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# Promoting Responsible Conduct in Research through “Survival Skills” Workshops: Some Mentoring Is Best Done in a Crowd

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**Keywords:** graduate training, education, responsible conduct, research ethics, professional development.

**ABSTRACT:** *For graduate students to succeed as professionals, they must develop a set of general “survival skills”. These include writing research articles, making oral presentations, obtaining employment and funding, supervising, and teaching. Traditionally, graduate programs have offered little training in many of these skills. Our educational model provides individuals with formal instruction in each area, including their ethical dimensions. Infusion of research ethics throughout a professional skills curriculum helps to emphasize that responsible conduct is integral to succeeding as a researcher. It also leads to the consideration of ethical dimensions of professional life not covered in traditional ethics courses.*

## I. Background

### “Survival Skills”: The missing component of graduate education

If our trainees are to develop into successful researchers, they must acquire a variety of skills. Of course, it is essential that these individuals understand the broad fundamentals of their discipline, gain some depth in the details of a particular sub-area, and obtain practical experience in research, including experimental design, methodology, and data analysis. However, they also need to develop a set of general professional skills.<sup>1-3</sup> For example, they must be able to present their results at scientific meetings and prepare written reports. They may need to obtain grants to fund their research, hire and supervise technical staff, and teach classes and mentor

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individual students. Moreover, with the decrease in tenured positions in academia, trainees must learn how to find information on, and prepare themselves for, other types of careers.<sup>1,4</sup> Indeed, within this broader range of careers, extra-laboratory skills may become all the more essential.<sup>1,5,6</sup>

Because of their importance to an individual's success as a professional, we have termed this set of abilities "survival skills". We are concerned that, whereas most graduate programs provide excellent training with regard to the theoretical and practical details of a discipline, they often do little to provide their students with formal instruction in these and other survival skills. Not surprisingly, therefore, many professionals (and many employers!) complain that advanced training programs do not prepare graduates for the realities of the tasks to be performed in professional life.<sup>3</sup>

Because survival skills are typically not taught in graduate school,<sup>7,8</sup> individuals traditionally acquire them in one of three alternate ways: through trial and error, instruction from one's mentor, or courses run by faculty in the discipline from which the skill derives. However, each of these methods has its limitations.

***Trial and error*** does not require that faculty or institutions commit resources to providing survival skills training. Rather, it places the burden of developing these skills on the students themselves. Although trial and error can be a very effective teacher, it is quite stressful, and can involve a great deal of time, energy, and anxiety. For students already struggling with their graduate studies, such experiences may be detrimental, even lethal to their intended career. Moreover, many students may not even recognize the need to develop such abilities until they are faced with an imminent need for a given skill. Students who have not received adequate mentoring prior to graduate school are particularly at high risk in this regard, as are individuals without access to a mentor. A disproportionately large number of these individuals are women, members of minority groups, international students, and students who represent the first generation of their families to seek advanced higher education.<sup>7,9-11</sup>

***Individual mentoring*** can provide highly individualized training over a period of time.<sup>10,12</sup> However, there is no guarantee that the advisors themselves have a fully developed set of survival skills. For example, most faculty have little or no experience in issues such as careers outside of academia. Moreover, even if an advisor is proficient in all of the necessary skills, the realities of professional life make it unlikely that they have the time necessary to implement individualized training in all skills for each of their students. Indeed, many students report that although they have an advisor, they do not have a *mentor*.<sup>13</sup> As in the case of learning by "trial and error", the negative impact may be particularly strong on individuals outside of the majority.<sup>11,14,15</sup>

***Formal courses*** in specific survival skills may be provided through departments or schools that focus on a given skill-related discipline – a course in oral communication in a Department of Communications, technical writing in a Department of English, teaching in a School of Education, and so forth. However, despite the richness of such courses, this instruction may not be properly focused so as to be relevant to the specific needs of emerging

researchers in other disciplines. Moreover, adding several additional courses into an already lengthy graduate training program is generally not feasible. The time required to obtain a degree for doctoral recipients has been increasing steadily over the past three decades in many disciplines and has been criticized by many including the National Academy of Sciences<sup>1</sup> as already too long.

If one cannot count on trial and error, individual mentoring, or formal courses to provide these skills, what other options are available? We have developed an educational model that provides trainees with an introduction to specific survival skills through a series of day-long workshops. In this article we provide an overview of those workshops. However first, we need to discuss a topic that is implicit in all that we have said so far – responsible conduct.

### **Responsible conduct in research: A survival skill**

Our program, as described in the next sections, has gradually evolved over the 17 years since we began providing instruction in survival skills in 1984 (e.g., see <sup>3,16-19</sup>). It has gone from 6 hours per year to 64 hours; from the minor involvement of a single faculty member to a full-time faculty director, a full-time project director, 70 annual speakers and discussants, and a secretary; and from an annual budget of \$750 to one of almost \$75,000. But the most important change has been our incorporation of responsible conduct of research into our program as a core – indeed, a transcendent – survival skill.

The integration of ethics into our survival skills program was prompted largely by the 1989 NIH mandate to provide training in responsible conduct for all individuals supported on National Research Service Awards.<sup>20</sup> However, our approach to providing such training in ethics derived from the simple premise that ethics is not distinct from research; on the contrary, competency in research *encompasses* the responsible conduct of that research and the capacity for ethical reasoning. Indeed, we strongly believe that responsible conduct is best taught within the context of other relevant aspects of an overall research training program (e.g., see<sup>21</sup>). In this way, we feel we can best accomplish three essential objectives of training in responsible conduct: (1) to indicate to our trainees that responsible conduct is integral to doing good science, (2) to maximize the chance of ethics instruction having an impact on the individual rather than settling for the “check off” necessary for the institution, and (3) to prepare individuals for ethical concerns that will arise in the future but cannot yet be anticipated.

A useful comparison can be made between instructing students in the critical analysis of the research literature in their field and instructing them in responsible conduct of research. How do we teach critical reading? First, we introduce students to the primary literature as soon as they enter their training program, and then we gradually increase both the complexity of the readings and the depth of the analysis. Second, we integrate reading journal articles into all aspects of the curriculum – core courses, seminars, the design of research projects, and the preparation of research manuscripts. Third, the instruction in critical reading comes from practitioners, the very people who provide instruction in other aspects of research and who serve as the

primary role models. Finally, we continually test student competency. This occurs whenever a student is asked to provide support for their ideas and conclusions, and to relate their work to that of others: from their first seminar presentation to their final thesis defense.

Training in the responsible conduct of research should be no less integral to a graduate curriculum.<sup>13,21,22</sup> Thus, the model for providing instruction in ethics that we advocate consists of four components: discussions of relevant ethical issues within (1) “survival skill workshops” and (2) the core curriculum of a discipline; (3) providing training in ethical reasoning; and (4) assessing competency in ethical reasoning. In this article we focus primarily on the workshop component of this model, which might be referred to as “bulk mentoring”. At the end of the article, we briefly describe the other three components of our model, as well as a few additional ways in which one might promote responsible conduct.

### **Survival skills and social change**

Whereas we strongly advocate the establishment of programs such as the one we describe, we do not wish such programs to replace or reduce the efforts of individual mentors. And, at a broader level still, we do not wish to inhibit efforts to effect long-term improvements in the larger social system. Needless to say, faculty members should continue to improve their mentoring skills, and institutions should continue to recruit more under-represented minorities and women into their training programs and their permanent staffs.<sup>11,23,24</sup> On the other hand, we do not believe that it is responsible to wait for the system to correct itself. Instead, we must provide individuals with resources for succeeding in *today's* environment while at the same time we strive to create an improved environment for the future.<sup>25,26</sup> In fact, programs in survival skills and ethics can serve both purposes since such programs can help to educate members of the community at large so that they may better understand and address the forces that result in disparities in training and opportunities.<sup>11,27</sup> With this in mind, we advocate inclusion of specific topics within the overall training program that might otherwise be neglected, such as techniques for remaining connected to science during a period of leave, mechanisms for obtaining role models, the availability of financial support for particular groups (e.g., minorities) and purposes (e.g., reentry), coping with the special challenges faced by professionals who are dual-career couples and/or parents, as well as the unique stresses often experienced by under-represented minorities. We have tried to integrate such concerns into our workshops, as described below.

## **II. Our Workshops: An overview**

The educational program we have developed provides formal instruction in survival skills, including ethics. (We have come to realize that the name of our program, The Survival Skills *and* Ethics Program, may seem redundant since the latter is a component of the former, but we felt it was necessary in order to emphasize the ethics component of our efforts to individuals not yet familiar with our programs.) Although

our emphasis in this article is on graduate education, our program is also geared towards postdoctoral fellows and junior faculty. Moreover, in principle, the model should be applicable to any group, including high school students, undergraduates, professional students, staff, and individuals who work in the private sector.

The program is comprised of eight units covering many of the skills most critical to success as an emerging research professional: (1) being a successful trainee (graduate student or postdoctoral fellow), (2) writing and publishing research articles, (3) making oral presentations, (4) job hunting and career options, (5) grantspersonship, (6) teaching, (7) creativity and developing intellectual property, and (8) advancing as a professional. These workshops are described briefly in Appendix I.

Each of the eight workshops represents a self-contained unit, thus enabling individuals to select only the topics of interest to them in any given year. Thus, a first year student might wish to attend the workshop on being a successful trainee, and perhaps the session on oral presentations, but postpone learning about teaching or grantspersonship until somewhat later in his or her training.

We have two major goals for our program. Our short-term goal is to provide our trainees with an introduction to the major survival skills required by successful professionals in research and research-related professions, including the ethical dimensions of those skills. It is not our purpose to develop competency in these skills; such an objective would require much longer periods of instruction, as well as opportunities for practical experience. Instead, our focus is to alert students to the importance of the given skill sets, provide a basic introduction to those skills, and then offer a list of resources – individuals and services on-campus, and print and electronic media – that may be of assistance in developing competency in these areas. Our longer-term goal is to sensitize educators across the country to the essential nature of competence in these skills and thereby make survival skill training an integral part of all programs that seek to prepare individuals for the practice of science.

### **Audience**

We began offering our survival skills workshops to a very limited audience – graduate students and postdoctoral fellows in the neurosciences, the professional discipline of one of us (MJZ). However, over the years we had requests from students in other disciplines that they be allowed to attend, and thus soon opened the workshops to individuals throughout the biomedical sciences. Requests continued to come from other sectors of the university. Moreover, the University of Pittsburgh agreed to provide us with financial support for our work from the budget of the Provost, the academic officer for the entire university. Thus, several years ago we opened our workshops to the community at large and have worked to serve that community. Although the majority of our participants still come from the sciences, we now have attendees who are pursuing degrees in education, public administration, and business, as well as several other sectors of the university.

Certainly we cannot address the specific needs of every field; however, much of what we teach is generalizable to a broad range of disciplines. Moreover, because experiences can be vastly different even among laboratories in the same field, we find

that group discussions on standard practices help to highlight the range of practices. They also help to alert participants to the need to take an active role in their training programs, and to seek out information on what the accepted practices are within both the field and the research group in which they work.

This is not to say that we cannot address any of the participants' specific needs. The use of breakout sessions (see below) is quite helpful in this regard. We also encourage departments to build on the workshops offered by providing in-department training on discipline-specific issues, though thus far we have had limited success with this endeavor. Examples of issues that can vary widely from discipline to discipline and thus deserve attention at the level of each academic unit include topics such as authorship and the proper organization of a research report.

### **General organization of workshops**

We have tried a variety of formats for providing instruction, including occasional 1-hr seminars, weekly 2-hour sessions, monthly 3- to 8-hour workshops, and a 2-week intensive course. The one that seems to best fit the needs of our local community is the series of eight monthly workshops, each of which is devoted to providing training in a specific survival skill. These workshops last for 6 or 7 hours, from 9 am to 3 or 4 pm, and are scheduled for a Saturday to avoid conflicts with other classes and seminar series. (We recognize that this may exclude some participants either because of religious reasons or the absence of childcare. However, in nearly a decade of running these Saturday workshops, less than half a dozen individuals have indicated their inability to attend our sessions for these reasons. Moreover, a brief experiment with providing childcare failed because of a lack of interest among the participants. Perhaps at some point in the future it would be useful to revisit these issues.)

Within a workshop, the morning sessions are usually devoted to lectures. Over lunch, which is provided, groups of 10-15 participants discuss an ethics case related to the workshop topic. For example, in the workshop on writing research articles, the case deals with authorship, whereas in a workshop on teaching the case focuses on rating student performance (see Table 1, pp. 578-579). These 1.5-hour discussions are led by faculty, senior staff, and postdoctoral fellows who are recruited from the various departments whose students participate in the workshops. The afternoon sessions may follow a variety of formats, including more lectures, a choice of breakout sessions devoted to specific issues, and/or a presentation by a keynote lecturer. The last 5-10 minutes of each workshop are reserved for participants to complete an evaluation form (see below).

The workshops on job hunting and on grantpersonship include an initial plenary session that focuses on generic issues (such as preparing a curriculum vitae and résumé, or the major sections of a grant application), followed by a series of concurrent breakout sessions that address a variety of specific opportunities. In this way, we can minimize faculty effort by having all participants attend a general session, and still address the specific needs of different groups via break-out sessions.

### **Faculty**

Although we provide a good deal of the instruction ourselves, we also include a large number of faculty in the program: approximately 75 individuals per year coming from a broad range of disciplines. These faculty serve as speakers, panelists, ethics discussants, and leaders of breakout sessions. The faculty are, by-and-large, active researchers. The use of researchers to teach this material, as opposed to specialists in the discipline of the skill, helps to emphasize the idea that these abilities are essential for success as a professional. Also, when teaching about the ethical dimensions of these skills, it is quite beneficial to have active researchers modeling an interest in issues of responsible conduct.<sup>21</sup>

Many faculty members are reluctant to participate at first. This might be because of the time commitment, their concern about their competence to deal with the material, or their skepticism about the value of the program. Sometimes “encouragement” must be provided in the form of a request from a program director or dean. Yet, our experience is that almost all individuals who participate as faculty in a workshop are quite ready to provide this service again.

### **Course credit**

Individuals participating in our workshop may obtain course credit, if desired. Students are required to attend three of the four workshops offered in a given term to obtain 1 credit, with a grade of “satisfactory”. Grades are based on attendance/participation. Less than 10% of the individuals who attend the workshops register for course credit. On the other hand, by providing the option of course credit, it is easier to schedule university classrooms, use library reserve systems, and get listed in course directories.

In addition to formally registering for the course, participants can request a letter documenting their attendance at workshops. Individuals often request these letters when supported by grants for which they need to verify that they received instruction in research ethics. In some cases the request may arrive several years after a student’s participation, as when a graduate student leaves the university and begins postdoctoral training elsewhere.

### **Funding**

In our experience, the workshop format that we currently use requires significantly more staff support, and consequently a higher budget, than a traditional course. However, it is probably more accurate to compare these workshops to a series of eight 1-day conferences than to a traditional course. Indeed, not only do the faculty change from event to event, but the participants vary as well. Food and advertising also contribute significantly to the annual budget, which totals approximately \$75,000. Virtually all of the funding comes from the University of Pittsburgh, although about 5% of this comes from registration fees (\$5 in advance; \$10 at the door). Is the program worth such an expenditure? We think so. It comes to about \$10 per student per hour plus meals, and we expect this cost to decrease significantly as our enrollment increases. Moreover, there are many benefits on which a monetary value cannot easily be placed, such as a reduction in the need for comparable programs at the school or

departmental level, and the increased attractiveness of our training programs (the Survival Skills and Ethics program is described on the University's web site and in several recruitment brochures).

### **Workshop development and evaluation**

Project evaluation is essential. It provides important feedback, demonstrates that we care about impact, and is necessary for continued funding. We have worked with a team of educational evaluators since the inception of our project. They assisted us in developing the workshops, as well as evaluating them. We incorporated into the design of the workshops basic principles that researchers in education have found to facilitate adult learning.

Individuals vary in their preferred learning styles.<sup>28-30</sup> Thus, we try to accommodate different styles within the workshops through the inclusion of a variety of formats including lectures and discussions, individual as well as group exercises, and both oral and visual stimuli. Allowing individuals to share their own experiences with each other not only seems to improve participant satisfaction, it frequently leads to increased learning opportunities for others in the group by providing different perspectives on the subject matter, as well as the incorporation of additional relevant issues into the curriculum.<sup>31-33</sup>

Experiential learning (i.e., learning that requires active participation) is also an important component of effective educational programs targeting adults. It allows participants to immediately apply and test their new skills, resulting in a more rewarding and effective learning experience.<sup>29,33-35</sup> Workshop exercises, including the ethics discussions over lunch, are included to meet this need.

Researchers have also found that adults are self-directed in their educational objectives,<sup>31,36</sup> and seek learning experiences that are directly applicable to their lives.<sup>28,37</sup> This view is supported by the comments of workshop participants. By designing workshops so that they are self-contained and independent of each other, individuals need attend only the workshops that meet their learning objectives.

At each workshop, participants are asked to complete an evaluation form. These were designed by educational evaluators with input from us. Participants rate the speakers and the value of the information presented, and also provide demographic information. Responses are otherwise anonymous. A student aide tallies results, and the information is used to improve future workshops and document program efforts. Common criticisms – which we continue to attempt to address – are that workshops involve too much lecturing and not enough discussion or other forms of active learning, and that the material is too oriented toward the biomedical sciences, the fields with which we are most familiar.

Recently, we have embarked on what may be a still more informative evaluation, a survey of graduate students and postdoctoral fellows who do *not* attend our workshops, and of the faculty. Although our workshops each average about 100 participants and involve 500-600 different individuals over the course of a year, this is still a small percentage of the total number of trainees at our institution. This survey, which is to be

performed by an outside professional agency, should be completed in early 2002 and a report will be available on request to anyone interested in the outcome.

We frequently are asked whether we assess the long-term impact of the survival skills training we provide to our participants. Such a plan was initially of great interest to us. Yet, based on the advice of our project evaluators, we have not pursued it. There are several reasons behind that decision: First, the population of students is highly heterogeneous and the individuals are affected by many variables over which we have no control. This in itself is not unusual and may not be insurmountable. However, it means that the size of the groups that would be required to assess the effect of our workshop probably greatly exceeds the population that we are training. Second, the possibility of dividing students into two equivalent groups is not available to us. Indeed, by virtue of the fact that most of our students are self-selected, they represent a particular subset of the total population. No comparable control group is available to us. Third, because most of our participants are graduate students, we would need to monitor their progress for at least five years so as to extend the evaluation process into their period of relative independence as professionals. The expense and time required for this type of longitudinal study makes it impractical. Instead, we do what most courses do; we rely primarily on student evaluations of the workshops.

### **III. Integration of Ethics Instruction**

Virtually every aspect of the survival skills curriculum has an ethical dimension, and these issues are identified and addressed while the survival skill is being transmitted. For example, when we teach about writing research articles, we discuss issues of plagiarism, honorary authorship, data selection, and graphic design. The workshop on “grantspersonship”, includes a discussion of the importance of not overstating the sensitivity of methods or the quality of pilot data, not exaggerating the assistance that one will obtain from colleagues, and not promising more than you know you can accomplish (see Table 1).

Instruction in ethics is integrated into the survival skills workshops in two ways – through the inclusion of material in the lectures, and through the active discussion of an ethics case. Ethics instruction within the lectures occurs without any special fanfare, just as a natural process of discussing a given topic in its entirety. For example, having indicated how one might present a figure, we note how important it is not to inadvertently mislead readers by failing to point out that the axes do not begin at “0.0”. In addition, each of the workshops includes a 90-minute lunch period during which an ethics case related to the survival skill being covered is discussed in small groups of students led by faculty discussants. Through such instruction, participants obtain experience in working through ethical dilemmas.

Many of the ethical issues discussed in the survival skills workshops are not likely to arise as subjects in traditional ethics courses for researchers. Examples of such issues include the importance of acknowledging the contributions of others in one’s oral presentations, the obligation not to allow worthwhile data to merely sit in lab notebooks but to publish them in reports so that others may benefit from the work (particularly if the work was supported with public funds), and the responsibility to ensure that other researchers can attempt to replicate your published results by the

complete and accurate presentation of your methods and a willingness to share all reagents not commercially available.

As noted above, the leaders of these small group discussions of ethics cases are usually faculty members recruited primarily from the departments whose students attend our workshops. These individuals are provided with training in advance of the workshops: Approximately 1-2 weeks before the workshop, the discussants receive an information packet containing the ethics case, notes on the issues in the case, and general suggestions on leading group discussions. Then, immediately prior to their meeting with the students, the ethics discussants gather for a faculty discussion of the case that is lead by one of us. Thus, this session assists them in clarifying elements of the case and provides the faculty with a chance to ask questions and try-out lines of reasoning. This instruction serves three functions – it prepares the discussants, it reduces anxiety about being “ethicists”, and it provides a forum in which new insights into the case inevitably emerge, both for the discussion leaders and for us.

#### **IV. Problems encountered**

As within any program, ours has not been without its problems. We have already mentioned two – getting participants and discussion leaders. Another, which may be related to these two is the need to overcome some less than supportive faculty attitudes. Some faculty assert that we are “spoon-feeding” the students and/or are “trying to put a gloss on bad research”. These are telling criticisms. For example, whereas we have been told that we are spoon-feeding students with specific instruction on how to apply for a job, we have never heard such comments leveled at instruction on more traditional topics. (Is one “spoon-feeding” a student by teaching core courses or by helping them with experimental design?) Moreover, we feel that helping students communicate their results will permit audiences to appreciate what they have accomplished so that their work and their future potential can be properly evaluated. Put another way, it seems highly unlikely that an inept researcher will be hired because they give a dazzling presentation; yet, it would not be surprising if an “unpolished gem” were to fail to obtain a job because their presentation was not sufficiently comprehensible.

Charges that individuals are wasting their time discussing survival skills are leveled not only at the students, but at the faculty providing the instruction as well. Anyone engaging in this sort of enterprise should be warned – teaching survival skills, particularly those aspects that relate directly to the responsible conduct of research, can be dangerous to one’s own survival! Waiting – or at least proceeding carefully – until one is awarded tenure is highly recommended, as is maintaining an active research program. One reason we try to involve so many faculty, especially senior ones, is that it is a way of getting them to a workshop, where they can evaluate the event for themselves. We hope that they come to recognize both the value of the workshops, as well as the involvement of their colleagues who teach in the workshops. (And indeed a number of skeptical faculty leave the event remarking that they could have benefited from instruction in survival skills when they were a graduate students.) An additional benefit of involving active researchers is that it increases the likelihood that the material being conveyed remains current as conventions change and new issues emerge. Involving faculty members from throughout the university as lecturers,

panelists, and discussion leaders also helps to anchor the program into the broader institution, particularly if some of those faculty are department chairs or deans. It is also quite useful to establish an advisory board comprised of faculty, students, and administrators from a range of sectors within the university. Our board provides us with input regarding the development of our program and endorses our program to others in the community.

## **V. Dissemination**

The development of our program into its current form has taken many years. Indeed, our program continues to evolve as we seek to help prepare emerging professionals for the new challenges that face them. To facilitate the development of such programs at other institutions, we run an annual trainer-of-trainers conference that provides participants with the information and materials necessary to establish or improve an existing course in survival skills and ethics at their institution. This event, which currently is held each June in Snowmass, Colorado, also provides faculty with like-minded colleagues who can provide a network for sharing additional resources and brainstorming. The event is usually attended by some 40 faculty and administrators who represent the “trainees” and another dozen or so individuals who provide the leadership. To date about 150 individuals from 90 institutions have been trained in these conferences. Further information is available on our website ([www.pitt.edu/~survival](http://www.pitt.edu/~survival)).

## **VI. Additional Aspects of an Instructional Program in the Responsible Conduct of Research**

Our program at the University of Pittsburgh focuses on the series of monthly workshops described above. However, for adequate training in responsible conduct, these workshops must exist within a much more comprehensive educational program.

### **Ethics in the core curriculum**

We believe that some training in ethics should be included within the core curriculum of a discipline, with ethics cases being discussed in each of the required courses. There are two reasons for this: first, if, as we have argued, responsible conduct is an integral part of doing research, then it should be infused through the training program for researchers. Second, there are many topics that do not fit logically into a “survival skills” context, but nevertheless deserve attention. Depending on the discipline, such topics might include informed consent, data management, storage, and retrieval, and ethical issues related to developing technologies (e.g., human cloning, gene therapy, etc.).

As in the case of survival skills workshops, ethics can be integrated into a core course in two complementary ways. First, course instructors can include comments on the ethical dimensions of their subject within the mainstream of lectures. Thus, a faculty member discussing genetic markers for disease might comment briefly on the ethics of genetic testing, whereas a course in anthropology might mention the possible

negative impact of fieldwork on the lives of indigenous people. Second, time can be set aside to discuss an ethics case of particular relevance to the focus of the course. The latter might be included as part of the series of breakout groups that core courses often organize in order to discuss a particular research article. Faculty involved in providing instruction in one or the other format can be provided with training in ethical reasoning (see below) and in leading group ethics discussions; they can also be provided cases and other materials as necessary.

We should note, however, that whereas we wholeheartedly support the concept of integrating ethics into the core curriculum, accomplishing this is no simple matter. One or two faculty members can mount their own training program in survival skills. However, influencing the courses of other faculty members demands skilled and time-consuming diplomacy. Moreover, it is an initiative that requires continual maintenance. There is often constant pressure on a course director to find time for new topics. In addition, the faculty and directors for a given course may change frequently. In both instances, issues of responsible conduct can quickly disappear from the syllabus. Our success in this area has been limited.

### **Training in ethical reasoning**

A danger in limiting instruction in ethics to a discussion of contemporary cases is that students may learn the rules for specific situations but not be able to generalize to other issues of immediate relevance to them. Moreover, they may not acquire the skills needed to deal with the many issues that will confront them in the future but cannot be anticipated. Thus, we are developing a curriculum that provides training in “ethical reasoning”. Based on the original work of Kohlberg that was expanded by Rest, Bebeau, and colleagues,<sup>38-40</sup> we are defining ethical or moral reasoning as the ability to systematically examine a situation and then choose and defend a position on the issue.<sup>40</sup> It includes the tasks of identifying (1) what the ethical issues and points of conflict are; (2) the parties that have a vested interest in the outcome of the situation; (3) the probable consequences of possible courses of actions; and (4) the ethical obligations of the central characters. Muriel Bebeau, to whom we are indebted for much assistance in the development of this component of our program, has shown that training in ethical reasoning is effective in increasing the ability of emerging professionals to engage in such tasks.<sup>39</sup>

### **Other venues? Let us count the ways**

There are many ways to make training in professional skills, including the responsible conduct of research, an integral part of doing science. For example, ethical issues (including cases) might be included in the textbooks of a scientific discipline (e.g.,<sup>41,42</sup>), represent the focus of occasional lab meetings, be part of a departmental retreat, be a subject for on-line forums (e.g.,<sup>43,44</sup>), and appear on the programs of professional meetings (for example, they are a standard feature of the meetings of the Society for Neuroscience). The objective is straightforward – to quietly and without offense ensure that training in responsible conduct exists side-by-side with discussions of all other aspects of science.

### **Assessment of competency**

All training programs establish milestones that their students must reach with a certain level of competency: these include a preliminary exam, a comprehensive exam, a proposal overview, and a doctoral thesis. If ethical reasoning is an essential skill, then a suitable milestone must be devised. One suggestion is that comprehensive examinations for graduate students include an ethics case of relevance to the student's area of research to assess the student's ability to engage in ethical reasoning. We have yet to try out this proposal.

## **VII: Survival Skills: The Lab**

Formal training, whether a one-day workshop or a full course, can only take students so far. In the end they must engage in mentored practice. It is not an accident that in many graduate programs, course work may last only 12 to 18 months but the PhD itself requires 5-6 years. The difference is time spent in the lab, the field, or the library, doing research and then interacting with an advisor and an advisory committee. And in many disciplines, this research experience is further supplemented by postdoctoral work, a period of 2-4 years that consists almost entirely of research experience. The acquisition of survival skills requires no less a period of practice. Indeed, it may require more. Thus, we advocate – but have not yet established – a program that makes available tutors for each of the skills we have described. For example, we envision each university having a team of technical writers able to work one-on-one with students (and faculty members!) on their research manuscripts, not simply to improve the manuscripts but to help the trainees become better writers. Other teams would work with students on their oral presentations, review and comment on curriculum vitae and résumés, and so forth.

Such programs would be costly but they would also be cost-effective. Faculty members would spend less of their time editing their students' manuscripts, undergraduates would complain less about the teaching done by graduate students, more students would obtain fellowships, and graduates would be more readily employed.

## **VIII. Summary**

We believe that in preparing our trainees for success, we must address a broad range of competencies that they will need to demonstrate as professionals. We must, for example, train them to communicate their research data as well as to collect them, to teach as well as to learn, and to develop a career as well as a thesis. Moreover, we must view responsible conduct in ethics as an integral part of good science and thus an integral part of our training programs. It follows, therefore, that the objectives and the methods for ethics instruction should be nothing less than for instruction in other skills that are valued within a discipline. Thus, our model for providing instruction in professional skills, including responsible conduct, is modeled after traditional programs for teaching students other skills that are necessary for their performance as researchers: (1) Start as soon as they arrive, (2) make the instruction part of everything

they do, placing the training in the context of their research rather than as a separate entity, (3) move from the simple to the complex, and (4) assess competency. In this way, there is no mistaking the message – communicating well, obtaining employment and research grants, excelling in teaching and mentoring, engaging in ethical reasoning, and behaving responsibly are essential skills, ones that are at the core of being a researcher.

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**Table 1: Providing training in the responsible conduct of research**

Venue for Instruction	Session	Topics	Case
<b>Seminar for first-year students</b> (6 hr ethics training)	Introduction to research ethics	The role of ethics in the advancement of science; absolute vs. relative values; means vs. ends; fabrication, falsification, plagiarism	Fabrication, falsification of data
	Components of ethical dilemmas	Identifying sources of conflict, parties affected, obligations, and responsibilities	Use of subjects
	Potential responses	Identifying the options and likely impacts on all parties; responsible whistle blowing	Whistleblowing
	Making a decision	Developing a well reasoned response; synthesis of previous topics	Social responsibility
<b>Core Curriculum</b> (8 hr ethics training)	Fundamentals of biomedical science	Social impacts of developing technologies	Gene therapy, Genetic counseling
	Systems neuroscience	Use of animal subjects; potential conflict of interest in industry-supported research	Conflict of interest
	Neurobiology of disease	Ethical issues in clinical research	Use of human subjects, informed consent
	Statistics	Data selection, analysis	Influence of hypothesis in data analysis
<b>Survival Skills and Ethics Workshops</b> (20 hr ethics training)	Being a graduate student; Being a postdoc <i>(These are two separate workshops. Trainees attend the workshop corresponding to their level.)</i>	Record keeping; ownership of intellectual property; advisor-trainee relations; suspecting, reporting misconduct	Ownership and retention of data; mechanisms for handling disputes
	Identifying a career, finding employment	Honesty in preparing résumé, CV; accuracy of answers in interviews; responding to illegal questions; when to disclose you are in a dual career partnership	Integrity in interviewing

*Promoting Responsible Conduct in Research through “Survival Skills” Workshops*

<b>Venue for Instruction</b>	<b>Session</b>	<b>Topics</b>	<b>Case</b>
	Writing research articles	Determining authorship; adequate description of methods; sharing reagents; citing sources; confidentiality in review process	Authorship
	Oral presentations	Proper representation of data; scholarship and citation; integrity in designing visual aids; modifying technical material for lay public	Obligation to cite information obtained in oral presentations
	Obtaining funding for training and research	Obligation to publish funded research; not overstating sensitivity of methods; ensuring quality of pilot data; accurately describing collaborations	Pilot data: how good is good enough?
	Teaching	Establishing grading policies; providing equal access; dealing with suspected misconduct; student-faculty relations	Providing equity in instruction
	Advancing in your career	Ethical hiring practices; fairness in supervising and mentoring; providing service; dealing with suspicions of fraud	Dealing with misconduct of an subordinate
	Intellectual property: Creating and protecting it	Patents and copyrights; ownership of data and products; record keeping	Trainee-Advisor disputes in ownership of intellectual property
<b>Individual mentoring</b>	Individual meetings with trainee Lab meetings Journal clubs	Data analysis, retention, reporting; requirements for authorship; confidentiality in reviewing grants and manuscripts	Real situations as they occur

## Appendix I: The Workshops

Each of the eight monthly workshops on survival skills and ethics is described below in detail.

### Being a Trainee

**Taking charge of your career:** Setting short and long-term goals—Selecting a research project—finding mentors—developing a training plan—being creative—separating well.

**Managing the essentials:** Scheduling your time—balancing responsibilities—minimizing stress—identifying and dealing with depression.

**Attending seminars and meetings:** Preparing and presenting posters and 10-minute talks; networking.

**Ethics discussion:** Advisor-trainee relations

**Specifics for graduate students (breakout sessions):** Negotiating the path to a degree—writing and defending a dissertation—getting finished on time.

**Essentials for postdocs (breakout session):** Establishing an advising committee—dealing with difficulties—preparing for permanent employment.

Trainees are encouraged to take this workshop as soon as possible after their arrival. It provides a concise, and what several individuals have termed as “eye-opening”, introduction to negotiating life as a trainee. The workshop outlines a path through the training process and offers advice regarding many of the decisions the individuals will have to make. Such topics include how to choose an advisor and a research project, what is reasonable to expect from one’s advisor, and how to “train” advisors who are not providing adequate mentoring. Throughout the workshop individuals are encouraged to be proactive in their training programs and to resolve conflicts as quickly as possible. Questions that beginning trainees may not know enough to ask, yet are essential to their careers – such as how their advisor determines authorship – are pointed out as key concerns. After this general introduction to being a trainee, separate sessions provide graduate students and postdocs with information specific to their level. For graduate students this might include such things as choosing committee members and writing and defending a dissertation, and for postdocs, it might include information on why they should establish an advising committee, even if it is not required.

Other sessions in this workshop focus on providing students with some of the tools to make their studies more manageable. The primary focus in this regard is a session on time management and on minimizing stress and depression. Other issues discussed include attending seminars and professional meetings. For example, students are provided strategies for maximizing the benefits of attending such meetings, and minimizing the stress that can accompany attending a meeting of thousands of people. The importance of networking is stressed throughout. How to prepare and present posters and 10-minute talks are also included in this presentation.

Many of the ethical dimensions discussed as part of this workshop include issues related to the ownership, access, and retention of data and ideas. Minimizing and dealing with advisor-trainee disputes is also discussed.

### Writing and Publishing a Research Article

**Why write?** A professional’s guide to the importance of writing.

**Writing journal articles:** Selecting a journal; structure of a research article; ethical dimensions of writing.

**Ethics discussion:** Issues of authorship

**20 steps to a publication:** The nuts and bolts of writing—when to begin; outlining the paper and writing the first draft; writer’s block; essentials of editing; submitting the paper; responding to reviewers.

**Presenting data:** Preparing effective tables and figures; responsible graphics.

We have found that many individuals find the task of writing a research article—especially their first one – a daunting chore. Moreover, researchers may feel that once they have answered their experimental questions, that they are now ready to move on to the next set of experiments, and taking the time to write up their research is a distraction.

Through our writing workshop, we seek to first convince students that it is both part of their ethical responsibilities and essential to their career and that they write up their research results. Particularly for research funded by public monies, it is an ethical obligation to publish their results so that others may benefit from their findings. Additionally, we also emphasize that advancement and tenure often depend on one’s productivity as evidenced by one’s publication record, particularly with regard to peer-reviewed research articles. As part of this workshop we review the anatomy of a research article, including what information should be presented in which section. The presentation of data receives particular attention and designing effective tables and figures is covered in detail.

We then focus on providing students with an introduction to tools and strategies for reducing what seems to be a daunting task into a series of manageable steps. Based on a technique developed by The Council of Biology Editors<sup>45</sup> and subsequently modified by us, we present the process of writing and publishing a research article as a series of 20 discrete steps. It covers the determination of authors in a paper (we suggest this be the first step) and ends with revising page proofs. We also discuss some common pitfalls that may arise in the process of writing, for example, writer’s block or dealing with multiple authors, and offer strategies for avoiding or resolving such problems.

Throughout the workshop, issues of responsible conduct in writing and publishing research articles are covered. This discussion includes not only the major ethical concerns of fabrication, falsification, and plagiarism, but also covers many of the less obvious issues that arise more frequently in the writing process. These include the level of detail to provide in the Methods section, guidelines for providing citations, and the importance of brevity and clarity in writing.

### **Making Oral Presentations**

**Get ready!** Determining your purpose—8 steps in preparing a presentation—the standard organization of a research seminar—designing visual aids.

**Speaking of speaking:** Proper pace and density—your visual focus—dress—using tools and technology—answering questions—handling stage fright and emergencies.

**Ethics discussion:** Responsibility to cite information obtained in oral presentations.

**All the world’s a stage:** Speaking to multi-cultural audiences—tips for native and non-native speakers of English.

**Practice makes perfect:** Learn from your peers as you hear and provide feedback on mini-presentations.

As students progress in their careers they will be required to give oral presentations. Usually the beginner’s task is to present a paper at a journal club. However, the tasks gradually expand such that they move on to presenting research findings at conferences, and giving presentations as part of interviewing for a job. We begin our workshop on oral presentations with a discussion of the ways in which oral presentations are important to a researcher’s career. Then, much like our workshop on writing research articles, we provide students with a series of discrete steps to follow for planning, organizing, and delivering an oral presentation. These steps begin with an analysis of objectives and messages, include issues related to making and using visual aids, and finally proceed through a discussion of how to handle the question and answer period and any emergencies that may arise during one’s presentation.

Other issues that are covered include strategies for minimizing and coping with stage fright, and methods that non-native speakers of a language can use to increase the understandability of their presentation. In addition to discussing the standard 60-minute research seminar, we also provide information on other types of presentations for example, 10-minute talks at conferences, informal presentations and networking, and seminars given as part of a job-interview.

Many ethical dimensions of oral presentations are covered in this workshop. Issues discussed include the need for high standards in the material presented, acknowledging the work of others who

have contributed to the data and ideas presented in the seminar, the responsible use of the audience's time, and graphics that are not misleading or ambiguous.

### **An Introduction to Teaching**

**Designing your course:** Creating a syllabus—choosing textbooks—developing a grading system—setting ground rules.

**In the classroom:** Lecturing and leading discussions—keeping their interest—using visual aids—working with a teaching assistant—dealing with problems.

**Ethics discussion:** Teaching and testing.

**Accommodating differences:** Recognizing different learning styles—making accommodations—complying with the Americans with Disabilities Act.

**Strategies for starting out:** Balancing teaching and other responsibilities.

This workshop is aimed at a somewhat more-senior audience, primarily postdoctoral fellows and junior faculty who are preparing to teach their first course. It describes in detail the basics of designing and delivering a course for undergraduates. It begins with an analysis of the teaching assignment: what must be taught, who the students are, what background they have, what the students need to learn, etc. Subsequent discussions focus on decisions including how to choose a textbook, information about outlining the course and lectures, deciding on grading policies and constructing and grading exams. Another session focuses on delivering the material, including the basics of lecturing and leading discussions.

New instructors frequently have difficulty balancing their teaching with other responsibilities, and, in fact, it is not uncommon for new faculty to do little else than prepare to teach during their first terms on campus. However, this is not necessarily what is best for their careers, as their scholarly productivity in those years will influence their chances for later promotion. Thus, as part of the workshop we provide a session on strategies for achieving balance between teaching and other responsibilities. Also covered are ways in which faculty can document their strengths as an instructor so as to aid future bids for advancement.

Throughout the day, issues related to promoting equity in the classroom with regard to accommodating individual differences are included throughout the sessions. Special attention is paid to complying with the Americans With Disabilities Act. Other individual differences that are considered include promoting gender equity in the classroom and including a variety of activities that favor a broad range of learning styles. Several issues related to ethics in providing instruction are discussed: topics range from accessibility in the classroom, to fair testing and grading, to faculty-student interactions.

### **Grantspersonship**

**Preparing the application:** Components of fellowship and research grant applications; maximizing your chances for success; the evaluation process; re-applying.

**Ethics discussion:** Pilot data—how good is good enough?

**Getting specific:** Break-out sessions on the intricacies of major funding agencies including the National Institutes of Health, National Science Foundation, Department of Defense, Department of Education, private foundations, and more.

**Mock study section meeting:** Gain insight into how reviewers think by participating in a mock review.

The Office of Research at our institution generally co-sponsors this event. This is one of the best attended workshops, and is the one that attracts the most senior audience. The morning sessions are devoted to an overview of the generic process of applying for funding. Background information provided includes information about types of funding (federal, private, etc.) and how to find out what is available. Then the focus turns to how to write, submit, and revise, if necessary, a grant application. What goes into the different components of an application is covered, as is the construction of budgets and budget justifications.

The afternoon of the workshop is devoted to break-out sessions addressing the intricacies of major funding agencies, for example, the National Institutes of Health, National Science Foundation, Department of Defense, and private foundations. These sessions are led by either by program staff from the given agency, or by faculty who have experience serving as reviewers for that agency. Leaders of the breakout sessions provide an overview of how to target an application to a particular agency, comment on the specific procedures used to review proposals, and what reviewers and funding agencies look for.

Ethical issues discussed in this workshop include developing a reasonable budget, getting appropriate approvals for the use of human and animal subjects, standards for pilot data, and not promising to do more work than one thinks they can complete. Ethical dimensions of the review of applications also are commented on – such as the need for confidentiality and fairness in review—as are the issues related to post-award behaviors, such as the use of funds and reporting of research results.

### **Intellectual Property: Creating It and Protecting It**

**Creativity:** What is it and how do I get more? (Lecture followed by panel discussion)

**Ethics discussion:** Trainee-advisor conflict over ownership of intellectual property

**Getting protection:** Patents and copyrights

**Misconduct in research:** Whistleblowing

This workshop is our newest and was developed in response to requests from participants. Students expressed a desire to hear about creativity and developing a line of research from distinguished scientists. Thus, the morning of this session is devoted to a discussion of creativity. After an initial lecture on creativity, a panel of distinguished scientists present their views on being creative and maintaining productivity. The ethics case provides an introduction to some of the issues to be covered in the afternoon session: ownership of intellectual property. Other ethical issues covered in the workshop relate to record keeping, copyright and patenting, and misconduct in research.

### **Moving On: Obtaining Postdoctoral Positions and Permanent Employment**

**Moving on:** When, how, and to where?

**Preparing your “package”:** CV’s, résumés, cover letters, and statements of interest.

**Interview Skills:** Being prepared, selling yourself, asking as well as answering questions.

**Ethics discussion:** Truth in advertising yourself.

**Break-out sessions on job opportunities:** Topics include teaching in 4-year colleges, junior colleges, and K-12; research at universities, in industry, and at research institutes; science journalism and publishing; research and educational administration; patent law; public policy; and more!

This workshop is by far our most popular. It addresses a major concern of our students: will they get a job? The workshop begins with a morning plenary session in which students hear about the basics of job hunting. As part of this session, students are encouraged to collect information not only about the careers that are available to them, but also about themselves; for example, strengths, interests, and aspirations. Considering a wide range of careers is advocated, and information is provided on ways that trainees can combine their doctoral training with other strengths to create a niche for themselves in such areas as patent law, science journalism, or investment counseling.

During the plenary session, trainees are walked through the process of assembling their “package”, which includes a cover letter, curriculum vita or résumé, statement of interests, letters of recommendation, and any additional supporting materials. Strategies for dealing with common concerns also are addressed, for example ways to minimize the effect of a leave of absence on one’s vita and career, how to deal with an advisor who will not write a fair and supportive letter of recommendation, and strategies for job hunting as part of a dual career couple.

The afternoon is then comprised of a series of breakout sessions from which individuals may choose those of interest. These sessions provide information regarding job opportunities in a particular area, such as teaching in 4-year colleges, public policy, or research administration. The speakers for these sessions are practitioners in the fields they are representing and are able to provide information about how to target one's job search for the positions in their field, in addition to being able to provide information about what such a job actually entails with regard to duties, starting salaries, career ladders, etc. Some of the ethical issues discussed in this workshop are honesty in representing oneself on CVs, résumés, and at job interviews, and dealing with illegal questions from interviewers.

### **Advancing in Your Career**

**The secret to success:** Strategies—criteria for advancement—being a member of a community—choosing a research problem—developing collaborations—preparing your portfolio for review.

**Ethics discussion:** Now *you're* the boss: Dealing with suspicions of fraud.

**Management skills:** Supervising and mentoring others—dealing with conflict in the workplace

**The juggling act:** Balancing personal and professional responsibilities.

This workshop focuses on providing an introduction to making the transition from graduate student or postdoc to permanent employment. The workshop begins with a general overview of how to advance in a career, for example, find out what variables are key to survival and promotion, integrate oneself into the community, and get help when needed. This session is followed by comments from established professionals representing different occupations. The panelists comment on the information presented in the previous session and modify or expand on it as necessary so that it adequately reflects norms for their field.

Also covered in this workshop are two much-neglected topics: how to be an effective supervisor and mentor, and how to balance personal and professional responsibilities. The former discussion begins with guidelines for interviewing and hiring individuals and then proceeds to describe steps for promoting teamwork and helping individuals grow in their positions. It also deals with solving problems with staff. The latter topic is usually presented as a panel discussion featuring successful researchers who have “a life” outside of work.

Some of the ethical issues discussed in this workshop include fair hiring and mentoring practices, dealing with suspicions of fraud, and balancing one's responsibility for training students with making progress on research grants.

## Appendix II:

### An Essential Library on Survival Skills

There are a number of excellent books on aspects of survival skills and ethics. These are our some of our favorites, and what we would recommend to someone just starting their library. For a more comprehensive listing of resources, see that section of our website, [www.pitt.edu/~survival](http://www.pitt.edu/~survival).

#### **Being a Trainee / Doing Science/ Creativity**

- Beveridge, W.I.B. (1950) *The Art of Scientific Investigation*, Vintage Books, United States.  
Medawar, P.B. (1979) *Advice to a Young Scientist*, Basic Books: United States.  
Peters, R.L. (1997) *Getting What You Came For: The Smart Student's Guide to Earning a Master's or a PhD*, Farrar, Straus, and Giroux, New York.  
Shekerjian, D. (1991) *Uncommon Genius: How Great Ideas Are Born*, Penguin Books, New York.

#### **Grantspersonship**

- Miner, L.E. & Griffith, J. (1993) *Proposal Planning & Writing*, Oryx Press, Phoenix, AZ.  
Reif-Lehrer, L. (1995) *Grant Application Writer's Handbook*, Jones and Bartlett Publishers, Boston.  
Ries, J.B., & Leukefeld, C.G. (1995) *Applying for Research Funding: Getting Started and Getting Funded*, Sage Publications, Thousand Oaks, CA.

#### **Graphics**

- Briscoe, M.H. (1996) *Preparing Scientific Illustrations: A Guide to Better Posters, Presentations, and Publications*, Springer-Verlag, New York.

#### **Job Hunting**

- Bolles, R.N. (2001) *What Color is Your Parachute? A Practical Manual for Job Hunters and Career Changers*, updated yearly, Ten Speed Press, Berkeley, CA.  
National Academy of Sciences. (1996) *Careers in Science and Engineering: A Student Planning Guide to Grad School and Beyond*, National Academy Press, Washington, D.C. (Available for free download on NAS website [www.nationalacademies.org/publications/](http://www.nationalacademies.org/publications/))  
Fisher, R., & Ury, W. (1991) *Getting to Yes, 2nd edition*, Penguin Books, New York.  
Yate, M. (2002) *Knock 'Em Dead 2002: The Ultimate Job Seeker's Resource*, Adams Media, Holbrook, MA.

#### **Mentoring**

- Fort, C., Bird, S.J., & Didion, C.J., eds. (1993) *A Hand Up: Women Mentoring Women in Science*, Association for Women in Science, Washington, D.C..  
Kanigel R. (1986) *Apprentice to Genius: The Making of a Scientific Dynasty*, Johns Hopkins University Press, Baltimore, MD.  
More of a novel than a “how-to” book on skills, but highly recommended. A good stimulus for discussions of mentoring, approaches to “doing science”, and creativity.

#### **Oral Communications**

- Schloff, L. & Yudkin, M. (1992) *Smart Speaking*, Plume, New York.  
The book lives up to its description: “60-second strategies for more than 100 speaking problems and fears.” Includes tips for a wide variety of situations, ranging from formal presentations to speaking over the telephone. Especially good for the novice.  
Stuart, C. (1989) *How to Be an Effective Speaker*, NTC Publishing Group, Chicago.  
This book takes you through the steps of giving a talk, from researching and outlining to answering questions. (This book is meant to be read in a linear manner, whereas it is easier to sample individual sections of Smart Speaking.)

### ***Personal and Professional Development***

- Griessman, B.E. (1994) *Time Tactics of Very Successful People*, McGraw Hill, New York.  
Simply outstanding! If you only read one book on time management, make this the one.
- Hobfoll, S.E., & Hobfoll, I.H. (1994) *Work Won't Love You Back: The Dual Career Couple's Survival Guide*, W.H. Freeman, New York.  
A useful combination of suggestions, personal anecdotes, questionnaires, and references for further reading.
- Roesch, R. (1996) *The Working Woman's Guide to Managing Time*, Prentice Hall, Englewood Cliffs, New Jersey.  
The best source we have seen so far in dealing with time management for women balancing multiple roles, including parenting.

### ***Providing Access***

- Katz, M., and Vieland, V. (1993) *Get Smart! What You Should Know (But Won't Learn in Class) About Sexual Harassment and Sexual Discrimination*, The Feminist Press, City University of New York, New York.
- Kucera, T.J., ed. (1993) *Teaching Chemistry to Students with Disabilities, 3rd edition*, American Chemical Society, Washington, D.C.  
Filled with common sense that we might otherwise ignore (e.g., refer to items in a visual aid by name, face students when you talk, offer oral exams), as well as new practical advice.
- Mitchell, R. (1993) *The Multicultural Student's Guide to Colleges*, Noonday Press, New York.
- Sonnert, G. & Holton, G. (1995) *Who Succeeds in Science? The Gender Dimension*, Rutgers University Press, New Brunswick, NJ.  
A thorough investigation of a variety of issues thought to contribute to the leaky pipeline; concludes with recommendations for individuals and for policy makers.

### ***Responsible Scientific Conduct***

- Bebeau, M.J., Pimple, K.D., Muskavitch K.M.T., Borden S.L., & Smith D.L. (1995) *Moral Reasoning in Scientific Research: Cases for Teaching and Assessment*, Indiana University, Bloomington, Indiana.
- Committee on the Conduct of Science, National Academy of Sciences (1995) *On Being a Scientist, 2nd edition*, National Academy Press, Washington, D.C. (Available for free download on NAS website [www.nationalacademies.org/publications/](http://www.nationalacademies.org/publications/))  
An outstanding document. To be distributed to anyone and everyone involved in research. Excellent text, stimulating cases.
- Korenman, S.G., & Shipp, A., eds. (1994) *Teaching the Responsible Conduct of Research through a Case Study Approach: A Handbook for Instructors*, Association of American Medical Colleges, Washington, D.C.  
An extensive series of cases on basic and clinical biomedical research. Inexpensive (\$15) and permission is routinely given for distributing copies of the cases to students.
- Macrina, F.L. (2000) *Scientific Integrity: An Introductory Text with Cases, 2nd Edition*, ASM Press.  
Includes cases for discussion along with good, practical advice on many of the skills we deal with such as mentoring, record keeping, authorship, and peer review.
- Sigma Xi (1986) *Honor in Science*, Sigma Xi, Research Triangle Park, North Carolina.  
Excellent document; another must for everyone.

### ***Teaching***

- McKeachie, W.J. & Gibbs, G. (1998) *Teaching Tips: Strategies, Research, and Theory for College and University Teachers, 10<sup>th</sup> edition*, Houghton Mifflin, New York.
- Prengt, R. (1994) *Charting Your Course: How to Prepare to Teach More Effectively*, Magna Publications, Madison, WI.

**Writing**

Booth, V. (1993) *Communicating in Science: Writing a Scientific Paper and Speaking at Scientific Meetings, 2nd edition*, Cambridge University Press, New York.

A thin book filled with wisdom about writing and talking. A sort of “Elements of Style” for scientists.

Council of Biology Editors, Committee on Graduate Training in Scientific Writing. (1968) *Scientific Writing for Graduate Students: A Manual on the Teaching of Scientific Writing*, Rockefeller University Press, New York.

An outstanding guide to how to teach writing. Includes a number of “before and after” examples.

Day, R.A. (1998) *How to Write and Publish a Scientific Paper, 5th Edition*, Oryx Press, Phoenix.

There are a great many books on the subject; this is the best — wise and witty, takes you from creating the title to checking the galley proofs. Read it, then keep it handy.