with others may rekindle excitement for one's own work.

Networking

Meetings and conferences are significant opportunities to broaden graduate students' knowledge within and beyond their field of interest. Attend a meeting or conference each year not just to look at posters and listen to presentations, but also to step forward and ask questions about the research presented. Don't pass up the timely chance to meet new people, discuss projects, and find answers to common technical problems. It is also an occasion to meet future post-doctoral advisors and potential employers.

Individual Initiative

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

3. COMMUNICATION

Communicating Effectively in Departmental Meetings

"And Our Next Speaker Is..."

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

Communicating Effectively in Departmental Meetings

Maureen Brandon
Idaho State University

Virginia Allen
Idaho State University

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

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

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

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

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

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

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

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

Another reason that individuals do not participate in group discussions is lack of self-confidence or intimidation by the group. These individuals may find it easier to assert themselves if they accept that their position within the group was earned through their abilities.

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

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

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

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

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

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

"And Our Next Speaker Is..."

Elizabeth J. Taparowsky
Purdue University

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

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

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

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

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

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

Select the Content of Your Presentation Carefully

Make an outline of your talk. The first outline you prepare is likely to contain more information than can be accommodated comfortably in the time allowed. Prune your data to include the best evidence to support your conclusions. Unless absolutely necessary, do not present experiments or procedures with which you are not thoroughly familiar or data from new experiments that may be preliminary. Likewise, do not use slides that contain extraneous information. Take advantage of the technology available to make slides customized for your talk. Presenting clear, informative slides will benefit your audience, and it will make preparing and giving your talk much easier. On your slides, label data

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

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

Prepare a Scripted Beginning and Ending to Your Presentation

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

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

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

Practice, Practice, Practice

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

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

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

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

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

Implement Self-Calming Strategies Directly Before You Talk

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

works best for you. Make your trip to the restroom well in advance of your scheduled talk. Available to you on the podium should be a glass of water—without ice, because ice makes it harder to drink, the noise it makes may be picked up by the microphone, and ice can numb your mouth. A brief walk in the minutes prior to your introduction is very helpful, but often is not possible. As an alternative, while you are seated in the audience, engage in deep, controlled breathing. Close your eyes and visualize yourself giving a great talk. Think about how wonderful you will feel once your presentation is over. It is important that you think positively in those preceding minutes so that your nervous tension will work to your advantage during the opening segment of your presentation.

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

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

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

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

John Fleischman
The American Society for Cell Biology

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

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

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

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

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

In this view, it's all tax money down the lab sink or a plot by money-hungry biotechs to sow Frankenfood or experiment on defenseless worms.

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

The more complex, the more powerful, and the more unexpected cell biology becomes, the more dangerous it is to keep it in the garden like a unicorn on a rope.

Unfortunately, much of what scientists believe about general journalistic coverage of science is true. It's inadequate, sensational and simplistic. Scientists are misquoted, their points distorted, and their work is presented out of context. Conversely, much of what science journalists believe about researchers is untrue: that most scientists are control freaks, personally possessive of what should be public knowledge, and so caught up in specifics that they can offer no context to outsiders.

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

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

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

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

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

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

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

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

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

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

Talking on science policy issues requires support. Consult websites such as the ASCB's that has the Society's statements and backgrounds on such issues as stem cells, fetal tissue and genetically modified foods.

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

4. MANAGEMENT

A Crash Course in Management

Designing Productive Lab Meetings

Some Tips on Successful Negotiation

A Crash Course in Management

Elizabeth Marincola
The American Society for Cell Biology

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

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

Don't Act, Ask

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

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

Sincerity and Equity are More Effective than Flattery and Favoritism

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

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

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

Be Specific in Your Criticism

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

Don't Apologize

Perhaps having internalized the traditional subordinate mother's role of an earlier generation, women in particular often have a hard time asking people to do something for them, even if it is the person's job, such as with a secretary or assistant. "Please" should be used abundantly, but "sorry" should be used sparingly. For example, "would you please copy this paper for me?" is more appropriate than, "I'm sorry, would you mind copying this paper for me?" if it is indeed the person's job to perform such tasks. "Can you do me a favor and...?" is another form that should be avoided (unless it is a favor, e.g. something personal). Many women are so used to being apologetic about managing other people that they are not even conscious of this terminology, which weakens them.

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

Drive Your Own Priorities

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

Let Others Look Good

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

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

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

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

It's the Money, Stupid!

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

Penny Wisdom is Pound Foolishness

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

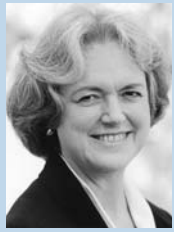
Negotiate for the Long Term

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

Set an Example

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

Designing Productive Lab Meetings



Beth Burnside
University of California Berkeley

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

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

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

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

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

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

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

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

The details of lab meeting organization are variable among labs, although several concepts recur. Food is crucial. Blood sugar and creativity must surely be associated. Attendance at lab meetings by all lab members is usually mandatory (possibly also correlated to food). The time period reserved for lab meetings is generally one to two hours, but some presentations stimulate large group discussions which cause time limits to be ignored. Most lab meetings occur in conference rooms, but some groups meet in the lab. The lab setting allows the speaker to quickly retrieve additional data, demonstrate a unique piece of equipment or experimental arrangement, or view a computer image.

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

Food is crucial.

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

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

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

These are reviewed by the principal investigator, revised in response to the criticisms, then collected into a laboratory notebook. These lab presentation notebooks or progress reports are important historical documents for the laboratory as well as helpful starting points for papers or theses.

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

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

Some Tips on Successful Negotiation

Elizabeth Marincola
The American Society for Cell Biology

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

Recognize When to Negotiate

Take control of framing the negotiation. For example, if an employee receives a competitive job offer, determine first if the threatened outcome would be advantageous or disadvantageous to the organization. If the change would be mutually beneficial, even if the threat is just a gambit to gain attention, do not rise to the bait. Tell the person that they will be missed. If, on the other hand, the threatened outcome is not beneficial to the organization, do not assume that there is no room for negotiation or reconsideration just because a statement is declarative.

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

Determine What the Other Person Wants

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

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

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

Add Value

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

Learn as Much as You Can

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

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

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

Re-state the Other Person's Position

Once a position has been described, re-state it calmly and impartially to the other person. This strategy confirms that the negotiating partner has been listening carefully and offers the opportunity to correct misunderstandings. In addition, neutral construction reduces the other person's defensiveness.

There Really is Such a Thing as a Win-Win Negotiation. There are Also Lose-Lose Negotiations

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

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

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

Concede Where Possible

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

Do not Personalize or Generalize

Avoid constructions such as "You always…", "You never…" or "You're so…". Do not make comments about the other per-

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

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

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

5. LEADERSHIP

Creative Mentoring Strategies

Crossing to the Other Side

Dealing with Unstable Colleagues

Creative Mentoring Strategies

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

Where was I when this was taught in school?

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

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

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

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

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

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

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

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

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

Academia can be rigid and it can be difficult to modify rules. Instead, one must "think outside the box" and seek advice from someone with more experience. The scientific community offers numerous opportunities for a well-trained scientist to excel, be creative, be

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

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

Reference

1. *Teaching Survival Skills and Ethics,* Beth A. Fischer and Michael J. Zigmond, University of Pittsburgh, www.edc.gsph.pitt.edu/survival. NIMH funded workshop, 2000.

Crossing to the Other Side

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

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

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

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

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

"Graduate Students Listen Too Carefully to Everything I Say."

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

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

The best way to deal with this is to learn to choose words carefully. We all remember how a few cutting words from our own graduate advisor could sting, and, likewise, how justified praise at the right moment could mean so much. Do not worry too much about the quirks. Students don't make fun of the faculty they despise; being lampooned is a real sign of affection.

"Graduate Students Don't Listen to Anything I Say."

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

"Nobody in the Lab Ever Tells Me When There are Problems."

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

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

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

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

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

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

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

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

Dealing with Unstable Colleagues

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

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

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

Handling Manipulative Behavior

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

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

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

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

Identifying Possible Mental Instability

Signs of mental instability can include inexplicable mood swings, irrational statements, extreme cycles of productivity, unexplained absences, depression, and violent or abusive behavior. These signs are an order of magnitude beyond normal acute disappointment expressed over an intractable experiment or a grant application that is not funded. The person may fail to follow laboratory standards for cooperation or safety. They may display an insensitive or overtly cruel attitude toward others or toward laboratory animals. They may initiate episodes of interpersonal friction in the laboratory and may alienate or frighten co-workers. Their statements may seem inconsistent, and they may react defensively when asked for clarification. Obsessive behavior toward other individuals, such as following someone home, can be another important symptom. In many cases, symptoms increase gradually over time until they reach an intolerable level. However, sometimes stressful workplace or personal events can trigger a crisis.

Signs of mental instability can include inexplicable mood swings, irrational statements, extreme cycles of productivity, unexplained absences, depression, and violent or abusive behavior.

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

Recognizing Violence

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

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

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

In all interactions, preserve the other person's dignity. Maintain confidentiality and be humane. If others must be informed about the situation, do so in private. The bottom line is that it may be necessary to ask an unstable individual to leave your laboratory. This may become more difficult with time, so it is important to be equitable and allow opportunities for resolution, but to move decisively if these efforts are unsuccessful. Ask for advice to make sure that you comply with relevant personnel policies. However, be aware of the responsibility carried by every supervisor to ensure a safe working environment that enhances everyone's ability to achieve their personal and scientific goals.

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

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

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

6. UNDERREPRESENTATION IN SCIENCE CAREERS

Affirmative Action for the Next Generation

Increasing Representation of People of Color in Science

Affirmative Action for the Next Generation

Donella Wilson
The American Cancer Society

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

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

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

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

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

In 2001, providing specialized opportunity to underserved/underrepresented populations is still acceptable legally, but may not be for long. In March 2001, a White-owned Colorado business complained that small business bonuses given to contractors who subcontract to minority businesses discriminate against non-minorities *(Adarand Constructors, Inc. v. Pena*). In the meantime, Georgia Power Company (April 2001) faces a potential class action discrimination lawsuit due to lack of fair promotion of African-Americans in their company. Company executives reported that they were unaware that the presence of hangman's nooses throughout company property was a racial slur against African-Americans.

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

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

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

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

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

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

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

Advocate Diversity

Diversity does not include just women, Blacks and Whites, but a wide variety of differences that we might not readily consider as sources of bias, such as sexual preference and age. It also includes the disabled, regional differences within the U.S., citizen vs. alien, dread-locs vs straight hair, males with one or two earrings, Gentile vs. Jew. Advocate diversity, not so much to right the wrongs of the past, but to ensure our nation's wordly competitiveness in science. Be serious minded in developing the next generation of talent and leadership pools for the future of our existence. The challenge is to acknowledge diversity as enriched, varied perspectives which increase the value of all, rather than as anti-"me" statements. Before the year 2050, over half of the U.S. population will be comprised of persons of color; minorities will become the majority. Shall we ignore this inevitability, try to beat it in court, or adequately prepare for it?

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

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

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

Recommend Choices that Can Help Individuals Grow Away from Biases

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

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

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

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

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

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

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

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Increasing Representation of People of Color in Science

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

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

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

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

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

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

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

One highly successful program aimed at elementary-aged minority children is the Mother–Daughter Program in El Paso, Texas. This program was established in 1986 by Josefina Villamil Tinajero, Professor of Bilingual Education and Acting Dean in the College of Education at the University of Texas at El Paso, who is also a child of a Texas barrio. Tinajero began the program in an attempt to reduce the high level of teen pregnancy, increase high school graduation rates, and increase college enrollment which had been essentially nonexistent, among children growing up in the poor neighborhoods of El Paso. In these families English is spoken poorly if at all, there is no family history of higher education, and both the children and their parents have low expectations of themselves.

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

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

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

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

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

In the first cohort of 33 girls, 32 graduated from high school, 10 as honor students, and all of the 32 enrolled in college. Three mothers in this cohort have graduated from the University of Texas at El Paso, and many others are pursuing their education. Over 2400 daughters and their mothers have participated in the program since its inception in 1986. Many of the former participants who are currently in college are acting as "big sisters" for new sixth graders entering the program. In addition, the rate of teen pregnancy in the program participants is far lower than for their classmates.

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

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

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

7. TENURE

The Tenure Process Viewed From the Top

Earning Tenure: Ten Recommendations

The Negative Tenure Decision

The Tenure Process Viewed From the Top

Martha D. Berliner
Retired

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

Department Composition

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

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Tenure History and Competition

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

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

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Government Influence

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

Influence from Outside the Department

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

Where Do You Want to Be?

Is the institution a place where you want to spend the rest of your personal and professional life? A person with tenure can become frozen at an institution and community because it then is very difficult to compete for new faculty positions at higher levels, unless you are willing to become an administrator or to change fields.

Joint Appointments

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

All Politics are Local

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

Support Staff

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

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

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

Collaboration

Graduate school and postdoctoral fellowships tend to see people as narrow specialists. Now is the time to explore new areas with a knowledgeable colleague who has an established lab, funding sources and graduate students in the pipeline. In return, generously share your experience and networks. Become a mentor, rather than needing a mentor yourself. One of the principal criteria for tenure is demonstration of intellectual growth and leadership.

Innovation

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

Although a tenure-track position is the objective for many academic scientists, tenure should not be your sole goal. In itself, it does not assure personal nor scientific success, fame nor fortune. ■

Earning Tenure: Ten Recommendations

Sara (Sally) Tobin
Stanford University

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

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

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

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

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

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

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

Create a Record of Productivity Long Before Tenure

Write grant applications before you move to the new institution so that they will be in review during the disruption of establishing the new laboratory. Design some "bread-and-butter" approaches that are sure to yield publishable results and will document your ability to complete scientific projects successfully. Do not abandon your scientific standards, but it will not hurt to carry out some lower risk projects also, perhaps with the help of undergraduate students. If all of your projects are high-risk, your chances of obtaining tenure are high-risk. Even if you are able to pull off a late-breaking scientific coup, you will still be vulnerable to the accusation of uneven performance that many consider a poor predictor of future productivity.

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

Gain the Support of Your Department Chair

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

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

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

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

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

Maintain Cordial Relationships Within Your Department

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

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

Recruit Mentors

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

Get to Know Others on Campus

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

Know the Procedures for Tenure at Your Institution

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

Ask for Supportive Letters

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

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

Assemble Complete Documentation

When you walk into your office as a brand-new faculty member, your first official act should be to grab a file folder, label it "Tenure," and put it in the file drawer of your desk (not that filing cabinet across the room). EVERY time you give a talk at the local high school, organize a meeting, serve on a committee or receive an award, make a note of the date and event and put it into the file. Otherwise, you will never remember the many contributions you have made when you are under pressure to assemble your tenure file five years later.

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

Don't be Afraid to Fight

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

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

The Negative Tenure Decision

Sally Amero
The National Institutes of Health

Maureen Brandon
Idaho State University

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

Collect Information

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

Do not overlook the value of informal support systems.

Consider Appeal

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

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

Set the Tone

The candidate denied tenure must function for a while in the system that terminated him or her, and it is best to actively pre-empt potential ill will. Establishing a cordial tone is critical, because this period becomes the springboard to the next, and gossip travels in the scientific community as in any other. Whether or not co-workers are listed as official contacts on job applications, assume they could be contacted. Formulate a noncommittal response to questions, and acknowledge concern and sympathy courteously. Be prepared for allegiances to shift: those who were once trusted may be aloof, while mere acquaintances may rush to "help". Quite possibly, the candidate's allies took a beating in his or her defense; on the other hand, misery loves company — it's easy to become fuel for someone else's fire.

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

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Ironically, the candidate denied tenure is faced with even greater pressure than before the tenure decision because she or he must find a job and also maintain ongoing faculty obligations. Distractions should be minimized: resign from committees, re-assign rotating students, reduce your lecture burden. If another shot at academia is the goal, then manuscript submissions and the grant proposal of a lifetime are essential. A senior lab member can be appointed as field commander; a remote location can be chosen for uninterrupted concentration, and telephone or e-mail messages can pile up temporarily.

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

The faculty member has a responsibility to ensure that damage to the careers of students, post-docs and staff is minimized.

Seek Positive Reinforcement

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

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

Look Before Leaping

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

Every academic department has a unique character, so it is advisable to carefully research a new academic position to avoid a similar tenure situation down the road. Before responding to an advertisement, check out the department's web site to get a sense of the faculty's interests and activities. Then, prepare an application that highlights your special strengths and matches the needs of that department. Once an interview has been arranged, formulate a set of questions to probe the environment of the department such as: what is its goal? What kind of infrastructure is available to support teaching and/or research activities? What is the tenure success rate of junior faculty? During your visit ask each faculty member these questions and look for similar answers.

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

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

Consider Other Options

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

8. PARENTHOOD & SCIENCE CAREERS

Juggling Career and Family

Optimizing the Family-Career Balance

Juggling Career and Family

Mary Ann Stepp
George Washington University

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

Having It All is a Fantasy; Having Enough Can be Reality

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

Be Prepared to Spend All Income

Managing family, a category which can include children, house, and aging parents, demands flexibility coupled with enough money to allow the purchase of good support for the family's needs. Good childcare is worth the cost and will allow parents to feel good about their time at work. When children are very young, especially if there is more than one child in the family, childcare costs can exceed one parent's income. Despite this, most scientists would never consider not working. Flexibility in childcare arrangements is important since different solutions to the need for quality childcare arise in response to the differing needs of the children as they grow. For example, over time, childcare arrangements may evolve from a

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

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

Do Not Micromanage the Family

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

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

Realize that laboratory expansion and publication rates will be less than those of colleagues without young children. The challenge while the children are young is to stay active and in the game. The research programs of many scientists often experience dramatic expansions after their children are grown.

Set Limits on Hours Spent on Teaching-Related Activities

In collaboration with a supervisor or chairperson, determine how much time teaching responsibilities should take and stick to that budget. Teaching is often the hardest activity to compartmentalize and juggle successfully. No matter how well prepared a lecture is, there is always another paper to read or a better way to organize and present the lecture material. Also, adult students are demanding, and they require and deserve mentoring. It is hard to close the door and focus on research when actively teaching a course or mentoring a student in the lab. But, just as parents have to learn to let their children grow up, teachers have to learn to let students solve some of their own problems and identify additional resource people.

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

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

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

Optimizing the Family-Career Balance

Elizabeth Marincola
The American Society for Cell Biology

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

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

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

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

make the importance of everything else fade in comparison.

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

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

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

All parents are anxious to maximize time with their children. Scientists may be more anxious than most, because time is particularly precious, and maybe because anxiety is in their nature. Here are some nuts-and-bolts suggestions from one mother's thirty child-years of experience:

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

- If just those and all those for whom you are directly responsible (typically children and spouse) are at home, don't answer the phone. That's why God invented voice mail. There's nothing that can't wait. An involved conversation easily derails an activity or conversation.

- Eat dinner together every possible night. This may mean late dinners and/or resuming work (preferably from home) after children are in bed. As my grandfather the Rabbi used to say, "there's no greater blessing than eight [or ten or six] feet under the table."

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

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

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

Eliminate music, telephone or other distractions when your children are in the car. The conversation it can inspire is amazing.

- Involve your children in your work in appropriate ways as they grow. The less of a black hole the office or lab, the less mystery and resentment it engenders. Talk about the day's excitement or problem in a way your children can understand. This allows them to get closer to you by sharing your real frustrations and satisfactions, and also helps cultivate their skills of listening, empathy and analysis. Ask their advice; it may be good.

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

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

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

9. EXPLORING VENUES FOR SCIENCE

Breaking Into Biotech

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

Breaking Into Biotech

Leslie Holsinger
Sugen Inc.

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

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

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

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

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

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

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

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

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

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

Conferences are an excellent place to make biotech contacts. Look for poster abstracts and presentations by scientists from particular companies.

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

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

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

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

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

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

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

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

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

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

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

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

Dianna Bourke
University of Charleston

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

Why Choose a Smaller Institution?

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

These faculty consider their teaching ability a strength and couldn't imagine not having daily student contact. They also feel that teaching is taken more seriously at smaller institutions and rewarded more appropriately. "I get jazzed from teaching," says Yolanda Cruz of Oberlin College. "When I was looking for a job, I applied to several different kinds of institutions. During an interview at the NIH I was assured that if I took the job, I would never have to teach again, as though this were a great perk. This

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

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

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

Research at a Smaller Institution

What about research at smaller schools? Faculty agree that research publishing requirements for tenure and promotion at their institutions are considerably more modest in numbers of papers than in the schools where they had trained. But all caution that quality of work was still an important issue in tenure review. After having witnessed the daily routine of their advisors and colleagues, most indicate that they had actively chosen a place where research occurred at a different pace. At the same time they accept that effective research in a small school environment can be a challenge. It is critical to keep in mind the main focus of your school to avoid frustration when, for example, students don't work as intensely as university graduate students or when the school refuses to buy equipment.

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

Support

An increasing number of small institutions are beginning to set aside realistic funds to support space, equipment and faculty-release time. While this transition is positive, it also ironically increases pressure to meet newly intensified research requirements for the most junior faculty members. Echoing concerns typical at research-intensive institutions, some indicate that this is resulting in unrealistic tenure expectations.

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

The level of support for such things as facilities, equipment and money for consumables varies widely from school to school. The more exclusive liberal arts colleges have more money. "It's the cash-strapped privates and the old teachers' colleges or branch campuses that have these sorts of [funding] issues," observes Deborah Cook of Clark Atlanta University in Atlanta, Georgia. Of the faculty polled, start-up funds were reported from high four-figure amounts to a comparatively generous $50,000. Continuing funds are often obtained by intramural competitive proposals for small amounts of $1,000 to as much as the low five figures. Clearly, very little in the way of equipment can be bought for such amounts while still allowing anything left over for experiments, so obtaining equipment is often left as a complicated dance with administration. My first Director of Academic Affairs was a historian, and the figures I quoted for laboratory equipment boggled his mind. "Faculty at smaller institutions are caught in a frustrating cycle when competing for external support: reviewers often respond to such requests by indicating that the item should be provided by one's institution. But the institution depends on faculty to get equipment by writing grants!", notes Cynthia Galloway of Texas A&M's Kingsville campus. Fortunately, more grants for smaller institutions are being offered both by the NIH and the NSF. An old standby for obtaining equipment is to write a grant for educational purposes and use it during non-class time for your research.

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

Personnel

If you like hands-on science, small colleges may be the perfect opportunity, because usually there is no one else around to do the work. Unless you manage to get a major grant with money for a technician, the most consistent workforce for the lab is undergraduate students. Some places may have master's degree programs, but the majority do not. "You need to pick [undergraduates] out early and grow them up," half-jokes Cruz. Of course it takes a lot of time to train and supervise undergraduates; often just when they become productive, they move on. Many institutions have student stipends to support research during the school year or over the summer. A consistent comment was that research must be divided into small, discrete, do-able units that the students can handle within the school calendar. Despite the difficulties, working with undergraduates can prove invigorating.

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

Isolation and Alienation

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

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

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

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

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

A problem that many scientists face is discipline isolation. In a four-person department, one colleague might be a marine biologist, one an environmental biologist, another an invertebrate physiologist and another a biomedically-oriented cell biologist. "You just have to make your own rules," notes Cruz. A mentor may not be as near as the next office, but as near as the Internet instead.

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

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

Finding a New Collegiality

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

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

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

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

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

10. WOMEN & SCIENCE CAREERS

Why Women Leave Science

Shaping the Future for Women in Science

Why Women Leave Science

Caroline M. Kane
University of California Berkeley

Consider the following statistics from the recent past[1]:

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

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

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

socialization of white males is well served, but the different expectations and requirements of women are often misunderstood, ignored or belittled. These include issues of self-confidence; for example, admitting difficulty in a subject may be interpreted as a weakness rather than an interest in sharing information in the process of learning. In one study[2], many undergraduate women did not think that they were doing as well or were as well qualified as others in the classes, even in cases where the grades received said just the opposite! Also, organized help for academic work may be viewed by some faculty as remedial rather than as an important means for students to more thoroughly integrate information. Many of the expectations and requirements may also be shared by men, although the culture of science and engineering has been more focused on a make-it-or-break-it, win-lose dichotomy. Learning as a competition instead of as an end in itself can often get in the way of success in the classroom, and having to fight against other students for a grade can be very discouraging when understanding is the overall goal.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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From experiences during education to experiences in the professions, women and men are confronted with positive and negative feedback regarding careers in the biological sciences. Earlier networking and mentoring advice to students and junior colleagues would serve to help women determine whether biological science is indeed the passion of their professional lives. The networking and mentoring that help in that decision making need to continue as the young professionals, and senior professionals, progress in their careers and encounter new issues unrelated to the passion for the discipline, but directly related to their ability to be successful in pursuing that discipline. From introductions at a national meeting to appointments onto powerful institutional committees, engaging women in the positive process of science as well as the pleasure of science may encourage more women to commit their energies to staying rather than leaving. ■

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Shaping the Future for Women in Science

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

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

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

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

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

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

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

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

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

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

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

We have to stop expecting that our male colleagues will change. The fact is, many of them are, understandably and appropriately, much more concerned about their own research than about the status of women. We need to face the reality of our colleagues' ambitions, recognize our own, and acknowledge that ours will not change theirs. Indeed, ambition and competition are mostly constructive contributors to good science. As Wallace Stegner puts it in his novel *Crossing to Safety*, "unconsidered, merely indulged, ambition becomes a vice; it can turn a man into a machine that knows nothing but how to run. Considered, it can be something else — pathway to the stars, maybe." We cannot expect that our male colleagues will become more collegial, less ambitious, or less competitive to meet our needs, and it is probably not desirable from the point of view of science.

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

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

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

Consider the phenomenon of menopause. What fundamental aspects of living things will be revealed when we understand this profound change? What will the implications be for understanding aging in general? Consider contraception. Adolescents in the United States become sexually active at about the same age and rate as teens in Canada and Sweden, but the U.S. leads the industrialized world in teen pregnancy. Clearly, more choices among effective contraceptives are desperately needed. Work in this area is likely to produce a substantial, fundamental understanding of the processes of ovulation, oocyte and sperm maturation, and fertilization. A successful effort might also yield innovative routes out of a political issue that is tearing our country apart: access to abortion. Our male colleagues have not insisted that contraception be on the active research agenda, but we should be strongly motivated to guarantee that it is.

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

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

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

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Congress to assure the promotion of a women's health agenda. The availability of grants in research of interest to women and the excellent science they can support will not only contribute to the ability of women to capture faculty positions, but they also will strengthen bargaining positions during recruitment negotiations. Carl Djerassi suggested in a letter to *Science* that extra help for child care should be considered comparable to the mortgage support that is used as a recruitment device in academic institutions. In families where one spouse's benefits provide for a family's health insurance, the other spouse could be offered childcare support as an employment benefit. There are many possibilities to think about. The important thing is to seize the opportunities that are being offered and to use them to define new scientific agendas that have the potential for major contributions to knowledge and alleviate societal problems. From this can come a vitality that cannot be ignored and that will place women at the center of the research enterprise. ■

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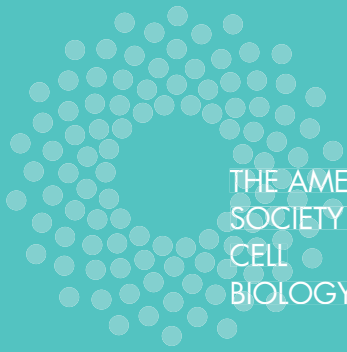

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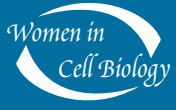

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