FOSTERING COMMUNICATION AND COLLABORATION

The NIH CATALYST

A PUBLICATION FOR NIH INTRAMURAL SCIENTISTS

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POSTDOCS AND CLINICAL ASSOCIATES

This issue of The NIH Catalyst *examines the concerns of postdocs and clinical associates at NIH—the more than 3,000 scientists who are not only helping to fuel NIH's scientific productivity today, but who will help to steer the world of biomedicine into the 21st century. Although it's impossible to capture all the ambition and angst that go into the making of a first-rate biomedical researcher, we've pulled together a group of articles that touch upon a wide range of issues from mentorship to employment opportunities. This collection includes thought-provoking pieces from members of the NIH Fellows Committee, individual postdocs, veteran mentors, and former NIH trainees pursuing careers in academia, industry, teaching, and other fields. These articles do not necessarily represent the views of our editorial board. However, in keeping with* The Catalyst's *charge to "foster communication and collaboration," we hope this special issue will spark further discussion of the ways that the entire intramural community—from first-year fellows to lab chiefs—can better foster the development of tomorrow's scientific leaders.* ■

THE VIEW FROM HERE: FRONT-LINE PERSPECTIVES ON NIH TRAINING

What is it like to train at NIH? The general description provided to prospective postdocs by the Office of Education paints this picture: "Trainees enter the NIH to participate in a research program of their choice; however, their education is not to stop there. They are encouraged to develop collaborations, to attend seminars and courses, to perform that type of science that can only be done in the corridors. Why? Because good science talk in the corridor often ends with a rush to the laboratory … ."

Lorna Heartley

Riccardo Alessandro, left, and Greg Michelotti.

True enough. But what about tight travel budgets, uneven mentorship, and job prospects after time runs out on the NIH training clock? In an effort to get a "reality check," *The NIH Catalyst* went to NCI's Laboratory of Pathology and the Clinical Center's Critical Care Medicine Department to talk with a few trainees in the trenches. Admittedly, the remarks of these postdocs and clinical associates are based on their own experiences and may not reflect the opinions of other NIH trainees. Nevertheless, we hope these comments will strike some common chords and help to put a personal face on the joys and difficulties of the NIH training experience.

Taking part in the discussions were postdocs Riccardo Alessandro, Ph.D., Susan E. Clare, M.D., Ph.D., Marta Corcoran, Ph.D., and Greg Michelotti, Ph.D., all from NCI's Laboratory of Pathology, and clinical associates Mark Cowan, M.D., Naomi O'Grady, M.D., David Russian, M.D., Tony Slonim, M.D., and Bill Vandivier, M.D., all from the Clinical Center's Critical Care Medicine Department.

How would you rate the quality of training you have received at NIH? Do you think your experience is the exception or the rule?

Alessandro: I can't say that my [rewarding] three years as a postdoc are the rule at NIH since I have known people who have had quite bad experiences in other

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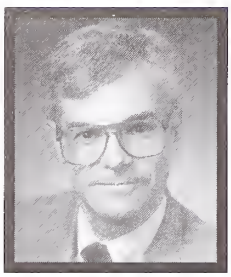
POSTDOCTORAL TRAINING: LOOKING BEYOND TODAY



Michael Gottesman

Ari Helenius, the initial speaker at the first annual NIH Fellows Symposium on Oct. 12, pointed out that postdoctoral training was not only invented by the U.S. biomedical research community, it may be the single most important factor driving our nation's impressive achievements in biomedicine. Because the intramural program trains about 15% of the biomedical research fellows supported by NIH funds, we have a special responsibility to lead the way in perfecting the art of training fellows for productive and personally fulfilling careers.

Until recently, postdoctoral training was viewed simply as a time for doctoral recipients to work in a laboratory unencumbered by distractions such as teaching or administrative responsibilities. This is a transition period when the fellow learns how to formulate scientific hypotheses and design experiments without constant supervision. But now the period has also become a time for postdocs to consider whether they will pursue careers as independent researchers, as collaborative researchers, or as nonresearchers in a science-based discipline. In the 1990s, this decision has become critical—and for many, agonizing.

Although the number of jobs in the biotech industry has doubled over the past 15 years and the amount of research support from private foundations such as the Howard Hughes Medical Institute has also increased, NIH's current steady-state budget means that there is not nearly enough funding to provide independent research positions for all of the postdocs in the United States.

Because most fellows begin their training with hopes of becoming independent researchers, NIH's intramural program must make every effort to provide training that will allow our fellows to compete in a world where independent research positions and funds are increasingly scarce. The prime contributor to such success is exposure to a high-quality research program with a superb mentor who understands both the need to advise and the need to step back as the fellow achieves independence. Recent improvements in the review of intramural labs by our external Boards of Scientific Counselors and the addition of new outside recruits at the junior and senior levels should enhance an already outstanding intramural research program. And the new NIH Committee on Scientific Conduct and Ethics is developing mentorship guidelines based on the central premise that a postdoc is not simply a "pair of hands" in the lab, but has the right to expect training in solving biomedical problems and assistance in career development.

Other actions that we are taking will benefit postdocs headed for a wide variety of careers—be they collaborative or independent investigators in academia, government, or industry. We have established a five-year limit for postdoc training at NIH. Although not always appreciated by fellows, the purpose of this rule is to ensure that fellows are not exploited to meet programmatic needs at the expense of developing their own careers. Although a normal postdoc period may be only two to three years, adding a year or two more in some cases allows progress on more complex research problems and provides a period of increasing independence. For clinical research training and in rare cases in which a programmatic need is overriding, even up to three years beyond the five-year limit may be approved. However, longer periods of training are undesirable because they usually make it more difficult to find an acceptable job outside NIH.

IF HISTORY IS ANY GUIDE, TODAY'S NIH POSTDOCTORAL FELLOWS REPRESENT A SUBSTANTIAL PROPORTION OF THE WORLD'S FUTURE SCIENTIFIC LEADERSHIP.

At the same time, fellows must be made more aware of the possibilities outside academia. NIH's Office of Science Education is developing a career-placement service for fellows who may choose not to have grant-funded research careers. Fellows need to be educated about "nontraditional" career opportunities that use their training in fields such as technology transfer, science policy, teaching, scientific administration, and business.

The NIH Fellows Committee has also taken an active and effective role in developing programs for basic and clinical research fellows. The group has substantially added to the intellectual atmosphere at NIH by nominating speakers for the Wednesday Afternoon Lectures and arranging for speakers to spend time with trainees, by organizing a day-long Fellows' Symposium, by working with special interest groups to develop workshops, and by organizing a fellows' travel-award competition. I strongly endorse a recent proposal by fellows to bring in speakers who work in nontraditional, science-based disciplines to share information about their careers.

If history is any guide, today's NIH postdoctoral fellows represent a substantial proportion of the world's future scientific leadership. These fellows deserve the best training and career guidance that we can give. Toward that end, each mentor at NIH must exert every effort to help fellows in these difficult times, and, despite the temptation to become paralyzed by cynicism and despair, every fellow must play an active role in shaping his or her scientific future by performing the best possible research and seizing career opportunities as they arise.

Michael Gottesman
Deputy Director for Intramural Research

The Training Experience: How to Make a Good Thing Better

by The NIH Fellows Committee

Our committee, which is a group of fellows representing every institute, center, or division (ICD), was invited by The NIH Catalyst *to comment on problems encountered by postdoctoral fellows at NIH. At our monthly meeting in October, we discussed this topic and several common themes emerged. The views expressed in the following article reflect the opinions and experiences of individual committee members and do not necessarily represent the position of the entire committee. We acknowledge that the postdoctoral experience at NIH is not uniform and is influenced by the attitudes and practices of the ICD and even of the laboratory or branch in which a postdoc works.*

There is a strong consensus among members of The NIH Fellows Committee that the quality of the scientific training at NIH is unique and outstanding. However, many of us also feel that there are a number of serious problems with the NIH postdoc experience that need to be addressed. Although our concerns are as diverse as the types of science being done on campus, the major shortcomings of being an NIH fellow in the '90s tend to fall into three general categories: mentoring, jobs, and special needs of certain groups. The following is our discussion of these problems and some suggested solutions.

Mentoring

NIH's primary purpose is to conduct scientific research that improves the nation's health. But isn't another purpose of NIH to serve as the largest single training center of postdoctoral fellows in the biomedical sciences? It's time to realize that scientific productivity is not the only standard by which NIH's success can be measured. Another critical test is whether or not this institution can provide the mentorship necessary to adequately train the next generation of scientists.

The sad truth is that *most* fellows feel that NIH has not yet succeeded in the area of mentorship. Many of us feel that, in the name of productive science, advisers take advantage of fellows, using them as "slave labor" rather than entering into a partnership with them that would allow for good science for the lab *and* successful career development for the fellow.

This begs the question: who is mentoring the mentors? Is anyone at NIH teaching senior scientists to focus some of their attention on the careers of their fellows, not just their gels? The answer in some ICDs is, apparently, no one! There needs to be a campus-wide effort to provide uniformity in helping advisers develop into accomplished mentors as well as fine scientists.

For starters, most postdocs would like to receive better feedback from their mentors. Perhaps NIH should require regular evaluations of the scientific progress of fellows. Some fellows report that they have no opportunity to sit down with their mentor on a regular basis and take a close look together at their progress, or lack thereof. Other fellows think that NIH may want to consider some type of *outside* peer review of postdocs' work.

Jobs

Perhaps the number one disadvantage that NIH postdocs face when they compete against other postdocs in the job market is our inability to establish a track record in grantsmanship. One suggestion to help alleviate this problem is to encourage more postdocs to write for outside grants from private institutions. This could be facilitated by publishing a booklet listing private foundations as well as tips on writing a good grant. Another suggestion is to establish an intramural, peer-reviewed postdoctoral grant program. Although this would require more work for postdocs in the short term, it definitely would be a long-term boost for their scientific careers.

We all know that the job market is not what postdocs or their advisers would wish for. But what are we at NIH doing to give ourselves a competitive edge in this bad market? We need heightened marketing skills, new alternatives, better networking, and cross-training. Fellows need opportunities to meet with head hunters and industry representatives. We need job fairs!

These days, it seems almost impossible for a fellow to get a foot in the door for a good academic position without a helpful letter or phone call from a senior researcher. We need our advisers to be *actively* involved in our job search. It would be great to know that advisers would accept some responsibility for helping the fellows they have trained get placed in good jobs.

We also need more information on how NIH's intramural program is reshaping itself. What kinds of positions are being downsized? What changes in NIH career opportunities can we anticipate, and how can we take advantage of them?

Foreign Fellows And Clinical Associates

There is strong sentiment among foreign fellows that the information at NIH about all-important visa issues is inadequate. Some fellows have had to hire immigration lawyers because they cannot get good counseling on campus.

NIH Fellows Committee at a Glance

Meeting Time: First Thursday of every month, 4:00–5:30 p.m.

Meeting Place: Bldg. 10, Rm. 2C310. All NIH scientists are welcome to attend.

Contact: Richard Nelson, NIDA, co-chair
Phone: 410 550-1412; E-mail: RNELSON@irp.nida.nih.gov

Resources: The Fellows Committee has sponsored career-development seminars, forums on the tenure-track policy, speakers for the NIH Wednesday Afternoon Lectures, and an all-day scientific symposium on the Molecular Mechanisms of Disease. Among its biggest achievements is the establishment of the NIH Fellows Award for Research Excellence, a merit-based travel award program for clinical and postdoctoral fellows. It has also worked with the Office of Education to develop a fellows handbook and to coordinate the annual NIH Clinical Teacher Award. ■

One possible solution is to set up an immigration ombudsman office that is independent of the Fogarty International Center. In addition, special assistance might be offered concerning the problems faced by foreign fellows who are searching for a job in the United States.

NIH has also not dealt adequately with another major headache for foreign fellows: the problems of language barriers. Prejudice and bias against foreigners is an unfortunate fact of life in some labs. What can we do to ensure that foreign fellows are not held to tougher standards than their U.S. counterparts?

Clinical fellows may differ from other postdoctoral fellows in having little formal training in research methodology. The prospect of becoming skilled clinical researchers is a primary draw for M.D.s coming to NIH. However, many clinical associates find their schedules so hectic and educational opportunities so limited that obtaining formal training remains an elusive goal. Apart from the new Clinical Research Core Curriculum, we are left with a catch-as-catch-can system of training. The politics and red tape involved in clinical research today also frequently extend a project's duration beyond a typical clinical associate's term—leading many clinical fellows to view themselves as simply another cog in a machine that too often seems to produce few tangible results.

Assorted Gripes, From Pay to Beer

Postdocs who are Intramural Research Training Award (IRTA) fellows work under terms that are left almost entirely to the discretion of their advisers. The lack of information on matters such as annual and sick leave or contracts leaves many IRTA fellows feeling unduly stressed.

Why can't there be a congressional exception that lets fellows qualify for Metro Rideshare rebates? Or, if that's not possible, how about a campus-wide initiative that compensates fellows for using environmentally sound methods of transportation?

Fellows' salaries should be raised more often and more substantially. As the postdoc position has evolved from being a short period of simple training to what is now a longer period with greater responsibilities within a lab, there ought to be greater financial reward.

Fellows at satellite campuses often feel cut off. Many receive announcements of activities on the main campus after the fact, or when they do receive them in time to go to Bethesda, they find it difficult to find a parking place.

NIH needs to help foster a sense of community among postdocs. Many of our nation's best scientific institutions have a bar on campus. This issue has come up again and again—we need a friendly beer pub on campus. Hey, how about in the B level of Building 27? Has anyone seriously looked into ways to install a friendly watering hole for beleaguered postdocs and their mentors? ■

Editor's Note: *Fellows may currently use the FAES Social and Academic Center at Cedar Lane and Old Georgetown Road for social gatherings.*

What Is FELLOW-L?

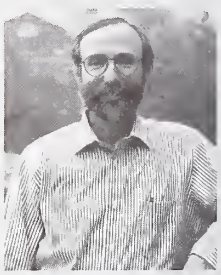
For some, FELLOW-L may be a lifeline. For others, a sounding board. And for still others, a glimpse at a world they had almost forgotten. To put it plainly, FELLOW-L is a new e-mail communications link established to enhance the training of scientists at NIH. This link, which is called a "'listserv," is open to everyone at NIH with an interest in postdoctoral or clinical associate issues. The NIH Fellows Committee, which maintains the list, hopes it will serve as a forum for fellowship, educational, scientific, employment, and cultural issues. To sign up for the list, send an e-mail message that reads,"SUBSCRIBE FELLOW-L YOUR NAME" to this address: LISTSERV@NIHLIST.BITNET ■

Office of Education at a Glance

Contact: Director Michael Fordis

Phone: 496-2427

Location: Building 10, Room1C125



Michael Fordis

Resources: In addition to distributing information on training opportunities and fellowship funding in the intramural program, the Office of Education—soon to become the Division of Intramural Training within the Office of Science Education—serves as the main institutional source of guidance and counseling for fellows once they arrive at NIH. It provides logistical support to the NIH Fellows Committee and, in conjunction with that committee, has created a new "NIH Fellows Handbook," which should be published this winter. Also available is information on a variety of topics, including NIH's tenure-track policy, loan-repayment programs, and post-NIH employment restrictions that relate to intellectual property and conflict of interest. The office maintains a job-opportunity binder, but has discontinued its EMPLOY job bank on the NIH-EDNET because of the lack of employer response and the difficulty that many fellows had in accessing that database. Now, the office is working on organizing career-development workshops and a project to put fellows' résumés in a new "job seekers" section on The Community of Science Web Server—a database designed to help individuals and employers locate researchers with the interest and expertise they desire. Currently, more than 40,000 scientists are listed at that site, which can be reached on the World Wide Web at this Uniform Resource Locator (URL): http://cos.gdb.org/ ■

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Representatives serve a one-year term, with a maximum of two terms of service.

Ph.D. Plight, A Numbers Game?

Much of the pressure that postdocs are feeling these days boils down to a matter of numbers: the growth in the production of biomedical Ph.D.s outpacing the growth in the number of desirable research jobs. For example, a recent report from the National Academy of Sciences (NAS) found that the annual number of biomedical Ph.D.s awarded to U.S. citizens and permanent residents increased 10% in the late 1980s and early '90s—rising from 3,400 in 1987 to 3,800 in 1992. One indicator that the supply of biomedical Ph.D.s may be exceeding demand is the starting salaries of Ph.D.s who hold full-time jobs, excluding postdoc positions. The NAS report shows that the starting salaries of biomedical Ph.D.s have been growing relatively more slowly than salaries for Ph.D.s in other scientific fields, with biomedical Ph.D.s' salaries increasing 8% less than the salaries of other science Ph.D.s between 1979 and 1991. ■

The Human (Management) Factor: One Researcher's Opinion

by Roger G. Erickson, Ph.D., NIMH

The "training" received in the course of postgraduate training fellowships of every kind—both inside and outside NIH—is almost invariably an absolute joke. It might help if there were guidelines for providing real training just as there are for manuscript authorship. For example, a postdoc must have at least one independent project, must personally present the data at a meeting, and must publish it as the sole author. In addition, he or she must participate in reviewing a paper and must apply for a grant. That would constitute training and preparation for an independent career. Otherwise, postdocs are nearly universally treated as workers who must find their own way to an independent career. Even having guidelines won't guarantee anything. What students need most is for someone to take the time to give them advice.

I've worked in eight different labs since I started as an undergraduate. The value placed upon human management was clearly evident or lacking in each. Some researchers successfully develop the talent possessed by students. Others simply attempt to use what's apparent on the surface or even try to force desired results without assessing skills or weaknesses. There is no doubt in my mind that the first approach is far more productive and efficient than the second and third. Everyone has something to learn and every lab can benefit by assessing what each student needs to learn. The needs are often not related to technical skills. A typical lab includes some combination of the following types of students and postdocs:

1. A fairly sophisticated person from a well-to-do family with one or more professional parents. Went to a good school. Often abrasive and aggressive, somewhat arrogant even if unaware of it. Often masters lab politics, is savvy, and is comfortable with surviving in laboratory environment even when not particularly interested in science per se.

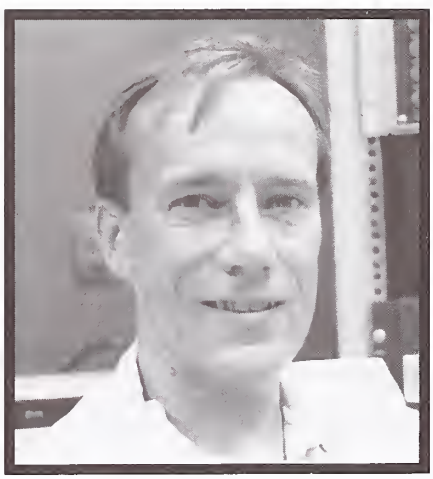
2. A *Wunderkind* bright enough to have gotten this far while remaining totally naive about every other aspect of life (i.e., can program your computer in assembly or devise complicated mathematical models overnight, but can't change a flat tire, feed himself or herself, or develop any personal relationship).

3. A constant complainer who drags on for years while never learning how to function independently despite possessing particular skills. Is often a source of friction in lab.

4. A very unsophisticated person who is bright enough to learn everything but is intimidated by everything. May come from a dysfunctional family, a poor, inner city neighborhood, or from a backward coal-mining town in East Tennessee. May be quite bright and reasonable, but is uncomfortable with aggressive, cynical co-workers or sudden exposure in the form of lab meetings, presentations at meetings, and attempts to write papers.

5. A nice, well-rounded person who is a pleasure to work with and watch develop.

Unfortunately, talent or genius is unpredictably distributed among these people and people of other descriptions. A good manager sees each person for what he or she is, and by taking the time to give advice, sees that each learns the small things needed to work well without supervision, to plan a career, and, eventually, to manage his or her own lab. After five to 10 years of such effort, a good manager often has a strong lab or nationally respected department staffed by a mature and secure group of excellent and committed scientists and/or technicians. The workers (and, ultimately, their field of endeavor) benefit by getting early and constructive feedback on what they need to learn, rather than criticism for what they fail to produce. Perhaps most importantly, the students learn to take an interest in each others' careers, in their department or lab, and in the state of their field. Everyone wins if the top priority is training people instead of just producing scientific results.



Bob Gelhard

Roger G. Erickson

A bad manager takes the same group of people and does nothing except expect them to produce results. At some end point, the individuals are judged as having "produced" or "not produced" and are either promoted or terminated, and the cycle continues. In this setting, survival of the fittest may not be a valuable strategy for either the lab or its field since "survivors" will perpetuate poor management practices. Many of the characters go through several cycles in other labs before finally finding their own ways to a successful strategy or to a more rewarding or more suitable career. The length of this process depends just as much on the quality of the people one learns from (i.e., peers and managers) as on individual talent.

After spending just one week in a lab, it is possible to predict which postdocs are likely to succeed and which are likely to fall by the wayside. People from excellent families, neighborhoods, or schools do indeed have an initial advantage and can, at least at first, be used more effectively than those from less sophisticated backgrounds. However, people with less preparation but with adequate or superior talent or abilities are nearly invariably underutilized for long periods of time—a tremendous waste of resources.

Most successful corporations recognize that their major expenses and most valuable commodities are almost invariably their work forces and not their products or raw materials. Academia, including government labs, is one of the last places where the long-term value of human-resource management is underappreciated. There are many examples of scientific "managers" who have developed remarkable labs or departments staffed by independent scientists whose collective results far outstrip the individual achievements of the "manager." Unfortunately, there are many more examples of scientists who have achieved some degree of personal acclaim, but who never contribute to formation of a productive group and who never pass their skills on to the next generation of scientists. Over time, the legacy of a strong department or lab is almost always more valuable than the accomplishments of any particular person. In terms of a return on investment, a manager who fails to develop a strong lab or department is a much more expensive mistake than a postdoc who doesn't publish enough. ■

Ten Ways to Improve Postdoc Life

by Mike Powell, Ph.D., NICHD

1. Keep track of where postdocs go when they leave NIH. Do they get tenure-track jobs, another postdoc, a manager's job at Radio Shack? I was recently told that these vital statistics are not kept at NIH. It is difficult to gauge whether the "training" aspect for fellows is successful if no one knows what happens to past postdocs.
2. Conduct exit interviews with postdocs.
3. Make success in mentoring a criterion for promotion of principal investigators at NIH. Success can be in part measured by the results of exit interviews.
4. Encourage communication among postdocs by creating a directory of fellows listing e-mail addresses and phone numbers, along with some biographical information, if possible.
5. Require institute directors to hold meetings of fellows and associates on a regular basis.
6. Make IRTA fellows eligible for programs that other NIH employees enjoy—for example, educational-loan–repayment and commuter-reimbursement programs.
7. Treat postdocs with some respect.
8. Provide better training for grant-proposal writing.
9. Provide a placement service for outgoing postdocs. For example, the Office of Education could keep a list of postdocs currently seeking employment and advertise to potential employers that such a system is in place.
10. Have more Dent cartoons in *The Catalyst*. ■

Grant-Writing Workshop: Better Late than Never

Contrary to some rumors that have been swirling around the NIH community, NIGMS's grant-writing workshop has not been canceled—just moved back to its customary April time slot. Last fiscal year, NIGMS decided to try holding the workshop in the fall (the fall of 1994), but attendance was much poorer than when the event was held in the spring. So, this fiscal year, the all-day event, officially titled "Grant Workshop: Extramural Progams and Grant Support," will be held on April 22 in the Natcher Building. "Anyone can enroll. There is a lot of information that is particularly directed at staff fellows who anticipate leaving NIH soon and setting up their own labs," says Paul Wolfe, program director in the Division of Genetics and Developmental Biology at NIGMS. The seminar provides a general overview of the extramural grant process along with perspectives from extramural grant administrators and from outside scientists who serve on study sections. Among the most popular features of the workshop is the afternoon "breakout" session, in which participants can have their questions answered "one-on-one," Wolfe says. For more information on the free workshop, contact NIGMS's Doris Smith (phone: 594-0943). ■

New On-Line Radiology Resource

by Irwin Feuerstein, M.D., CC

As part of NIH's effort to tap into the power of the World Wide Web, the Clinical Center's Department of Diagnostic Radiology is encouraging intramural researchers to check out its new home page, replete with an electronic radiology and medical teaching file. The goals of this innovative teaching site are to store a collection of educational and illustrative radiographs and to provide information about the diseases the radiographs depict. In addition to the instructional file, organizers of the diagnostic radiology home page are currently developing files to promote the Clinical Center, recruit patients, and report conference proceedings. Other possible applications include the electronic storage of imaging-related lectures, as well as the presentation of research posters in digital format. Organizers are also seeking additional teaching materials, including more cases and, more importantly, other interesting imaging-based applications. Although the site is still under development, diagnostic radiologists are opening it up to the NIH community for preliminary evaluation of its format and utility. At the bottom of each on-line page is a link that enables users to send an e-mail message to the site's developer, or "webmaster." Users are encouraged to click on such links after exploring a site and provide the webmaster with feedback. To access this new radiology resource, launch a World Wide Web browser program, such as Netscape or Mosaic, and enter the following address, or Uniform Resource Locator (URL), in the "Open location" or "Open URL" box: http://www.cc.nih.gov/drd/home.htm ■

CASE: Colonic Gangrene Complicating Burkitt's Lymphoma

HISTORY

A 20-year-old male previously diagnosed with Burkitt's lymphoma complains of a mild fever earlier that day due to inflammation of the colon. His condition escalated reapidly and within a few hours he was overcome by gas gangrene and deceased shortly after.

Learn more about Burkitt's Lymphoma
See more cases of Lymphoma
See more cases of gangrene
Learn more about gangrene

What It Means to Be a Mentor

There are probably as many styles of good mentoring as there are ways of doing good science. However, adjectives such as "supportive," "patient," and "enthusiastic" often pop up in the descriptions of scientists whom postdocs and clinical associates consider to be top-notch mentors. The NIH Catalyst *asked two intramural researchers who've earned high praise from their scientific protégés to share a few of their thoughts on mentorship. William Coleman, a group leader in NIDDK's Laboratory of Biochemical Pharmacology, and Henry Masur, chief of the Critical Care Medicine Department at the Clinical Center, offer the following perspectives.*

How would you describe the quality of mentorship you received as a young scientist on the way up?

Coleman: The mentors who were influential in steering me toward biomedical research shared the uncanny ability to recognize the potential in me—and the willingness to take exceptional measures to provide me with the opportunities for a scientific career. Let me elaborate. I began my undergraduate schooling as a music major. I quickly realized the limited possibilities for a career in music, especially for a black organist. I toyed with the idea of going to medical school but lacked the financial support to pursue such an idea. Being young and foolish, I left Alabama for Atlanta to pursue broader opportunities.

I visited Mary Reddick, chair of the Biological Sciences Department at Atlanta University. I had not even applied for admission and had no financial means for graduate school. Before examining my transcript, Dr. Reddick accepted me conditionally, requiring me to perform general laboratory assistance, i.e., clean mice cages. I enthusiastically accepted her offer. That was the turning point in my education and my career. She was a unique role model—a black female scientist who overcame immeasurable barriers. She demanded that I achieve goals that seemed beyond my limits, and yet she was caring and I knew that she would not allow me to falter. After Dr. Reddick, I had three other mentors who played important roles in guiding me toward biomedical research—Drs. Lafayette Frederick, Frissell Hunter, and Luther Williams. They provided me with fellowship support and laboratory resources.

Masur: My mentor at Cornell was, I suspect, fairly typical of a successful mentor. He was an impressive role model for young physicians in that he was a superb clinician yet he was also widely published. His knowledge of parasitology, his perspective on the relative importance of issues, his ability to criticize me and others in a constructive manner, and his generosity in allowing me to develop my own career enhanced my enthusiasm and productivity. More importantly, they imbued me with a sense that science was both important and fun. There are many mentors here at NIH like him. Across the country, however, there are not enough similar individuals to accommodate all the promising young scientists or, more specifically, not enough mentors with funding so that they can afford to spend the time both pursuing science and being a mentor.

Lorna Heartley

Henry Masur, right, with Andre Kalil, left, and Suresh Narayanan

Now that you are a senior scientist, how do you approach your role as mentor?

Coleman: I firmly believe that senior scientists have an obligation to train the next generation of scientists. We need to recognize those who have the potential to become first-rate scientists and to inform others about career options that benefit from scientific training, such as work as science policy makers, science administrators, science writers, and, very importantly, science teachers. For more than a decade, I've taught a grad-level course in bacterial physiology at Howard University. This allows me an added arena for mentoring.

Masur: Our department invests considerable effort in identifying fellow candidates who have the intelligence and the drive to be successful. Persuading such candidates to come to NIH requires considerable effort, but is clearly time well spent. After they come, we try to set challenging goals and then to provide a steady stream of positive reinforcement combined with constructive criticism and further opportunities for the individual to develop a scientific identity of his or her own. During fellows' research years, I think that they need to be provided with adequate scientific, technical, and administrative resources so that they can be successful. They need regular feedback that they are headed in the right direction, that their techniques are appropriate and that their endproduct is both attainable and important.

What is the most difficult aspect of mentoring? The most rewarding?

Coleman: The time and energy required for mentoring should not be underestimated. However, I found that at the NIH, one of the major difficulties is laboratory space. When summer research students arrive, I scramble to find a small lab bench space for them, and they often have to sit in the hallway to read.

Reward is measured by the success of the students I've mentored and the realization that in some small ways, I might have contributed to their success. ... The first student I mentored is now a thoracic specialist practicing in California. Two years ago, I had a high-school student from Washington, D.C. She was a bright and hard-working student. I was pleased to read in the news that she was honored in a presidential ceremony, having been selected by the Children's Defense Fund as a student who had succeeded despite immense hurdles. Others are similarly successful in various scientific careers.

Some are faculty members in research institutions, researchers in biotech firms, and many are physicians.

Masur: It is difficult to offer criticism in a way that is constructive to the project and to the trainee's intellectual development. It is rewarding to see trainees succeed, but the mentor-trainee relationship is often a precarious one. There comes a time when fellows need to establish their independence in another lab or at another institution, even though their work under their mentor is productive and convenient for both parties. Certainly, there are many examples of mentors who are threatened by the success of their trainees, who cannot admit that great ideas at some point might be the exclusive creations of the trainee, and who thus end their relationship in a manner that creates unhappiness and may be destructive to one (or occasionally both) careers. For me, however, it is rewarding to see trainees embark on careers that are scientifically productive, and which they themselves perceive as worthwhile and productive.

Lorna Heartley

William Coleman, center, with, from the left, Lishi Chen, Teri Ballou, and Li Ding.

What concrete advice do you have for other scientists who are assuming the role of mentor or who would like to improve their mentoring skills?

Coleman: Provide a nurturing and supportive environment in the laboratory; assign students specific meaningful projects. Do not view students as "just an additional pair of hands"; acknowledge their contribution to the project. ... Elicit family support in a student's commitment to time and energy in laboratory research (i.e., that it is not a 9-to-5 job and often requires them to work on weekends). Serve as a role model who teaches, counsels, and opens career doors.

What advice do you have for young scientists when it comes to improving their relations with their mentors?

Coleman: Be aggressive and learn as much as they can; learn not only about the project in which they are involved but also how it relates to a larger picture; learn how their mentor chose his/her career path; learn career options.

Masur: Young scientists early in their relationship with their mentors need to establish goals and expectations that are realistic. They also need to establish the ground rules: how long will the training period be, what resources will be available such as technical help and supplies and space, what are the prospects for a permanent position, what salary and benefits will be available, and what will the authorship policy be early and later in the relationship? These are sensitive issues, but the mentor owes it to the trainee to be specific about these issues and to update the trainee about changing prospects for first authorship, support, etc.

What can NIH as an institution do to improve the quality of mentorship provided to its trainees?

Coleman: When I came to NIH in the '70s, I was often told that NIH is a research institution, not a teaching institution. Therefore, there was no emphasis placed on NIH scientists to be mentors. I've noticed a slow shift in culture and attitude toward mentoring. The fact that *The Catalyst* is interested in this subject is a clear statement acknowledging that change. While individual scientists need to make their own commitments to train the next generation of scientists, it requires the support of the NIH leadership to make mentoring a valued activity. Promotion for intramural scientists should take into account mentoring activities. Mentorship may not result in publications, yet such activities are necessary and take time and energy.

Masur: NIH is a wonderful place to be a mentor since there are such outstanding resources available in both clinical and basic science areas. Many perceive NIH's sole mission as being the production of superb research: when promotions and resources are allocated, there is not always a clear understanding concerning the importance of training and mentorship and how the value of those activities compares with research productivity. This is evident by the fact that some superb scientists and labs invest in training and mentorship, while others do not. If a trainee is to be successful, part of the resources that he or she needs include a training period that is long enough for the trainee to develop the skills and produce the publications necessary to obtain a first-rate job. Other necessary resources include lab supplies, administrative assistance, and travel to professional meetings. NIH needs to track the accomplishments of their trainees who leave NIH, and make sure that the investment in training is paying off. If NIH trainees are not meeting expectations when they leave, NIH should modify its training programs and mentorship policies. If one looks at the success of the many M.D.s and Ph.D.s who have trained at NIH and then left over the past 20 years, it's clear that many of NIH's training programs have been fabulously successful, and we should continue investing heavily in this worthwhile endeavor. However, we need to continuously monitor our "products." Lastly, it is important to point out that NIH offers courses through the FAES [Foundation for Advanced Education in the Sciences] that greatly facilitate training. These courses, and the recent introduction of a clinical research core curriculum by Clinical Center Director John Gallin, need to be supported and expanded since they add substantially to what one lab—or mentor—can provide. ■

Institutional Mentorship: The Making of Models

by Rebecca Kolberg

Although there's no substitute for the one-on-one guidance of a wise mentor along the rocky pathway to becoming an independent researcher, some parts of NIH are beginning to realize that part of the responsibility for ensuring that trainees receive adequate training and mentorship rests with the institution itself.

Currently, there are no NIH-wide guidelines for mentorship. However, the newly established NIH Committee on Scientific Conduct and Ethics recently formed a subcommittee to develop mentorship guidelines to be appended to the NIH Guidelines on the Conduct of Research. In addition, two institutes, centers, or divisions (ICDs)—NIMH and the Clinical Center—are getting the ball rolling on their own.

In a report endorsed by NIMH Acting Scientific Director Sue Swedo and presented Oct. 16 to the institute's lab and branch chiefs, NIMH's Fellowship and Education Committee sets forth some far-reaching recommendations for improving the training of the approximately 150 basic research fellows and 25 clinical research fellows in the institute's intramural program. The recommendations include

- Conduct annual performance reviews for all fellows and mentors. The reviews should include a priori benchmarks such as mastering a specific lab technique, presenting at journal club, and writing a protocol. Because it is often impossible to predict how experiments will turn out, the committee did not support using the publication of papers and submission of scientific abstracts as benchmarks.
- Establish an NIMH Office of Fellowship Education to monitor performance reviews, mediate conflicts between mentors and trainees, provide information about educational resources at NIH and neighboring institutions, offer career counseling, and ensure availability of a core curriculum for clinical fellows.
- Set up a Fellowship Educational Advisory Board to advise the director of the Office of Fellowship Education.
- Improve grantsmanship training by providing didactic grant-writing experience for fellows, which may include seminars and a practicum.

"Our recommendations should enrich fellowship training at NIMH by providing greater uniformity of experience. This should improve both the recruitment and placement of fellows," says Alan Breier, chairman of the committee. "Well-trained fellows will produce better work in their branches, and that will improve the overall quality of science done in the intramural program." Now a tenured scientist in NIMH's Experimental Therapeutics Branch, Breier notes that although he received excellent scientific guidance as a postdoc at NIMH from 1984 through 1987, he felt ill-prepared for the world of competitive grant writing when he ventured out of NIMH to take a position as a senior scientist in charge of his own research group at a nearby university.

> "Most fellows fail to progress due to correctable reasons that could be addressed in their first year, if only their mentors took the slightest interest in their eventual success."
>
> —NIMH Fellow

Many of the report's recommendations stem from a proposal authored by the NIMH Fellows Committee, which sent its suggestions along with a questionnaire to all of the institute's fellows in June. The Fellows Committee survey, which had a response rate of 27%, found that although the majority of fellows reported they were receiving good mentorship, about one fellow in eight "disagreed" or "strongly disagreed" with this statement: "My mentor has been helpful in promoting my professional development." Guinevere Eden, who chaired the NIMH Fellows Committee, says, "Although we didn't get a sense that most fellows had many really bad problems with their mentors, we felt if even one in 10 was experiencing difficulties, it certainly would be worth making the situation better."

Seven percent of NIMH fellows responding to the survey reported that they do not have adequate access to their mentors, and 17.5% said the research they are carrying out is solely in their advisers' best interests. In the space for further comments, one basic fellow wrote, "The nature and content of the [scientific] presentations are very tightly controlled by my adviser to the point where I feel that I am presenting only the adviser's ideas and interpretation of the data, and not my own." Another basic fellow observed, "Most fellows fail to progress due to correctable reasons that could be addressed in their first year, if only their mentors took the slightest interest in their eventual success."

Overall, clinical fellows seemed more satisfied with the quality of mentorship they had received than basic fellows. More than 70% of clinical fellows meet with their mentors individually at least weekly, compared with about 55% of basic fellows. More than 90% of clinical fellows consider their mentors to be helpful in professional development, compared with about 75% of basic fellows. All the clinical fellows who responded to the survey said they had been encouraged to present their work at scientific meetings, compared with 81% of basic fellows.

Both the Fellows Committee and the NIMH Fellowship and Education Committee found that there is a strong desire among clinical fellows for formal research training such as courses in statistics and experimental design. One clinical fellow wrote that he looked forward to taking part in the Clinical Center's Core Curriculum for Clinical Research but lamented that the first two offerings have been filled because preference is given to senior fellows.

Indeed, the Clinical Center is another part of NIH where the concept of insti-

tutional mentorship is being paid more than lip service. Begun last April, the 44-hour, accredited Continuing Medical Education course for fellows is taught by 30 staff members. Divided into four modules, the curriculum uses both didactic lectures and practical experiences, such as meetings of mock Institutional Review Panels, to teach everything from meta-analysis methods to ethical and legal issues to the design and funding of a clinical research study. Although clinical associates ideally would have encountered many of the topics during their three to four years of NIH training, Bruce Baum, clinical director of NIDR, says he considers the core curriculum to be a kind of "safety net" to ensure that departing trainees are equipped with the "fundamental set of skills deemed necessary for clinical research."

In addition to providing institutional mentorship in the form of the core curriculum, the Clinical Center also plans to address issues involving individual mentorship through the Medical Board's Training and Career Paths Subcommittee. In meetings that began this fall, the panel plans to conduct a systematic evaluation of the mentorship received by clinical associates and develop suggestions for improving the training experience for both students and mentors. "You can be a great scientist and not be a great mentor, and the reciprocal is also true," says Baum, who heads the subcommittee. "Personally, I don't think everyone should be a mentor."

According to Baum, the subcommittee particularly wants to study ways of recognizing NIH scientists who have an excellent track record in helping fellows go on to successful scientific careers. Clinical associates and senior scientists can submit their comments on mentorship to the subcommittee by faxing them to Baum at 402-1228. "Mentorship is not a trivial issue," Baum says. "It's the future of biomedical science." ■

PIA Award

The Printing Industries of America has honored *The NIH Catalyst* with a 1994 Certificate of Merit. The award for "outstanding printing and design" was presented to NIH and Peake Printers Inc. of Cheverly, Md., the contractor that printed the issues of the newsletter submitted to the competition. ■

New Life For Old Equipment

One scientist's trash may be a student's treasure. That's what the Office of Science Education is finding out in its new Resource Program, which collects outdated scientific equipment from NIH labs to use in educational outreach. This equipment will be part of the teaching tools used by NIH scientists who volunteer to go into the classroom and work with students and teachers in grades K-12. Items that are in particular demand are microscopes, mini-gel boxes, power sources, small centrifuges, balances, and glassware. The equipment should be in working condition. For more information, contact Gloria Seelman (phone: 496-0608; fax: 402-3034; e-mail: gq5@cu.nih.gov). ■

Registration Reminder: Molecular Genetics of Development

Although NICHD's conference on the Molecular Genetics of Human Development is almost a half year away, organizers are urging intramural researchers to send their registration forms in early if they want to be ensured a place at the popular meeting. That advice should not be taken lightly since NICHD's 1994 conference on the same topic was oversubscribed. The registration deadline for this year's conference, which is scheduled for May 1–4 at Airlie House in Airlie, Va., is Feb. 4. Requests will be filled on a first-come, first-served basis. The cost for room and board, based on double occupancy, is $420. In addition to an array of developmental experts from NICHD, this year's speakers include David Anderson of the California Institute of Technology in Pasadena, Juan Botas of Baylor College of Medicine in Houston, Linda Buck of Harvard Medical School in Boston, Mario Capecchi of the University of Utah in Salt Lake City, Victor Corces of Johns Hopkins University in Baltimore, Eddy De Robertis of UCLA School of Medicine in Los Angeles, Peter Gruss of the Max Planck Institute for Biophysical Chemistry in Gottingen, Germany, Marnie Halpern of the Carnegie Institute in Baltimore, Matthias Hammerschmidt of Harvard University in Cambridge, Mass., Alexandra Joyner of NYU Medical Center in New York, Chris Kintner of the Salk Institute in San Diego, Ruth Lehman of the Whitehead Institute for Biomedical Research in Cambridge, Mass., Robin Lovell-Badge of the Medical Research Council in London, Randal Moon of the University of Washington in Seattle, Don Riddle of the University of Missouri in Columbia, and Janet Rossant of the Samuel Lunenfeld Research Institute in Toronto. For more information, contact NICHD's Kathy Shoobridge (phone: 496-4448; fax: 496-0243; e-mail: idawid@nih.gov). ■

Half Empty, Half Full: How Bad Are Job Prospects?

"Are you going to write the truth—that there are no jobs out there?"

Astonishingly enough, this quote did *not* come from a postdoc who has been searching for employment with no luck for the past two years, on the verge of eviction and having her car repossessed. It was actually made by a former NIH postdoc who recently found a permanent, science-related job in another government agency and whose spouse, also a former NIH postdoc, has secured a research job in the private sector. They didn't even have to relocate.

What the statement does reflect is the fundamental clash between reality and perception that occurs when many NIH postdocs discover that, despite years of diligent training and research, they may not get their dream jobs. Are there really no jobs out there for biomedical Ph.D.s? Or is the problem really one of perception, that is, "there are no *good* jobs out there," such as tenure-track positions at Harvard or UCSF?

To address such questions, it would help to consider some quantitative measures of the biomedical employment situation. Unfortunately, hard statistics on the fate of former NIH postdocs do not exist. Although it is hoped that such information will be included in an NIH-wide database now in the planning stages, the intramural program currently keeps no statistics on what sort of positions its approximately 3,000 postdocs and 225 clinical associates land when they leave NIH. "It is important to make available the resources to track fellows," says Michael Fordis, director of NIH's Office of Education. "Such information is vital to determining the outcome of the training you are providing."

However, the general employment outlook for America's next generation of Ph.D. and M.D. researchers *has* been touched upon in several recent studies, including the National Academy of Sciences' (NAS's) June 1994 report, "Meeting the Nation's Needs for Biomedical and Behavioral Scientists;" the Committee on Science, Engineering and Public Policy's (COSEPUP's) April 1995 report, "Reshaping the Graduate Education of Scientists and Engineers"; and Stanford University's August 1995 report, "The Production and Utilization of Science and Engineering Doctorates in the United States."

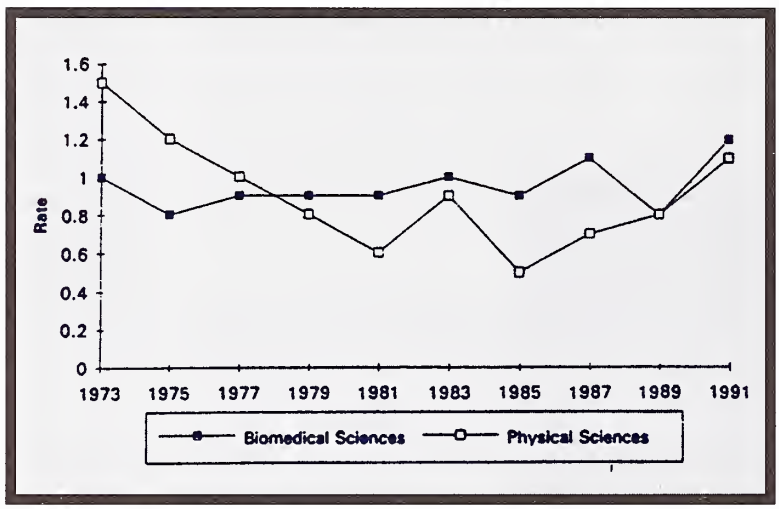


Figure 1. Underemployment rates of biomedical and physical sciences Ph.D.s 1973–1991. *(Courtesy National Academy of Sciences.)*

At first glance, the picture appears bleak. The Stanford report estimates that about 28% more bioscience Ph.D.s are currently being produced than can find employment in academia, industry, or government over the long term. According to the COSEPUP analysis, less than one-third of people awarded Ph.D.s in science and engineering from 1983 to 1986 were in a tenure-track position or had gained tenure by 1991. However, as the NAS findings illustrate, not all Ph.D.s are the same, and lumping biomedical Ph.D.s in with Ph.D.s from other fields such as mathematics, physics, and whole-organism biology may lead to an unduly grim career outlook.

According to the NAS report, the U.S. basic biomedical work force expanded dramatically in the 1980s, soaring from 64,000 Ph.D.s in 1981 to 92,000 Ph.D.s in 1991—a 44% increase that was double the rate of employment growth in other sciences and four times as great as the rate of growth of the entire U.S. work force. The NAS panel concludes that "expanding opportunities in health research" was the prime engine behind this "robust growth," which was accompanied by a 10% increase in the annual number of biomedical Ph.D.s awarded to U.S. citizens and permanent residents. The Stanford report, on the other hand, says that the production of science and engineering Ph.D.s may have far more to do with academia's need for teaching and research assistants than it does with the job market.

Despite the spurt in Ph.D. production, the NAS study shows the unemployment rate for biomedical Ph.D.s never surpassed 1.6% from 1973 to 1991—compared with a rate of 4.9% to 6.7% for the entire U.S. workforce during the same time frame. In a perhaps more relevant analysis, the report finds that the past two decades have seen a slight, but steady, increase in the percentage of biomedical Ph.D.s who are *under*employed, meaning they are working part-time when they would prefer full-time jobs or they are working at jobs that do not fully utilize their science skills. About 0.8% of biomedical Ph.D.s were underemployed in 1975 compared with about 1.4% in 1991 (see Fig. 1).

The number of new Ph.D.s with postdoctoral positions is sometimes considered to be a reflection of employment conditions, with postdoc appointments rising when the job market is tight. However, the NAS panel concludes that the dramatic rise in postdocs in the 1970s, followed by erratic swings in the 1980s, may instead reflect the availability of *funding* for postdocs, mirroring the increasing availability of funds in the 1970s followed by periods of constraint and relaxation in the 1980s (see Fig. 2).

Although figures from the past decade are reassuring, the NAS com-

by Rebecca Kolberg

mittee warns that the biomedical employment boom is rapidly trailing off and the job outlook may be far less rosy for newly minted biomedical Ph.D.s than it was for even their recent predecessors. Confirming the suspicions of many NIH postdocs, the NAS analysis found that employment opportunities for basic biomedical Ph.D.s have grown more slowly in the academic sector than in "nontraditional settings"—with only about half of the biomedical science work force currently employed in academia compared with two-thirds in 1981. Although industry has picked up much of that slack, with almost 30% of biomedical Ph.D.s now working in industry compared with less than 17% in 1981 (see Fig. 3), the report says, "The best predictions for economic activity and R&D funding in the near future suggest that demand for basic biomedical scientists will grow slowly at best." Unless there is a sudden upswing in demand, the current rate of entry of Ph.D.s into the biomedical science work force—about 3,400 in 1990—should prove adequate, the panel concludes.

In its examination of clinical research, the NAS report reaches no strong conclusions on the job outlook for what it calls "physician scientists." The panel notes that total budgeted medical school faculty vacancies have grown at an average yearly rate of about 6% since 1989, with most of that growth coming in the clinical science departments as medical schools have grown increasingly dependent upon clinical income to support their activities. In fact, between 1981 and 1991, the number of full-time faculty employed in clinical departments mushroomed from about 38,000 to more than 59,000—an annual growth rate of nearly 5%. On the other hand, the health-care market's increasing emphasis on cost containment may place academic medical centers at a disadvantage in obtaining clinical income, possibly cutting into support for clinical investigators. Furthermore, the panel observes, the pressure to decrease the proportion of specialists in medicine may dampen enthusiasm for clinical research spending.

From his vantage point at the Office of Education, what does Fordis see in his crystal ball for the hundreds of postdocs and clinical associates now toiling at NIH? "I'm cautiously optimistic about employment prospects in industry, but I see a very guarded outlook in academia. The role of tenure is being reevaluated, and restructuring related to managed care is adversely affecting academic health-care centers across the nation. However, there will always be opportunities for people doing outstanding science. The job of all of us is to make certain that we are providing fellows with the best possible training and mentorship in laboratories doing outstanding science." ■

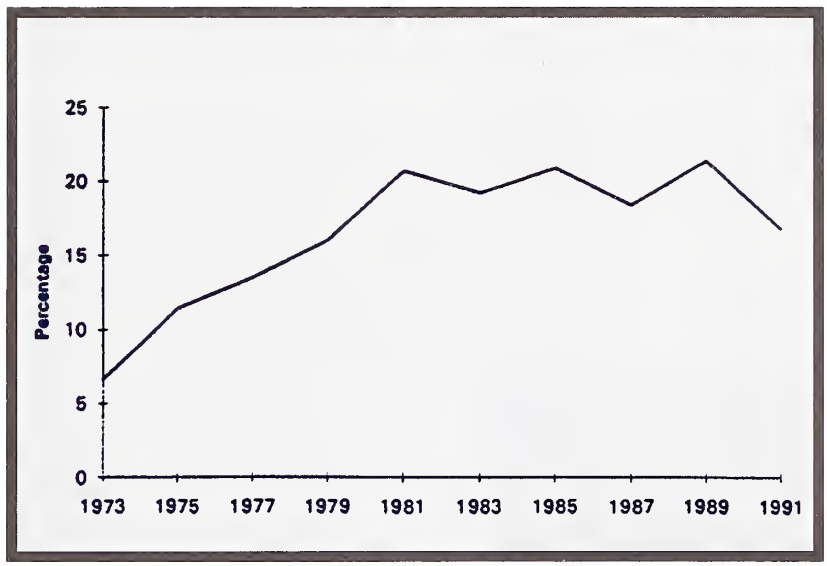
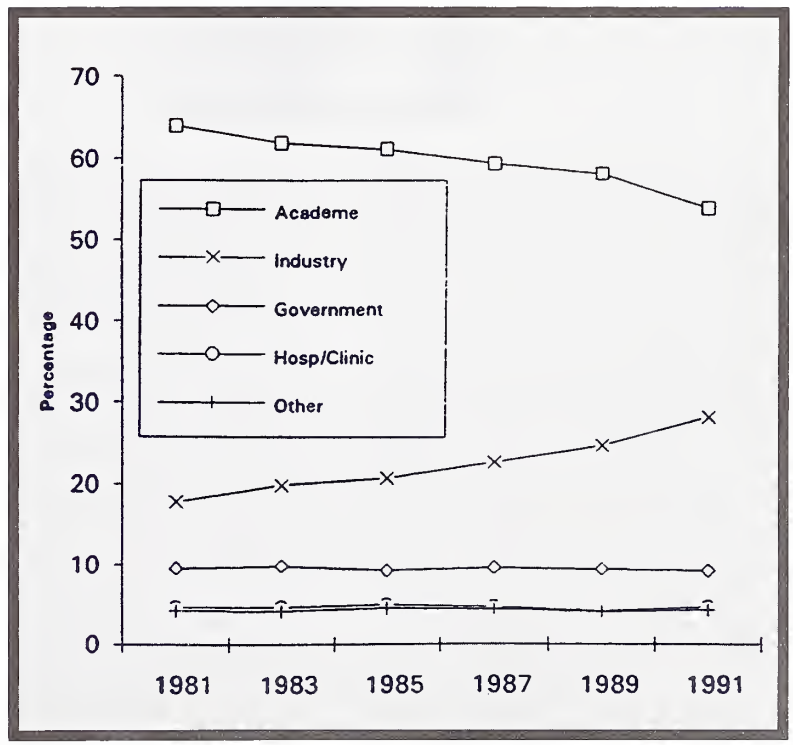


Figure 2. Fraction of biomedical science Ph.D.s at career age 4-5 years on postdoctoral appointments, 1973–1991. *(Courtesy National Academy of Sciences.)*

Figure 3. Employment sector of the U.S. biomedical science work force, 1981–1991. *(Courtesy National Academy of Sciences.)*



The Chosen Few: Landing a Job in Academia

More than 400 résumés sent out ... 11 interviews ... one year of intense searching—and still no job. At this point, many young researchers seeking a tenure-track position in academia might have thrown in the towel. But not Kathyrn Sandberg.

"Sometimes I would get depressed and think, 'Oh my god, my life is over!' But being the eternal optimist, I would get through it and keep on looking," says Sandberg, a former NICHD postdoc whose persistence recently paid off in the form of a tenure-track appointment at Georgetown University School of Medicine in Washington.

Like Sandberg, many young biomedical researchers, be they Ph.D.s or M.D.s, aspire to a tenure-track appointment at a research-oriented academic institution. Although no one disputes the fact that competition for academic posts has grown fierce, especially among Ph.D.s, Sandberg is proof that some NIH-trained postdocs and clinical associates are defying the odds and securing academic posts even in this harsh job environment. Factors such as timing and luck may play key roles in winning a coveted academic position. However, former NIH postdocs and clinical associates who've landed academic jobs say their experiences have taught them that there are concrete steps that young researchers—and their mentors—can take to improve their chances of finding employment in academia.

Charles Stroll

Kathryn Sandberg

Like most successful job hunters, Sandberg, an assistant professor of medicine and pharmacology at Georgetown, says she did not limit her search to advertised openings. Instead, she sent letters and résumés to all the chairs of departments that matched her research interests, even those located in regions where she really didn't want to live. In the end, Sandberg's "mass mailing" effort paid off, although by a more circuitous route than she had originally envisioned. A departmental chairman at Georgetown, who did not call Sandberg in for an interview, forwarded her résumé to a division head at a Florida institution, whom Sandberg had already written. Georgetown later recruited the Florida researcher and gave him the go-ahead to expand the division's research program—at which point he contacted Sandberg for the job she eventually got. "It helps to have your name thrown around by as many people as possible," Sandberg observes.

Derrick Grant, a former NIDR postdoc who recently took a tenure-track post at the Cardeza Foundation of Jefferson Medical College in Philadelphia, agrees that name recognition is a valuable asset in the job search. Grant credits his mentors Hynda Kleinman, George Martin, and Kenneth Yamada with driving home the importance of scientific networking. "Collaboration was highly stressed in our lab, and travel to scientific meetings was encouraged," says Grant, adding that the intensive collaboration also helped him average about five publications a year during the six years he was at NIH.

Sean Donevan, who is leaving NINDS after five years to take a non-tenured, two-year appointment as a research assistant professor at the University of Utah in Salt Lake City, also sings the praises of networking. Donevan says he thinks a major reason he got his academic job was because of a contact he made with a Utah researcher at a meeting several years ago. Both scientists were doing research on the electrophysiology of the glutamate receptor, and when they ran into each other this year at a neurosciences meeting, the Utah researcher mentioned to Donevan that his department had an opening. "You definitely have to talk to people," he says.

Another success story out of the same lab as Donevan, the Neuronal Excitability Section of the Epilepsy Research Branch, is Jong Rho, a clinical associate from 1992 to 1994 who is now a tenure-track assistant professor of neurology and pediatrics at the University of Washington School of Medicine in Seattle. In addition to publishing high-quality research, Rho singles out two key factors that can improve a young scientist's employment outlook: having an interested mentor and being encouraged to make presentations at national meetings. "The mentor is important because he knows the people who are looking to hire ... . Presentations are important because you can meet program heads and other important people," says Rho, adding that it would be helpful if NIH would provide more money for junior researchers to attend national meetings. Rho also commends his mentor, Michael Rogawaski, and other senior scientists who remember to weave the names of their postdocs and clinical associates into their conversations with other influential researchers. "People whose names are never brought up to outside department heads often have a more difficult time" finding jobs, Rho says.

If a young researcher can't get the mentorship or guidance he or she needs within NIH, Sandberg, who spent her seven years as a fellow in NICHD's Endocrinology and Reproduction Research Branch, suggests following her lead and asking a former Ph.D. adviser for help. "They have no conflict of interest. They usually have a special feeling for you. And they know what search committees are looking for," she says.

Grant says his mentors' emphasis on making sure that postdocs took the time to polish their papers and presentations helped him put his best foot forward in application letters and job interviews. "Hynda [Kleinman] always told us that you must write clearly, tell a good story. To impress people you must do more than just show them data—you have to stand out."

Mentors and NIH seminars can also help to prepare NIH-trained postdocs for what many consider their biggest hurdle in the search for academic employment: writing grants.

To acquaint the young scientists in her lab with the dog-eat-dog world of grantsmanship, Kleinman insisted that they submit grant proposals to corporate competitions, even though odds weren't good that the fledgling grant writers would win. In addition, Grant said he

by Rebecca Kolberg

took the NIGMS seminar on grant writing—twice. (See box, page 7.) "The first time a lot of it didn't sink in," says Grant, an assistant professor of medicine, pathology, and cell biology who is now busy trying to craft investigator-initiated (R01) grant applications that are "sexy" enough to be in the top 3–5% of projects funded on the first round. "It's really horrible out here now. You've got to make the study sections go, 'wow.' "

R. Mark Buller, who landed a tenure-track associate professor position at the University of St. Louis in Missouri after 12 years at NIAID's Laboratory of Viral Diseases, says that it is particularly difficult for postdocs who are "longer in the tooth" to find an academic position if they don't bring along any grant support.

"Institutions want to be assured that you are going to attract funding, especially in the funding climate that we have now," says Buller, noting that the only major difference between himself and another candidate for an academic position that he did not get was that the other applicant had grant money. Now that the roles are reversed and he's serving on search committees himself, Buller reports that the first two questions used in evaluating a candidate are: "Will this person be able to bring in money?" and "Will this person's research interest be complementary to ours?" To compensate for the lack of funds, Buller, an expert on poxvirus pathogenesis who did not get tenure at NIH, says he believes that intramural researchers who want something better than an entry-level academic position must work hard to cultivate an outstanding reputation in their fields. "You have to bring something special to the table that they are willing to pay more money for," he says. Otherwise, according to Buller, the university will opt for an outside researcher with grants or a less experienced researcher who can be paid a lower salary.

Wesley Rose

Derrick Grant

Sandberg, who thinks it would be a good idea if NIH set up a highly selective intramural grants competition to give postdocs a taste of the extramural grants process, says she tackled her lack of grantsmanship head-on in her application letters and her interviews. "It is very important to show where you want to go, not just to talk about what you have been doing. You have to set a clear direction—to put forth your ideas in terms of grant proposals. Let them know that you are thinking along that line," she says. "If you come from NIH, they know you can publish. They don't know if you can write a grant." In addition, Sandberg suggests that NIH fellows with considerable research experience—but no grant support—may want to do what she did: negotiate an assistant professor position with immediate promotion to associate professor upon receipt of a major grant.

Now that she's exchanged her job-seeking anxieties for grant-writing pressures, Sandberg recommends that NIH postdocs start looking for employment after three years of research. "There's really no advantage to staying at NIH longer because you will start at ground zero in academia until you start bringing in grant dollars," she explains.

As a final tip for academic job hunters, Sandberg suggests following up on applications and learning from failures. "If you're rejected for an opening, talk to the chairman and ask why you were rejected—and then, if it's something you can fix, fix it," she says. For those who would scoff at her job-seeking mantra of "Don't give up," Sandberg offers the case of an excellent postdoc from Georgetown who searched for a long and frustrating 2 1/2 years until recently landing an academic position—not just any post—but a terrific job that was exactly what he wanted. ■

NINDS Neuroscience Series January–February Schedule

Jan. 8	Lewis Rowland, Neurological Institute, New York
Jan. 22	Andy McMahon, Harvard University, Cambridge, Mass.
Jan. 29	Huda Zoghbi, Baylor College of Medicine, Houston
Feb. 5	Linda Buck, Harvard Medical School, Boston
Feb. 12	Christine Petit, Pasteur Institute, Paris
Feb. 21	Walter Gehring, University of Basel, Switzerland
Feb. 26	Daniel Johnston, Baylor College of Medicine, Houston

Lectures are held at noon in Bldg. 10, Lipsett Auditorium. Continuing Medical Education credits are awarded. For more information, call 496-9106. ■

DDIR's Bulletin Board

All lab, branch, and section chiefs, along with all authorized users of radioactive materials and other interested researchers, are urged to subscribe to the Deputy Director of Intramural Research's electronic Bulletin Board. In addition to the regular bulletins distributed to subscribers following each scientific directors' meeting, the list is used to send out other messages that the DDIR needs to distribute quickly. To subscribe, send an e-mail message that reads "Subscribe DDIRBB-L Your Name" to the following e-mail address: Listerv@ list.nih.gov ■

Redefining Scientific Success: Reports From Industry

by Rebecca Kolberg

With nearly one in three biomedical Ph.D.s currently employed by industry, one time-honored yardstick of scientific success—the tenure-track academic appointment—is looking a bit antiquated when it comes to measuring the worth of an individual scientist's contributions to research and to society.

"I feel bad that scientists in industry are often regarded as not as good as those in academia. I have not found that to be true," says Jane Brokaw, who spent 4 1/2 years as a postdoc at NCI and NIAID before joining U.S. Surgical Corp. in North Haven, Conn., last January as a staff scientist working on the biology of wound-healing.

> "One doesn't have the burdens of teaching, of supervising graduate students, and of having to write grants in a very, very competitive environment."
> —Josephine Cox, SRA Technologies

Brokaw says she had several reasons for not even looking at academic positions during her job hunt, including the grim funding prospects for extramural grants and her preference for team-oriented bench research. And Brokaw is far from alone. In fact, her adviser from her graduate years at Wake Forest University in Winston-Salem, N.C., recently decided to leave academia to go into industry.

Although she's still "on the upside of the learning curve," Brokaw says her experience in industry has been going well so far. "One thing that's really different is the sense of isolation you feel at times. We are a small group, so it's been a bit of an adjustment from NIH, where you are used to having a lot of different types of researchers around and where you can find an expert on almost any topic you're interested in," she says. U.S. Surgical's strong emphasis on securing patents has also forced Brokaw to be more cautious than she was at NIH about publishing her findings and discussing her research with outside colleagues.

Josephine Cox, a British researcher who was a visiting fellow for five years in NIAID's Laboratory of Viral Diseases, says she became a senior staff scientist at SRA Technologies in Rockville, Md., two years ago after the small firm, which conducts clinical trials of experimental therapies for government and industry, agreed to support her work visa. Although she had also been hunting for academic positions, Cox says she feels fortunate that fate steered her to industry rather than academia. "I'm really glad to be here. One doesn't have the burdens of teaching, of supervising graduate students, and of having to write grants in a very, very competitive environment," says the immunologist, who spends about half her time on supervisory duties and half on bench work and other aspects of research and development.

Cox says one of the most pleasant surprises of corporate life—besides monetary bonuses for outstanding performance—has been the chance to flex her managerial muscle and to discover that "I'm good at it!" She suggests that to better equip Ph.D.s for careers in industry, NIH might consider giving senior postdocs some lab-management responsibilities and also sponsoring seminars or courses on good manufacturing practices (GMP) similar to those already offered on grant writing (see box, page 7).

For Cox, an unsettling difference between academia and industry is the lack of a clear career path for scientists in industry. "I really question where I will go from here. There's no obvious next step. In academia, you know where to go—from assistant professor to professor to department chairman," she says. Another drawback of being a Ph.D. in industry, according to Cox, is that there are often not as many opportunities to publish, especially as first author.

Although salaries may be substantially higher in industry than academia, Brokaw points out that she and other industrial scientists do not necessarily have easier schedules than their academic counterparts. "For me, it's not a 9-to-5 job. I might not come in as much on weekends as I used to [at NIH], but that doesn't mean I'm working any less. If anything, I'm working harder," she says.

A prominent concern for many scientists considering positions in industry is job security. Tales of companies suddenly shuffling their research portfolios, being bought by competitors, or going out of business strike fear in the hearts of scientists who, over the course of a decade or more of pre- and postdoctoral training, have been taught to aspire to the permanence of a tenured position. But Brokaw observes, "Everything is uncertain, even academia. If you lose your [grant] funding, you may not have your lab for long." ■

Electronic Helper for Materials Exchange

Wading through technology-transfer paperwork is not most scientists' idea of fun. However, a new site on the World Wide Web can help intramural researchers streamline the process of sharing biological materials with colleagues at other institutions. The Web site, maintained by the Association of University Technology Managers, Inc., allows scientists to quickly determine whether an outside institution has signed the Uniform Biological Materials Transfer Agreement (UBMTA)—a nationwide accord to facilitate scientific exchanges that was reached last March under the leadership of NIH's Office of Technology Transfer. If an outside colleague's institution has signed the UBMTA, the only paperwork required for an exchange of biological materials is a letter, called an "implementing" letter, that must be signed by both parties certifying that both work at signatory institutions. For more information on this process, contact the technology development coordinator at your institute, center, or division. To access the UBMTA database, launch a Web browser, such as Netscape or Mosaic, and type the following Uniform Resource Locator (URL) in the Open Location or Open URL box: http://autm.rice.edu/autm ■

ANOTHER DEGREE?

by Rebecca Kolberg

Although more schooling is the last thing most Ph.D.s want to think about, a professional degree such as an MBA may prove to be more than extra icing on the cake for a postdoc pursuing a nonacademic career.

With an eye to the burgeoning number of biomedical doctorates being awarded and the steady or shrinking employment opportunities for Ph.D.s at universities, some scientists are heading back to academia as students to improve their marketability in the worlds of corporate management or scientific publishing.

"WE WELCOME THOSE PH.D.S WHO WANT TO BRANCH BEYOND THE BENCH."
—Rochelle Weichman, MIT

A pioneer in equipping scientists with the tools to advance through the upper echelons of private industry is Cornell University's Johnson Graduate School of Management in Ithaca, N.Y., which last June began a new 12-month MBA option for scientists and engineers. Nearly one-third of the first year's class of about 30 students have Ph.D.s, and the remainder have earned at least a master's degree.

"We didn't mount this program as a public service to scientists. We did it because we thought properly trained scientists could be a tremendous benefit to the business community," says Richard Highfield, director of Cornell's MBA program, noting that a recent Cornell survey found that senior corporate managers say that less than half of their colleagues are technologically literate.

Taking advantage of scientists' and engineers' previous analytical training and experience, Cornell's special program allows such students to move through the MBA course work in 12 months instead of the customary 16. Rather than making scientists sit through traditional MBA core courses that teach quantitative methods with which they are already proficient, the 12-month option focuses immediately on the business applications of such skills. As is the case with most top business schools, Cornell's MBA isn't cheap: the 12-month option carries a tuition price tag of about $32,000. On the positive side of the ledger, a 1995 survey of MBA programs by *U.S. News & World Report* shows that 94% of Cornell MBAs are employed three months after graduation at a median salary of $58,500.

The MBA program that ranked No. 1 in the *U.S. News* survey, MIT-Sloan School of Management in Cambridge, Mass., also offers a 12-month master's degree program in conjunction with MIT's School of Engineering. That intensive program, which costs about $40,000 in tuition and was established 15 years ago as the nation's first advanced business degree in technology management, is expressly for mid-career engineers and scientists who will handle increasing managerial responsibilities on the technical or manufacturing side of private- or public-sector organization.

"We welcome those Ph.D.s who want to branch beyond the bench," says Rochelle Weichman, director of the MIT Management of Technology Program, noting that applicants must have a minimum of five years of post-university experience and usually have a technical background. One potential drawback of the program for NIH postdocs is that most of the 45 students admitted already have experience in private industry. Ninety-eight percent of MIT-Sloan's graduates have a job three months after graduation, with a median salary of $68,000.

But what if a career-swapping scientist craves excitement more than money? One answer may lie in the handful of science writing or journalism programs that are aimed at students with an academic background in science. Located at Johns Hopkins University's Homewood campus in Baltimore, the nationally recognized Writing Seminars program, for example, offers a master's degree in writing about science. The program, currently headed by Barbara J. Culliton, the editor-in-chief of *Nature Medicine,* runs nine months and costs about $20,000 in tuition. However, as Culliton notes, Master's candidates often receive scholarships that offset some of the tuition cost.

"If what you want is practice in writing, practice in translating scientific results for the lay person, this is a good program," says Ann Finkbeiner, a visiting assistant professor who runs a course patterned after scientific news conferences. "But it's not like a journalism school." Rather, the Johns Hopkins program encompasses all genres of science writing, including essays, book reviews, and even fiction. Some alumni now work at major consumer and scientific publications like *Time* and *Science.* Others are writing books, reporting for newspapers or broadcasting outlets, or pursuing careers in science education.

Although it offers a certificate rather than a master's degree, the University of California at Santa Cruz's science writing program—the only one in the nation to require that applicants have significant previous training in science—also boasts a solid track record when it comes to employment. Many Santa Cruz alumni are working as public information officers at universities and government research institutions. However, recent graduates have also found jobs at the *Dallas Morning News, New Scientist,* and *U.S. News & World Report,* and graduates of earlier years are working everywhere from *Science News* to the *Philadelphia Inquirer* to NBC Nightly News.

John Wilkes, director of the Santa Cruz program, says he's found that pay levels for science writers generally parallel those for academics. Science-writing graduates with a master's degree in science earn starting salaries in the $30,000–$40,000 range, while top-notch science writers with five or more years of experience are able to command $50,000–$70,000 at national publications. Although he doesn't turn away Ph.D.s, Wilkes cautions that the transition to science writer is usually more difficult for people with doctorates than for hose with master's or undergraduate science degrees. "Ph.D.s are the hardest ones to retread," he says, noting that the narrow scope and relatively inflexible focus required to earn a Ph.D. are at odds with the flexibility and large-picture view demanded of a good science writer. ■

The Road Less Traveled

The following articles are by and about people who have left the biomedical research bench to head down other career pathways that take advantage of their scientific training.

Teacher ...

by Karolyn M. Andrews, Ph.D.

"Get out or stay in?" "Get out or stay in?" That question grew from an unthinkable whisper to a haunting roar as my years in basic research sped by.

The whisper first surfaced while I was a graduate student at the University of Chicago, but I shooed away my doubts: everyone hates grad school, right? I stayed, I got a Ph.D., and I happily, idealistically, and naively left Illinois for a postdoctoral experience at Cornell's Medical College in White Plains, N.Y. That innocence faded over the next two years in a bloody, inch-by-inch battle that pitted the realities of bench research against my own Candidesque mindset. When my usual powers of rationalization—now considerably more sophisticated—proved ineffective, I stepped back, wrestled with reality, and lost. A critical catalyst came last Christmas in the form of a front-page article in *The Washington Post* about the difficulties facing up-and-coming Ph.D.s. That article articulated my doubts and from that moment on, my departure from the bench became only a question of time.

Lorna Heartley

Karolyn Andrews with Emerson students.

To be certain, I could stomach the 80-hour work weeks that left time for little else. I could survive an increasingly lengthy and nomadic postdoctoral path to a tenure-track job. Once on the track, I considered it simply a necessary evil to write (i.e., "cut and paste") three to five grant proposals a year in hopes of snagging one grant. Continuing in this rationalizing vein, I looked into a future in which administrative responsibilities would begin to pull me away from the bench, but in which I could interpret that change as a sign that I had moved up and on. Besides, at that scientific echelon, I could justify spending less time on my teaching because everyone knows publishing is where it's at. If I still needed more time to catch up on my research, I could just take a sabbatical without leaving the lab. These musings made it clear to me that if I tenaciously clung to a life of research, I could only look forward to placating an uneasy conscience for years to come. Now, my commitment to science remains, but in a happily altered form.

When "get out" finally won over "stay in," I searched for positions that would blend my love of (and training in) things scientific with other unexploited skills. As a grad student and as a postdoc, I taught to supplement my meager monies and had liked it. Based on that experience, I contacted universities but came up empty-handed. Those refusals precipitated my decision to apply to private high schools. Private schools can hire a teacher without certification and, in my case, one did. I found a job teaching biology, chemistry, and psychology (my Ph.D. is in Biopsychology) at Emerson Preparatory Institute, which has a unique approach that meshes well with my own ideas about education. At Emerson, the oldest college prep school in the District of Columbia, students graduate in two years, not four; they spend 90 minutes in each class and none in extracurricular activities; and they are placed according to ability, not age. Like a hand in a well-worn glove, I slid easily into this next incarnation.

After spending the last few months teaching, I realize that I can do something for science that I've long felt needed doing: beefing up our public image. Scientists are an autonomous, solitary bunch immersed in terminologically tangled conversations. The language of science need not be translated in its entirety for the general public, but the core of scientific debate—the ideas that enliven a scientist's mind—should be. Research that explores scientific ideas is financially supported by the public, and to be supported, it must be appreciated, and to be appreciated, it must be understood. I've decided that classroom proselytizing furthers research as surely as a life spent in the lab. Fortunately, it also suits me better. ■

... Lawyer ...

by Joseph G. Contrera, M.S., J.D., OTT

For the past four years, while working as a biochemist-pharmacologist for the FDA, I attended law school at night in hopes of getting a job in the intellectual-property or food-and-drug fields. I am happy to report that I joined NIH's Office of Technology Transfer this fall. I'd like to mention a few points about my job search in hopes that they will help other young scientists in their own job searches.

First, don't listen to people outside of the field in which you want to work when you're obtaining advice about the number of jobs or the ease of finding employment. After I started law school, all the other scientists I worked with kept telling me how I could "write my own ticket" after school. It was all bull*@#*. They didn't know any more about the legal job market than I know about the computer science job market. Talk to people who are *employed* in those fields of interest.

Second, start looking into that job market *long* before you graduate. Keep reading industry trade magazines and journals. Follow trends in the fields you are interested in. You may be surprised to find out that what was a hot field when you started has cooled considerably before you finish. Be prepared to change your ideas about what you want to do while you still can. Even if it is too late for that, you can rewrite your resume to skew it toward the more open employment fields.

Third, keep many different versions of your resume. Believe me, I know how painful it is to get just one perfect version, but you will need versions that emphasize certain aspects of your skills over others. Fourth, get someone in your chosen field to review your résumé. You will be surprised to find out what kind of important information yours is lacking. ...

Fifth, I adhere to the philosophy of sending out as many résumés as possible—both for advertised and nonadvertised positions. I must have sent out more than 100 résumés over a one-year period. For many, I never received even confirmation that the resume was received. I was asked to about a dozen interviews. They broke down evenly between employers

who had advertised and those to whom I had mailed my résumé unsolicited. I received my offer from an advertised position posted at my school. Sixth, don't be surprised if the interviewer hasn't read your resume. About one-third of interviewers didn't know I had published any scientific papers or that I was a law journal editor, even though both credentials were plainly visible on my resume. Sometimes the interviewers had lost my resume. So, bring extra copies of your most recent publications and résumé to the interview.

Seventh, don't get discouraged when you get those wonderful little letters that say, "We had so many qualified candidates, it was hard to choose ... (i.e., *not* you). We're sure with your credentials you will find a position ... blah, blah ... ." Just consider each interview practice for the one job you *will* get.

Finally, don't be surprised if the real reason you don't land the job is because of personalities. I think this point has not been emphasized in previous employment posts. Most often, employers want a qualified person who can get along with everyone. You may be the brightest woman or man in the world, but if you act like it, no one is going to want you around. Be amiable during the interview. Show you have a life, hobbies, etc. Check out the employer's office as you sit there. Are there pictures of fish? Pets? Kids? Talk about those things near the end of your conversation. Does the office view employment the same way you do? If not, you will probably not get the job or be unhappy if you do. Remember, it is worse to *get* the wrong job than not get it.

This article was adapted with Contrera's permission from an electronic message originally posted on the Young Scientists' Network on Aug. 11, 1995. ■

... WRITER ...

by Elia Ben–Ari, Ph.D., NIAMS

I began thinking about science writing and editing as a career alternative back in graduate school, perhaps because I felt that doing research did not take full advantage of all my strengths and might not provide the career fulfillment I was seeking. I enjoyed writing and editing, and many people told me that I wrote well. Nevertheless, I finished my Ph.D. in pharmacology, which I have never regretted, and continued on to a postdoctoral fellowship in NCI-FCRDC's Laboratory of Viral Carcinogenesis. During my postdoc, however, I grew increasingly convinced that I might be happier—and make a more significant contribution—writing about science than doing it.

I started scouring journals and newspapers for other job possibilities. One day in 1989, while looking through *Science*, I saw an ad for scientists willing to write occasional reviews of children's science books for *Appraisal,* Boston University's quarterly publication for librarians. Reviewers weren't paid, but they could keep the books. This seemed like a good opportunity to try my hand at writing about science for a lay audience as well as to get something published under my byline. I signed up and have been doing occasional book reviews ever since.

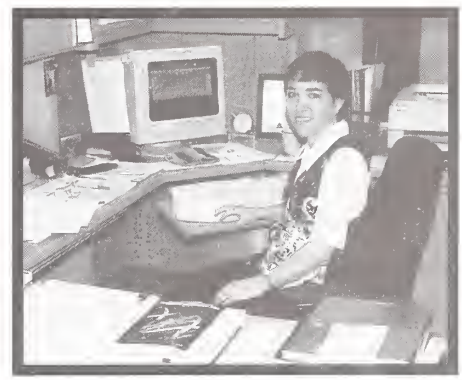
Next, in early 1991, came an ad for an editor position with *The New Biologist,* a basic cell and molecular biology journal based in Bethesda. The description of the ideal candidate fit me pretty well: Ph.D. biologist with broad interests, good writing skills, no editing experience necessary. So, after doing some research about the journal, I carefully crafted my cover letter and résumé and sent them off. To my delight, the managing editor and editor-in-chief soon called me in for an interview. The editors offered me the job that very day and gave me the upcoming three-day weekend to make my decision.

That weekend, I sought advice from everyone I thought could provide insight. To leave the lab might well be an irreversible step. Did I really want to abandon a basic research career after spending so many years preparing for one? "You've been talking about going into science writing for years," my friends reminded me. "This is your chance to try it." I could always return to the lab after a year or two if I didn't like the job. By Monday, with a mixture of excitement and trepidation, I decided to take the plunge.

After breaking the news to my postdoc mentor, who was very understanding, and tying up some loose ends in the lab, I reported to work as meeting reviews editor. It turned out to be one of the best decisions I've made. I loved the job and my colleagues, several of whom had also started out in research. In the course of inviting researchers to write reviews of scientific meetings and of editing those reviews, I got to talk with many leading scientists and learn what was hot in a wide range of fields. I also attended and wrote about some meetings myself, including a memorable meeting on signal transduction held in a tiny village in the Swiss Alps.

After 10 months, my bubble burst. The journal was not doing well financially, and our publisher decided to fold it. My colleagues and I were given eight weeks notice and handed our severance packages. With the help of my managing editor, I began searching madly for a new job. Among the people I contacted was Anne Thomas, who is associate director for communications at NIH. At her suggestion, I spoke to public information officers at several NIH institutes. I began reading the weekly NIH job listings and applied for several writing positions.

Armed with my book reviews and reports on scientific meetings, I convinced NIH administrators to give me a chance at writing for lay audiences, despite my limited experience in this area. Once again, I have learned quite a bit on the job. My work in NIAMS's public information office includes writing about science for the nonscientist in various formats, such as news releases, articles, and congressional reports, as well as handling some public and media inquiries. I interact with intramural and extramural scientists and scientific administrators, as well as with reporters.



Lorna Heartley

Elia Ben–Ari

I enjoy doing my part to fill a great and growing need: bridging the gap between scientists and the general public. I also enjoy learning about new areas of research as I write about a wide range of topics. My broad science education and research experience have served me well in being able to communicate with researchers and translate what they do into lay terms. Last year, I became deputy

director of the office, which means taking on more managerial and editorial duties. However, I still get to do what I like best—learning and writing about biomedical research.

My advice to anyone considering a science writing career is to talk with science writers, such as people in your institute's communications office or members of the D.C. Science Writers' Association and the American Medical Writers' Association. It's also valuable to get some writing experience, even if it's only a letter to the editor about a scientific issue. This shows that you're serious about writing and provides you with published samples for prospective employers. Look for writing internships if you can afford the time and low pay, or take a science writing course or general journalism class.

There clearly is, and will continue to be, a need for people who understand science and can explain it in terms that nonscientists can understand. Although I will always miss some aspects of doing research, I know that, for me, the decision to leave the lab and pursue a less traditional career path was the right one. ■

Lorna Heartley

Joan McGowan

... CHIEF

Many scientists would say Joan McGowan had it made years ago: a faculty position at Harvard Medical School and a lab at Massachusetts General Hospital. But McGowan didn't think so.

"To my way of thinking, my growth was limited. Some people are wedded to the lab, bench work, and actually doing research. But I always had a broad vision ... I wanted to move on and over to a different type of creative neuronal activity," says McGowan, who, 12 years after getting her Ph.D., decided to leave the lab to become a scientific administrator at NIH.

Although it may have seemed like a rash move to her scientific colleagues, McGowan had been working up to the transition for some time. At Mass General, she sat on boards that reviewed grant applications going out to NIH and acted as an adviser to the director of internally sponsored research at the teaching hospital. The idea of becoming an administrator intrigued her even more after she served on NIH study sections and interacted with administrators who oversaw extramural grants. Then in 1989, McGowan took the leap—moving to Bethesda and enrolling in the Office of Extramural Program's Grants Associate Program, a one-year training program established more than three decades ago to help scientists make the shift from bench research to extramural administration. In addition to course work, the grants associates rotate through assignments among the 22 extramural divisions at NIH.

Eventually, McGowan moved through the extramural administrative ranks to become director of the Musculoskeletal Diseases Branch at NIAMS. "In writing and talking to researchers, I think I am a much more valuable contributor to science than I was as a participant," McGowan says. "I feel like I have blossomed by getting the opportunity to do this."At the same time, McGowan says she hasn't missed the lab. "I never wake up in the morning and wish that I was injecting a rat that day or running a gel."

McGowan says her years of bench research, writing grants, and publishing papers are not wasted. "I really do know the strains and how important each grant application is in the life of the investigator. That's often a lot more important than having a background in their specific field. I know what it's like to be on the front lines."

Although administration may lack the pizazz of other research career pathways, McGowan says some of her colleagues from the lab express a bit of envy when they see how much she enjoys her job. And, she chuckles, some of them have even started asking, "Now, exactly how did you get to do what you're doing?" Unfortunately, it may be difficult to duplicate McGowan's exact steps at the moment. Although there are currently three grants associates at NIH, the program is accepting no new applicants this year and its future is in limbo due to the federal downsizing mandate, says James O'Donnell, the program's director. ■

On-line Job Hunting

Although nothing can beat a good interpersonal network when it comes to landing a job, the Internet has quickly become a valuable ally for scientists in the highly competitive job market. Job seekers can take advantage of the Internet's global reach in two ways: by posting their résumés in databases used by organizations that are looking to hire scientists and by checking out sites that list science-related jobs. The following is a list of addresses, or Uniform Resource Locators (URLs), for selected job-hunting sites on the World Wide Web.

Résumé Posting

Arrow Chemistry & Biology
http://soho.ios.com/~ilyak.arrow.html
Molecular biologists, biochemists, and chemists can add their résumés to a database that can be searched by hiring managers.

Community of Science
http://cos.gdb.org
NIH researchers can post their résumés on this "expertise" database subscribed to by more than 100 North American companies.

FSG Online
http://www.chemistry.com/biotech-jobs/
Résumé posting and job-searching services for biotech, drug, and medical industries.

Job Searching

Bionet
gopher://gopher.bio.net:70/11/EMPLOYMENT
Biological science job openings that are screened before they're posted.

Chronicle of Higher Education
http://chronicle. merit edu.
Job openings inside and outside academia, updated weekly.

Nature
http://www.nature.com
Recruitment classified ads.

NIH Senior Job Opportunities
http://www.helix.nih.gov:8001/jobs/
Although the NIH job openings listed are for senior personnel, the site also contains links to other lower-level scientific, medical, and administrative job opportunities.

***Science's* Global Career Network**
http://www.edoc.com/sgcn
Recruitment classified ads.

***Science's* Next Wave**
http://sci.aaas.org/nextwave/nextwave.html
Links to job and career sites under its "Natural Resources" section.

The Scientist
gopher://ds.internic.net/11/pub/the-scientist
Recruitment classified ads.

Young Scientists' Network
http://snoni.chem.washington.edu/ysnarchive/
Traditional and alternative scientific job openings. ■

NIH TRAINING
continued from page 1.

labs. I believe that about two-thirds of postdocs are satisfied with their training.

Michelotti: I would rate my quality of training very high, simply because our lab head is a tremendous scientist. Unfortunately, I feel that this is the exception rather than the rule, as there are many tenured scientists who are not as qualified to head a lab, much less train young scientists. I refer to them as dead wood.

Russian: On the clinical side, I think it's well known that you see a very unusual patient population here. Although it's challenging, sometimes I worry that it's not going to be the optimal preparation for working out in the real world, even the real academic world. But I think everyone knows that coming in, and that's sort of the downside of having that freedom to do research later on—knowing that you're going to be in a hospital that has an unusual, but somewhat limited, patient population.

Cowan: I'm the optimist of our class. I'm pleased with our clinical experience here. I think the point about the Clinical Center patient population being a little bit skewed and it not being the most rounded experience is true. But I think the program is set up to make up for those deficits. We spend the majority of our time at the Clinical Center, but we also rotate at neighboring institutions. During our first year, I spent a couple months at Navy [Bethesda Naval Hospital], a couple months at the Washington Hospital Center, and [some time] at Children's Hospital.


Lorna Heartley

Naomi O'Grady and Bill Vandivier

O'Grady: The downside of being at the clinical center is that the volume of patients just isn't there.

Slonim: I've only been here four months, but ... there are two key concepts that I've gotten here at the Clinical Center. One of them is the importance of having a command of procedural skills—and we have more training than we could ever want when it comes to procedural skills. ... The second thing is the value of being [part of] a multidisciplinary team ... when you go out to other institutions, it becomes really evident that there is something to that concept. ... When you have only physicians going on rounds, I think you miss out on a lot of the issues that surround that patient. And that point really struck home when I came back [from an outside rotation] to the Clinical Center.

What steps could administrators take to enhance the training experience at NIH?

Michelotti: Postdocs are here to do experiments and be sufficiently productive to land a good job. We can't be as productive when we must wait too long for standard reagents. I say give labs (or a subset thereof) standard purchase orders at certain key biotech companies from which a lot of ordering is done.

Alessandro: I think that something could be done to help postdocs get jobs after they leave NIH. A data bank of c.v.s that companies and academic institutions can access through the Internet would be something easy to start with.

O'Grady: One thing would be to really concentrate on the fundamental issue of bringing patients into the Clinical Center, whether it be for clinical studies or patient care or both. Clinical associates need to see patients.

Vandivier: And for our group [Critical Care], those patients need to be inpatients. A lot of studies are going to outpatient. It seems less emphasis has been placed on inpatient protocols, which leaves the hospital half empty.


Lorna Heartley

Mark Cowan, left, Tony Slonim, and David Russian.

Russian: What I worry about, given that most of us are going to have to leave the nest here... is that I'm not getting exposed to the sorts of survival skills that I'm going to need out in the real world—like grantsmanship.

Vandivier: Another thing is that our travel budget is horrible. We basically have enough money to go to one meeting a year and that's it. If we have to go to a meeting where expenses are higher, we end up paying for it ourselves. Going to meetings is really important

Cowan: I may be a little naive about budgetary things, but it seems ... sending me to another meeting would be a drop in the bucket.

How important is mentorship to the development of a young scientist? What could be done to improve the quality of mentorship throughout NIH?

Michelotti: The key is to have knowledgeable and effective mentors. The

best way to do this is by exposing postdocs to as many high-quality scientists as possible—intimate exposure, not just a few minutes after a seminar. ... Perhaps it would help if funding were made available for a postdoc association that could hold functions (e.g. seminars, luncheons, receptions) so we could interact with lab heads.

THE JOB PROSPECTS FOR ACADEMIC POSITIONS ARE BAD RIGHT NOW AND MAY GET A LITTLE WORSE BEFORE WE GET OUT OF HERE.

Clare: My guess is that whether your boss is a good mentor or not is a matter of the luck of the draw. I am most fortunate that my boss is committed to having us meet people in our field and to present our results as often as is appropriate.

Corcoran: I believe that mentorship is crucial for the development of a scientist. Maybe the quality of mentorship can be improved by making all principal investigators take mandatory classes to teach the basic qualities of being a mentor and how to troubleshoot certain situations. A quarterly evaluation should be made by the postdoc and the mentor, not only to enhance communication, but also to improve the progress of the research project.

O'Grady: I would rate my mentorship as excellent thus far.

Russian: I would second that.

Cowan: Jim Shelhamer is my mentor, and most of the time he's in his office, which is right next to my bench. We work closely together and have a wonderful relationship.

How would you assess the current job market for biomedical researchers? What do you envision yourself doing 10 years from now?

Michelotti: Crappy. I've already decided to apply to med school because the prospect for funding in the future is bleak at best.

Clare: The current job market for Ph.D.s, from what I have read and observed, is very tight. I envision myself in an academic medical center with a limited surgical practice and with a lab 10 years from now.

Alessandro: The job market is tough and competitive. I hope to get a permanent position in Italy and come back quite often to the U.S. to keep myself up to date on the latest techniques and scientific developments.

Corcoran: NIH postdocs don't receive formal training in teaching, which is often needed for a job in academia. The experience we get at NIH is not industrial-based and, therefore, not appealing to industry. Although I lack industrial experience, I probably see myself working for industry at some point in the next 10 years. NIH administrators can help lessen postdoc anxieties by ... creating programs that allow postdocs to stay longer than five years. In the current climate that grants few tenured positions at [NIH], postdocs are unable to realistically compete with older and more experienced scientists.

Vandivier: There have been a number of fellows who recently completed training here. They all spent a lot of time trying to find good academic jobs, and it was very hard. ... and once you get to that job, your prospects for getting a grant are horrible.

O'Grady: The job prospects for academic positions are bad right now and may get a little worse before we get out of here. I think that's probably a universal concern.

Cowan: Granted, we [M.D.s] are better off than the Ph.D.s in a sense that if the academic situation continues to be bad and get worse, I know that I can get a job taking care of patients and make enough money. ... I get job offers in the mail every day. So that's a secure feeling.

Lorna Hearley

Susan E. Clare

Lorna Hearley

Marta Corcoran

Vandivier: It's true that we [M.D.s] have that [private practice] to fall back on, but I don't think anybody who's come here really wants to do that unless they have to. That brings up another point ... I think that the time that is allowed for the research part of this clinical fellowship should be lengthened. The reason I say this is because many M.D.s come to NIH with a lower baseline of knowledge and ability to do research, especially bench research, than Ph.D.s. So, we end up spending a lot of time relearning things we have left behind 10 years ago to do medical training. On top of that, many of us get double board certification [which requires another clinical year]. So, you may not end up taking the risk to venture into a more complex research project because you just don't have the time to do it. ■

RESEARCH GRAPEVINE

Stem-Cell Gene Therapy

The important take-home messages from the first Conference on Stem Cell Gene Therapy: Biology and Technology, held in Rockville, Md., on Sept. 28–Oct. 1, is that procedures that increase the transduction efficiency in the colony forming units (CFUs) assay are not predictive—and even may be misleading—for determining transduction efficiency of repopulating cells in vivo and that, at this time, there is no surrogate assay to predict in vivo reconstitution.

For years, researchers have been examining techniques for transducing normally quiescent hematopoietic stem cells. Peter Quesenberry of the University of Massachusetts Medical Center in Worcester demonstrated that when stem cells are stimulated to divide by the addition of cytokines and 5-fluorouracil (5-FU), they may lose the ability to engraft in bone marrow. Use of cytokines and 5-FU may stress the cells and cause differentiation. Peggy Goodell of the Whitehead Institute for Biomedical Research in Cambridge, Mass., described the isolation of a unique population of bone marrow cells that, when mixed with nonproliferating marrow cells, were found to be enriched 1,000-fold for reconstitution activity, as shown by the competitive repopulation assay. These cells could be identified in several species—including humans (in marrow and cord blood)—by sorting after Hoescht 33342 staining.

On another front, there was considerable controversy concerning data from studies using adeno-associated virus (AAV) vectors for transduction of quiescent stem cells. Several researchers reported long-term expression of marker genes in cells bearing the CD34+ surface marker, which enriches for early progenitor cells. For example, Saswati Chatterjee of the City of Hope National Medical Center in Duarte, Calif., reported six-month expression of a marker gene transplanted into mice. Chatterjee's lab also found expression in animals that received cell transplants from the primary transplanted animals. However, other teams attempting to reproduce the results with crude AAV lysates like those used by Chatterjee detected contaminants in the lysate that may have simulated AAV transduction, leading to what is being dubbed "pseudotransduction." ■

—Catherine McKeon and David Badman, NIDDK

Radiation Update

The Building 37 radiation contamination incident and safety concerns following the Oklahoma City bombing are sparking security changes at NIH.

The NIH Radiation Safety Committee recently passed tighter security measures, including requirements that all rooms posted for the use of radioactive materials be locked when unoccupied; that all unattended radioactive materials be locked up; and that no radioactive materials be stored in the corridors after Dec. 26. The Radiation Safety Branch is monitoring security compliance closely and has suspended the ordering, receipt, and use of all radioactive materials in several labs For non-clinical users, a first violation of security policy results in a mandatory suspension for 14 to 30 days, two violations in a year results in a 60-day suspension, and a third violation may result in the permanent loss of radionuclide privileges.

Based on feedback from a meeting with all authorized radionuclide users, Deputy Director for Intramural Research Michael Gottesman has established a Radiation Safety Committee working group to make security provisions more user friendly, and an advisory panel to examine alternatives to the use of radionuclides in research. To respond more swiftly to security risks, the Office of Research Services (ORS) has initiated one-day service to install or replace locks on rooms where radioactive materials are used or stored. To request such service, contact the Locksmith Section (496-3507; after hours: 496-5685). For other radiation concerns, contact the Radiation Safety Branch (496-5774). ■

CATALYTIC REACTIONS

In this issue, we are asking for your reactions in four areas: Clinical Center design, a new advice column, Hot Methods, and radiation safety measures. **Send your responses on these topics or comments on other intramural research concerns to us via e-mail: catalyst@od1em1.od.nih.gov; fax: 402-4303; or mail: Building 1, Room 334.**

In Future Issues. . .

- It's a Small World, Foreigners at NIH
- Ion Channels: Influx and Outflux
- Designs for the Clinical Center
- Perspectives on Alternative Medicine

1) Designers of the new Clinical Center are seeking community input on the possibility of including some commercial establishments, such as restaurants, hotels, and stores. Do you support commercial development on campus? If so, what sort of businesses would you like to see?

2) *The NIH Catalyst* is planning a new "Just Ask" column in which we will try to answer questions and solve problems that stand in the way of the efficient conduct of intramural research. If you are having trouble tracking down collaborators or otherwise navigating the NIH bureaucracy, send your questions in now.

3) Our Hot Methods Clinic will return next issue. What suggestions or comments do you have about techniques featured in past issues? What methods would like to see covered in the future?

4) What specific suggestions do you have on how the security of radioactive materials can be improved without compromising the quality and efficiency of research?

The NIH Catalyst is published bi-monthly for and by the intramural scientists at NIH. Address correspondence to Building 1, Room 334, NIH, Bethesda, MD 20892. Ph: (301) 402-1449; e-mail: catalyst@od1em1.od.nih.gov

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