No Help Wanted

Young U.S. scientists go begging with serious consequences for our future

First of a series

By Boyce Rensberger
Washington Post Staff Writer

The post-World War II boom in American science funding that sustained the world's greatest expansion of knowledge and improvement in living standards ended in 1987, and many scientific leaders say that as a result, the United States may eventually see slower rates of technological advancement and flagging battles against disease, hunger and environmental degradation.

In 1987, the long-sustained increase in federal funds for research stopped growing faster than inflation. It has since remained level.

Although a constant amount of funding might be expected to support a steady pace of scientific advancement, leaders in the research community caution that may not be the case because of another factor: rapid growth in the number of U.S. scientists. The number of university-based scientists being supported by federal grants has continued to grow at a rate of 5.7 percent a year—2 times faster than the U.S. work force as a whole. The number of medical scientists has grown 10 times faster.

One of the effects of this increased competition for funding, many scientists say, is that basic or pure science research proposals that might yield major advances frequently are rejected because they are long shots or would take too many years to pay off. Instead, they say, the grant money goes to more cautious, incremental proposals.

Another effect is that many young scientists—the future lifeblood of American science—cannot find permanent jobs in research and are quitting a profession that once was viewed as a lifelong calling. Older and more established scientists occupy most of the permanent positions and get most of the grants. According to a study by the National Academy of Sciences, even as the overall number of grant applications was increasing, applications from scientists under the age of 37 dropped 54 percent between 1985 and 1993. Researchers suggest that younger scientists are not seeking grants because they have no permanent job base from which to apply.

The unemployment rate among scientists with PhDs is now among the highest for all professionals. Since 1988 it has tripled, from 1 percent to 3 percent, the sharpest rise occurring even as the overall unemployment rate has been falling in recent years.

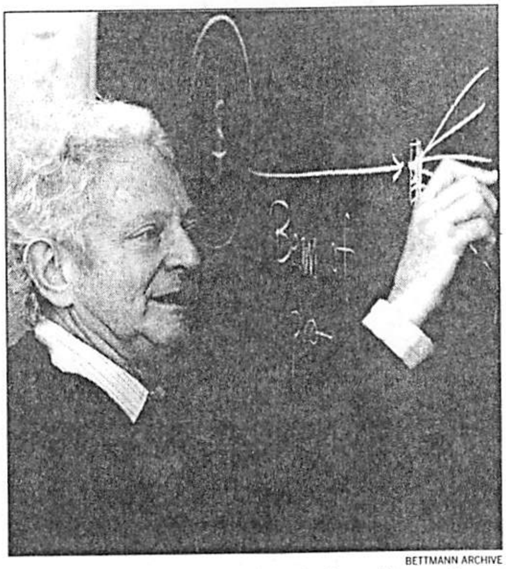
The growing number of newly trained PhDs has coincided with a recent influx of foreign researchers, creating a pool of professionals that far exceeds the number of science jobs available in academia and industry. Far from the shortage that experts once forecast, the country now faces what many call a scientist glut.

Scientific groups and politicians have proposed a range of possible ways to avoid the feared dulling of America's scientific edge. Not surprisingly, some organizations contend that the answer is to boost research funding, especially for basic science, the kind of research aimed at learning more about how nature works. Others—including the National Academy of Sciences and its sister groups—say current spending is sufficient, but the nation must set priorities.

Some political leaders and advocacy groups argue that instead of spending so much on basic science, money should be directed into targeted research, such as curing specific diseases or developing particular technologies.

A few scientific leaders say the combination of stagnant funding and a glut of scientists is not altogether bad.

"There's always going to be an oversupply of scientists," says Bruce Alberts, president of the National Academy of Sciences. "My own view is that the system has to be competitive. Getting government funding is a privilege. The stiffer the competition, the better the chance that only the best are getting grants."



BETTMANN ARCHIVE

Physicist Leon Lederman sees America's position weakening as a result of inadequate funding of scientific research.

But virtually all, including Alberts, agree that in the longterm some effort should be made to remedy the current imbalance between scientists and research money in order to revive the higher-risk, speculative research that helped establish America's preeminent position. "If we persist on this course," says Leon Lederman, a Nobel laureate in physics and former director of Fermilab, the world's most powerful atom smasher, "we can expect to see America's position in the world gradually weaken. We will watch as our technology-based products become less and less competitive in world markets."

Lederman, who was president of the American Association for the Advancement of Science in 1990, links this country's economic and cultural growth through this century to its once exuberant pursuit of science and points to increased science spending by such rising global competitors as Japan and Germany. "America has lived and grown great through science and technology," Lederman wrote in a 1991 warning to his colleagues titled "Science: The End of the Frontier?" "Once upon a time American science sheltered an Einstein, went to the moon, and gave to the world the laser, the electronic computer, nylon, television, the cure for polio, and observations of our planet's location in an expanding universe. Today we are in the process, albeit unwittingly, of abandoning this leadership role."

ALTHOUGH SCIENCE FUNDING HAS BEEN FLAT SINCE 1987, some areas of research have fared better. Nonmilitary biomedical research, mostly funded by the National Institutes of Health (NIH), has grown in purchasing power at an average of 4 percent a year, from \$6.5 billion in 1987 to \$8.4 billion (in 1987 dollars) for 1994. Although this is a real increase, it has not kept pace with the growth in the number of medical scientists—increasing at an annual average of 9.4 percent.

The growth in spending for nonmilitary research has been almost precisely offset by a drop in Defense Department research spending, from \$39 billion in 1987 to \$33 billion this year.

The relative good fortune of civilian research ended in 1992, when budgets for civilian and military research flattened. In the 1995 federal budget for NIH, dominant supporter of biomedical research, and for the National Science Foundation (NSF), chief supporter of nonmilitary and nonmedical research, Congress provided an aggregate boost in current dollars of only 4.1 percent. This just compensates for the inflation rate in the cost of research, which has risen faster than the consumer price index.

Over the same period, the number of researchers competing for federal grants has been soaring. Many universities expanded their PhD programs in the 1980s in response to NSF predictions of a coming shortage of scientists. As a result, the number of scientists grew by an average of 4.6 percent a year from 1977, when there were 240,000 scientists, to 1989, when there were 374,000 scientists.

Although the NSF changed the way it collects data after 1989, making it difficult to compare totals from subsequent years, other statistics indicate that the trend continues. For example, the number of scientists in "postdoctoral" positions—temporary jobs at which newly graduated PhDs work for established scientists until they can find permanent jobs—has been growing even faster—5.7 percent a year, even as the U.S. labor force as a whole grew at only 2.2 percent annually. Leaders of the scientific community are now trying to encourage young scientists and those still in school to find other careers.

The American Physical Society, the main professional organization of physicists, last April urged university physics departments and professors to tell their students about the poor job market and to steer them to other careers. Some major universities are considering cutting the number of students they admit to graduate schools. Cornell University's physics department, for example, has led the way by cutting admissions to its graduate school by 25 percent.

The number of scientists was swollen further in 1990 when Congress passed a new immigration law designed to give visa preference to foreigners with advanced degrees. As a result of the 1990 Immigration Reform Act, the annual number of job-based visas nearly tripled, from 54,000 to 140,000. About 30 percent of the total is believed to be scientists.

IN 1993, AN ADDITIONAL, ONE-TIME WAVE OF scientists came from China with passage of the Chinese Student Protection Act, enacted in response to the government shootings of students in Beijing's 1989 *Tiananmen Square* protests. At a stroke, nearly 27,000 Chinese students were granted permanent visas, a high proportion of them believed to be in science and engineering.

In 1979, according to NSF figures, there were 12,000 U.S.-born postdoctoral researchers and 6,000 foreign-born. As of 1992 there were 16,000 U.S.-born and 17,000 foreign-born.

"After spending 16 years training for a career in physics," says Robert Zacher, 35, "I have given up trying to find a job in physics and have become a computer programmer" in a temporary job in Cambridge, Mass. "I was one of the lucky ones and am grateful to have a job. I have been forced to write off my years of investment in physics as a waste of time. My experience is not unusual. It has become the norm."

Even in biomedical science, where the relevance of the research to curing disease is widely accepted, the mood is bad.

"There's a lot of discouragement, disillusionment," says Keith Trujillo, 37, who earned a PhD in neurobiology in 1986 but found only temporary jobs until a few months ago, when he was hired at the recently established California State University at San Marcos. "People are working hard, putting in long hours, weekends, and then they find the jobs aren't there. The money's not there."

New scientists just starting out with a PhD can expect to earn around \$18,000 to \$20,000 a year. Trujillo recalls that in 1986 when he got his doctorate in neuroscience, his younger brother got a bachelor's degree in business. That same year, his brother made twice as much selling copiers for Xerox as he made in the first of a series of temporary postdoctoral positions. Today, eight years later, the salesman still out-earns the scientist twofold to threefold.

A generation ago the postdoctoral fellowship was a brief internship that virtually guaranteed a permanent job on a university faculty. Now many young scientists move from postdoc to postdoc, hauling their families from city to city every few years. Paul Sotirelis, a young physicist, calls these scientists "the migrant workers of today's high-tech society." Sotirelis says that after he got his PhD, it took 1½ years and nearly 200 job applications to land his current first stint as a "migrant worker" at Ohio State University.

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THE HEALTH OF U.S. SCIENCE

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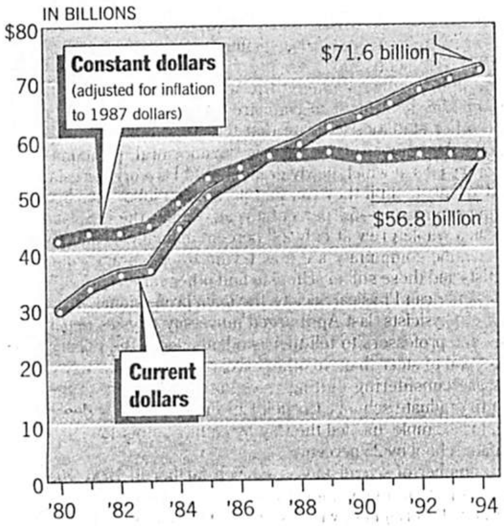

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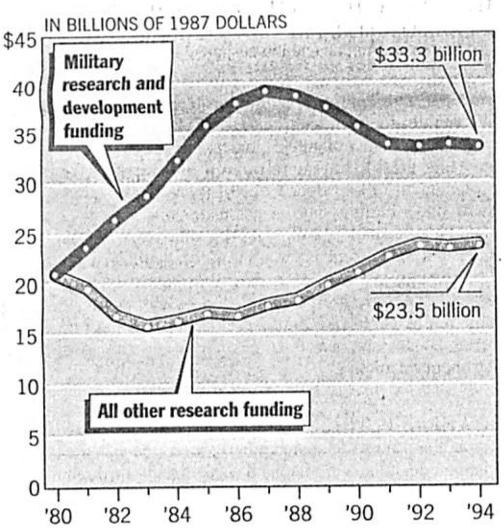

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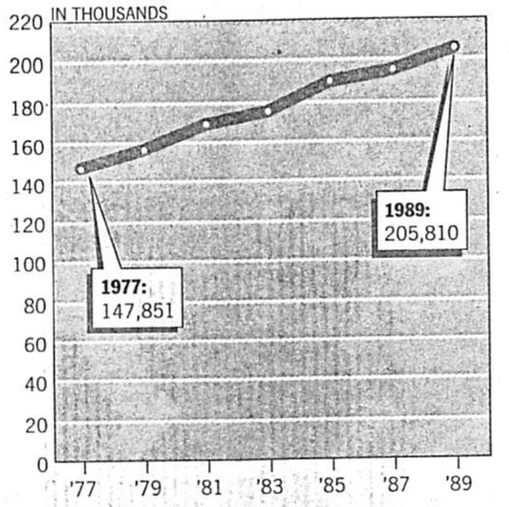

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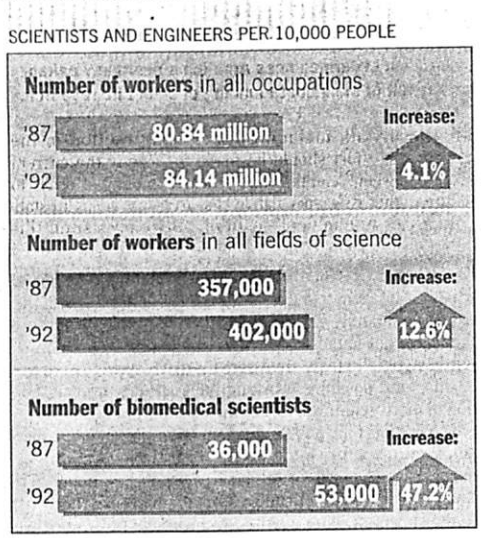

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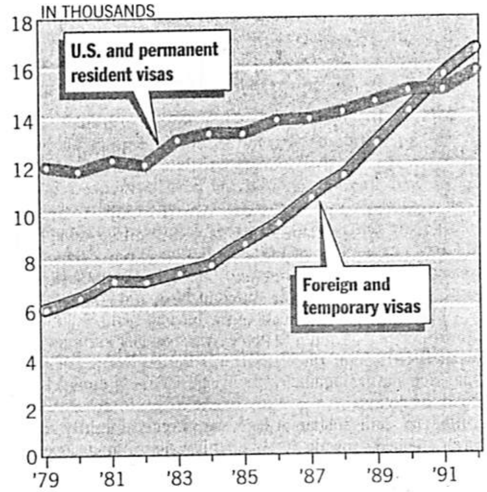

SOURCES: National Science Foundation, Bureau of Labor Statistics

THE WASHINGTON POST

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Many scientists say granting agencies no longer are willing to fund risky ideas, however visionary, because that would take money away from more modest proposals that are sure things.

"Creative grants are nit-picked to death because everyone knows there are insufficient funds. Worse yet, they are trashed based on containing an element of risk," says Sondra Lazarowitz, an associate professor in microbiology at the University of Illinois at Urbana-Champaign and chair of an NIH panel for postdoctoral fellowships. "Frankly, the most creative science is that which takes risks. The situation is favoring the lemmings who copy what has been done and is safe."

Scientists who have reviewed grant applications confirm that review panels have become timid. "The low rate [of success in grant applications] does have the effect of decreasing the likelihood that innovative or unusual research is funded," says Anne C. Petersen, who has reviewed grants, was the University of Minnesota's vice president for research and is now deputy director of NSF. "Some review committees are able to overcome this problem but most are too conservative."

PRIVATE INDUSTRY ALSO IS CUTTING BACK ON scientific research. According to the pharmaceutical industry's trade association, drug manufacturers cut more than 3,000 science jobs in the last two years. The chemical industry shed 16,000 jobs last year, according to the American Chemical Society. Such technological giants as AT&T Corp., IBM, and General Electric Co. have been similarly "downsizing," eliminating thousands more jobs in research and development.

"Near-term profitability pressures have led to a significant downsizing of their [industry's] research staff," says Kumar N. Patel, who led a major research division at AT&T Bell Laboratories until recently becoming vice chancellor for research at the University of California at Los Angeles. "Even those high technology giants who built their industries on the results of basic research have substantially reduced fundamental research activities." Many industry leaders say they intend to rely more on universities to do the research that would lead to new products. But NIH and NSF calculate that they now are able to fund the smallest percentage of applicants in their histories—less than 28 percent of a total of 55,000 applications last year. In some crucial fields, such as biomedical research, the success rate was just 21 percent. Twenty years ago, nearly half of all applications won funding.

Scientists who have served on grant-evaluation panels say today's lower funding rates make for arbitrary choices among the best applications when deciding which to fund. As a result, many scientists whose ideas receive top marks still go unfunded.

EVEN THE NIH'S HUGE RESEARCH PROGRAM AT ITS Bethesda, Md., campus—once viewed as a crown jewel of American science—is cutting its staff by nearly 12 percent over the next four years. Part of a Clinton administration downsizing of many government agencies, the reduction will require NIH to drop 400 positions in 1995 alone. The 1995 federal budget cuts the Pentagon's funding for research by 14 percent.

Far from being a temporary squeeze, scientific and political leaders say the constriction is likely to continue for the foreseeable future for one simple reason: The 1993 budget agreement between Congress and the White House, intended to fight the deficit, effectively prevents Congress from increasing federal science spending over the next five years unless it makes offsetting cuts elsewhere. And no one expects the budget problems to be gone that soon.

Nor is science funding likely to increase under a Republican-led Congress. Although Republican Rep. Robert S. Walker of Pennsylvania, who is to chair the House Science Committee, and House Speaker Newt Gingrich of Georgia are both known as supporters of science and technology, they remain constrained by the budget agreement. Moreover, observers on the Hill say their advocacy of expensive "big engineering" projects such as the space station may divert funds that would otherwise go to science.

And yet, for all the anguish to be heard within the research establishment, observers would be hard pressed to think that American science—at least for the moment—is anything but a powerhouse of new ideas and bright promises. Biomedical researchers continue to discover the genetic defects underlying many cancers and other diseases. Astronomers make new discoveries about the origin and evolution of the universe. The electronics and communications industries continue to develop ever more sophisticated new technologies.

There are so many smart people in science making use of such powerful new research methods that scientific leaders say impressive progress is virtually assured for many years to come. But they predict that the slump in practical payoffs will come decades from now, when discoveries of today's basic science would be expected to bear fruit.

"The U.S. system of science, which has historically led the world in inventiveness, is being strangled to death," says Dick Tracy, professor of biology at Colorado State University in Fort Collins, who has served on NSF panels that review grant applications. "This is a tragedy for science."

The Real Science: Raising Enough Money to Keep Going

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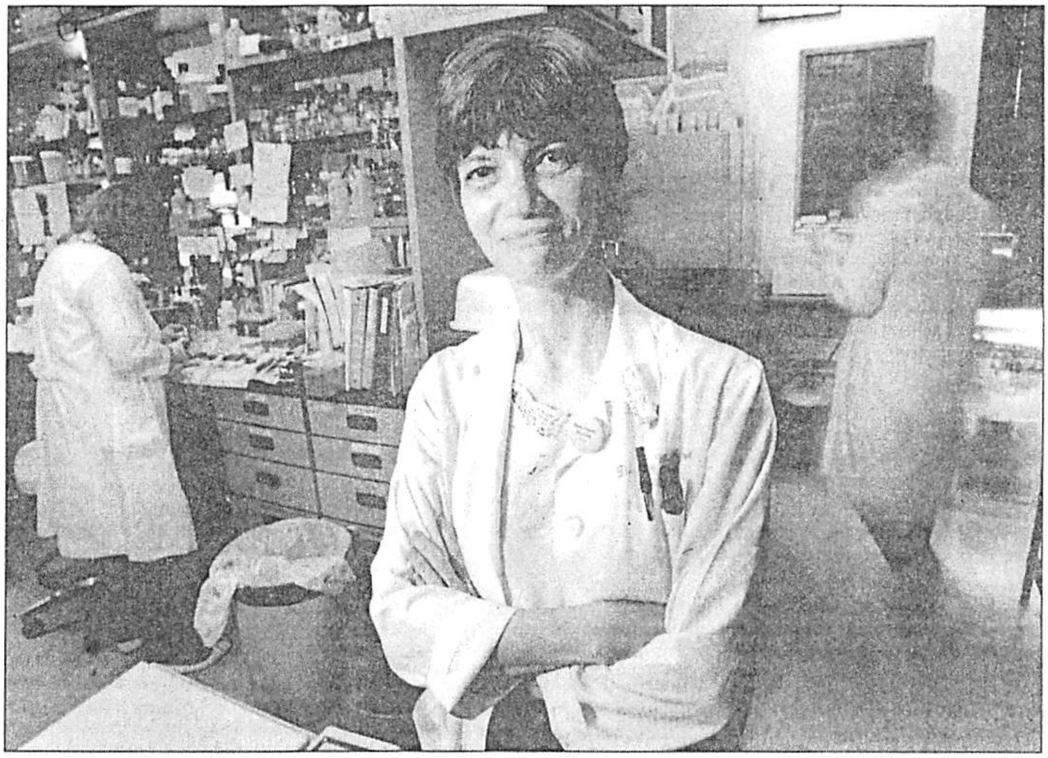

BY PAUL S. HOWELL FOR THE WASHINGTON POST

Joy Mulholland, a research team leader at Baylor College of Medicine, found a job in Philadelphia after losing her grant.

HOUSTON

Joy Mulholland's scientific career is in trouble. Until a few months ago, the Baylor College of Medicine researcher was leading a team of three other PhDs and a technician studying how hormones regulate genes in the uterus. The research was relevant to developing better contraceptives, improved treatment for infertility and new approaches to uterine cancer. And, as the result of a surprise finding last year, it looked as if the lab was on the trail of a new insight into Alzheimer's disease.

But Mulholland has disbanded her team and is shutting down her lab. Her grant money ran out last summer and even though she wrote lots of proposals that got high marks from funding agencies such as the National Institutes of Health (NIH), they brought in no money. Each time, too many other proposals received slightly more favorable evaluations and got all the available funds.

"I had to tell my people they should look for other jobs," the Harvard-trained molecular biologist says in her small, windowless office decorated with postcards and cartoons. "I won't have the money to pay myself, either. I'll be out the door too."

All Baylor scientists, like those from most other academic research centers, must raise part or all of their salaries and fringe benefits through grants. And those grants must also provide the salaries and benefits of the scientists who work for them.

At Baylor and many other top-ranked private universities from Harvard to Stanford, most or all researchers are on this "soft money." When hard times come, the university may—or may not—pick up a scientist's salary for a few months or maybe a year. Researchers who haven't won a new grant in that time are expected to leave. State institutions are more likely to guarantee salaries but, because all universities count on taking a cut—sometimes more than 50 percent—of every grant for "overhead," their scientists are still under fierce pressure to bring in money in the form of grants.

Of Baylor's 60 faculty members in the Department of Cell Biology—one of the main fields of basic biomedical research—almost everyone has lost at least one grant and many have had to let people go, Mulholland says.

"It's a rough system," says William Brinkley, a prominent cell biologist and dean of Baylor's graduate school, "but that's the way science works in this country. My frustration is listening to these horror stories and trying to keep morale up, trying to keep people from jumping ship."

The nation that is the unchallenged world leader in providing medical advances, new technologies and deeper understanding of the natural world depends for much of its scientific and engineering excellence on freelancers with no job security. They may carry the title of professor and have a campus parking sticker, but when the grant well runs dry, they're on their own. Only the few who have tenure—a status that guarantees them a faculty position—can expect to stay on, most likely at a much-reduced salary.

A generation or two ago, a scientist with a new PhD could expect to go straight into a job on a university faculty. Then, as competition for better faculty positions grew, new scientists sought to broaden their training and experience by taking postdoctoral fellowships for a year or two. Then they would get the real job.

But as the number of new scientists kept rising, the competition kept getting stiffer. Postdoctoral fellowships—which pay about $18,000 to $20,000 a year—grew longer and if no job materialized after the first fellowship, the only choice was to take a second one. And, for a growing number, a third one. Today it is not unusual to find "young scientists" pushing 40 and barely making the median salary for all American workers—$23,100 a year in 1992, according to the Bureau of Labor Statistics. And they are still without a permanent job.

Openings for faculty positions at major institutions commonly draw 300 to 400 job seekers. Of these, many department chairmen say, maybe 100 are outstanding candidates.

Another sign of the plight of young scientists emerged from a study in which the National Academy of Sciences found that the number of researchers under age 37 applying for grants had dropped by about half since 1985. The study did not reveal what had happened to the young scientists but many in the scientific community believe that they are not applying because they have not found the permanent jobs that give them standing to apply. Instead, they remain in low-paying, temporary postdoctoral positions, working for a steadily graying population of more senior scientists who do have grants.

Today's tight job and funding situation "is sending a discouraging message to young people considering careers in science," says Richard C. Atkinson, a former National Science Foundation (NSF) director and former president of the American Association for the Advancement of Science who is now chancellor of the University of California at San Diego. "Thirty years ago I entered the field with the promise of a career in science that would go as far as my abilities would allow. If I were entering today, I would have second thoughts about the quality of life I faced, particularly whether I would find the resources to support my intellectual pursuits."

MULHOLLAND JUMPED AT THE OFFER OF A POSITION at Baylor even though it was 1,300 miles from Wilmington, Del., where her husband is a chemist with the Du Pont Co. She says she and her husband have decided that the demands of research careers are such that they cannot have children, even if they someday found two jobs in the same place. It is a decision many two-scientist couples have made.

Researchers say the tradition of openness and cooperation in science has been undermined by the competition for jobs and grants. Mulholland says that at Harvard, where she got her PhD, for example, some labs were so secretive that postdocs were not allowed to discuss their research with people from other labs. "People were terrified," she recalls. "When I started out, I was very idealistic. I thought everyone in science cooperated. Boy, was I wrong!"

Today's increased competition has also worsened the longstanding tendency of scientists to work long hours and weekends. "Far from being a relaxed, supportive environment, major research universities are often intense, competitive, high-pressure workplaces," says Guy M. Smith, a marine geologist at St. Louis University's Department of Earth and Atmospheric Sciences. "Long hours, stress-related health problems, and family and marital problems are common. The divorce rate among untenured faculty is high."

Because quantity of publications is the key to success in the scientific establishment (although not necessarily in the advancement of knowledge itself), there is also pressure to divide one's findings into ever smaller units, each of which could be published as a separate scientific paper. As some scientists put it, the trend is toward the "least publishable unit."

"The rush to print is eroding the overall quality of the research literature in that complete results of projects tend to come out as part of several papers instead of just one," says Peter B. Boyce, executive officer of the American Astronomical Society.

NOWHERE IS THE COMPETITION MORE FOCUSED than in the process of applying for a grant. "This is the part of science I don't like," Mulholland says, flipping through the 35-page instruction manual for completing an NIH application. The agency funds most of the nation's biomedical research.

In addition to explaining the proposed project, which is allowed to take up to 20 single-spaced pages (and usually does), the applicant must fill out 11 pages of forms. Besides the obvious who, what, when, where, why and how much, the forms ask for such things as the cost of each scientist's fringe benefits, the type and amount of other grants in hand or being sought, the kind of lab equipment and computers available, whether the lab is a "drug-free workplace," whether the scientist does any lobbying, and—right there on the first page—what congressional district the laboratory is in.

Each application must also include the complete curriculum vitae of all the scientists on the project, a list of all their previous scientific publications and several pages of detailed budget. Because Mulholland's lab uses rats, for example, her budgets also include such items as "Rat Care: 1,500 rats x $0.30/day x 21 days (average) = $9,450." The application can easily run 40 pages or more.

Scientists say it usually takes them two to three weeks of intensive work to prepare each application. Because it is rare

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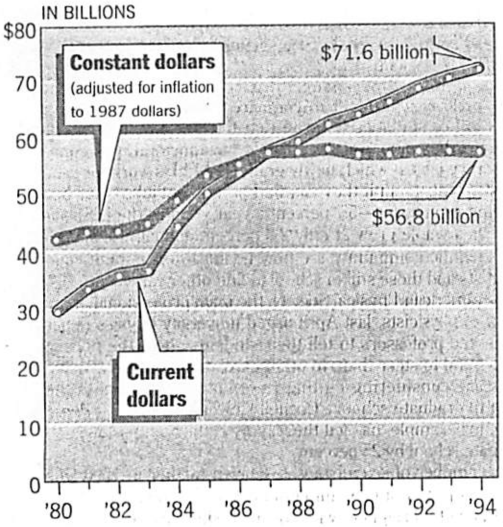

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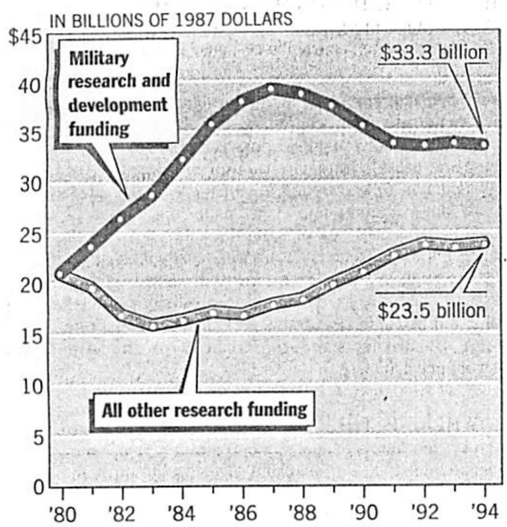

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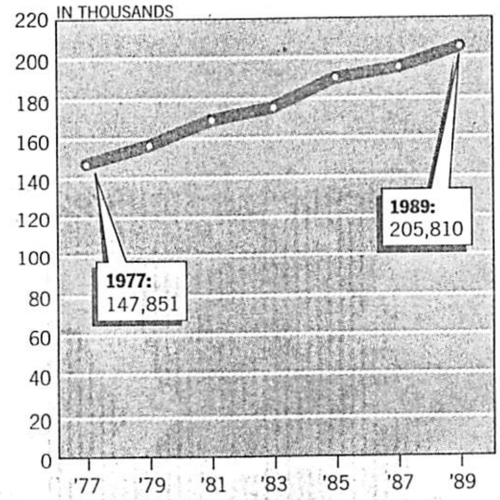

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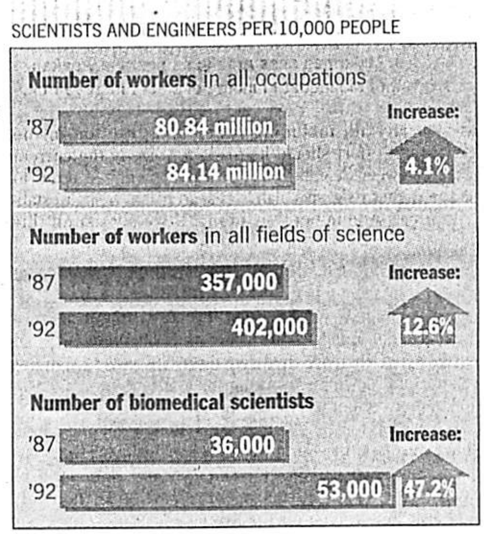

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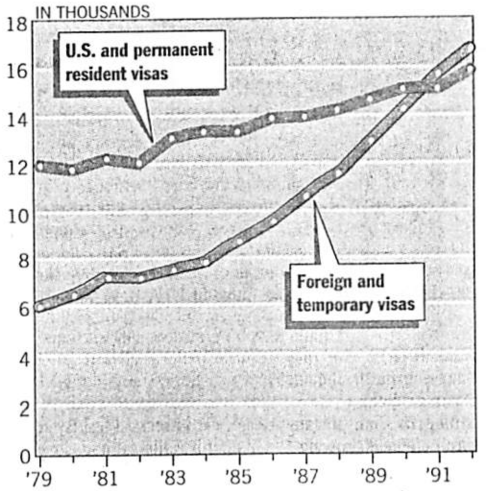

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A Life's Work Decided in 10 Minutes

After the weeks of work that a scientist puts into applying for a grant from the National Institutes of Health, the fate of each application is decided in about 10 minutes. That's how long an NIH panel responsible for evaluating proposals usually spends on each one.

To review grant applications, NIH uses a highly formal, two-step process in which the biggest part of the decision is in the hands of a panel of private citizens—a group of scientists from academia, government and industry with expertise in the same subspecialty. NIH has about 100 of these "study sections," each made up of about 15 scientists from across the country. Researchers serve four-year terms. Each study section meets in Bethesda, Md., site of the NIH campus, three times a year to evaluate 80 to 100 applications at each session.

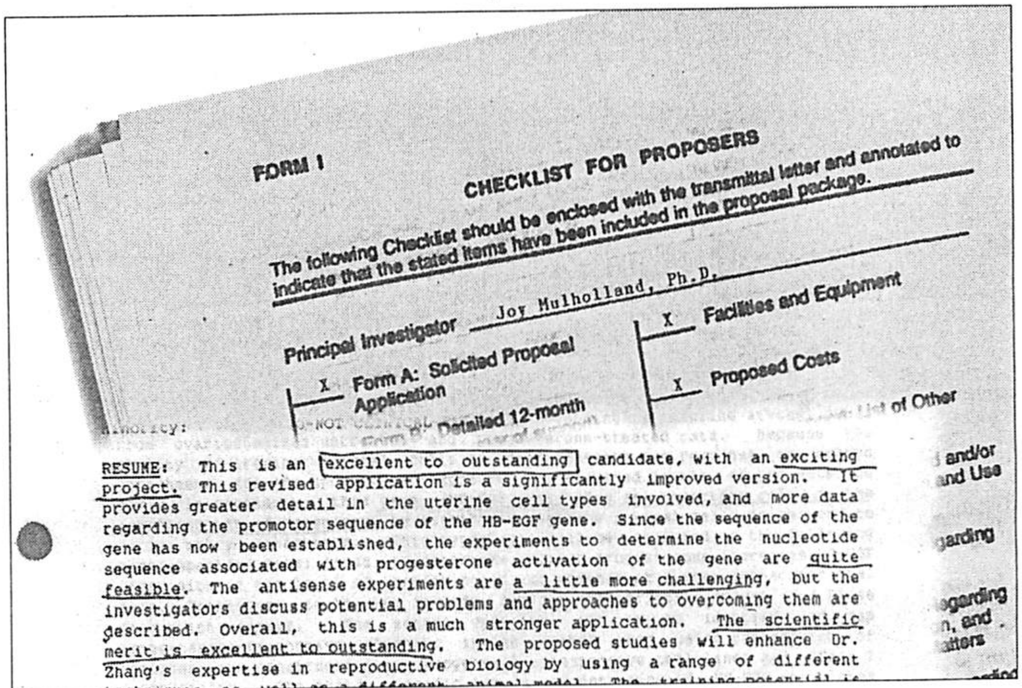
"Most scientists agree to do it for altruistic reasons," says George M. Stancel, chairman of the pharmacology department at the University of Texas medical school in Houston, who also teaches a course in NIH grantsmanship to beginning scientists. "There's not much else in it. They pay you $100 per diem but that's about $50 short of what it actually costs you."

EACH PROPOSAL IS SENT TO EVERY MEMBER OF the study section but is read in detail only by two people, those assigned to be primary and secondary reviewers.

"The primary reviewer has 10 minutes to present your grant to the group," says Stancel, who has served on study sections. "He or she describes it and says what they think. All your months of preliminary research and preparation come down to 10 minutes of make-or-break. Your primary reviewer may love the idea but be a mumbler and not give a good impression. The secondary reviewer may concur or give a different opinion."

After some discussion ("If any one of those 15 people expresses some hesitation, that's the kiss of death," says Stancel), each member assigns a score to the proposal.

After all the applications are scored, they are ranked and sent to the second step of NIH's process—the advisory council at each institute. This is a group of institute administrators and scientists, and outsiders, including community representatives. Their job is to start at the top of the priority ranking and distribute the money as far as it will go.


FORM 1

CHECKLIST FOR PROPOSERS

The following Checklist should be enclosed with the transmittal letter and annotated to indicate that the stated items have been included in the proposal package.

Principal Investigator Joy Mulholland, Ph.D.

X Form A: Solicited Proposal Application

X Facilities and Equipment

X Proposed Costs

Detailed 12-month

RESUME: This is an excellent to outstanding candidate, with an exciting project. This revised application is a significantly improved version. It provides greater detail in the uterine cell types involved, and more data regarding the promotor sequence of the HB-EGF gene. Since the sequence of the gene has now been established, the experiments to determine the nucleotide sequence associated with progesterone activation of the gene are quite feasible. The antisense experiments are a little more challenging, but the investigators discuss potential problems and approaches to overcoming them are described. Overall, this is a much stronger application. The scientific merit is excellent to outstanding. The proposed studies will enhance Dr. Zhang's expertise in reproductive biology by using a range of different

Joy Mulholland's grant application generated many favorable remarks but still was rejected.

But the council is allowed to deviate from the study section's ranking. It may decide that some proposals are too far from the institute's mission, as defined by tradition and Congress, and reject even high scorers. The council also usually awards less than the amount requested.

Because so many more scientists are competing for a relatively small pool of money, NIH institutes last year received 25,000 grant applications and had enough money to fund only the top 11 percent to 32 percent of applicants, depending on the institute. The National Science Foundation was able to fund 30 percent.

A generation ago the success rate of grant applicants was about 50 percent, though the total number of applications was smaller. For instance, in 1974, NSF received about 13,000 applications and funded 49 percent. ■

— Boyce Rensberger

for one grant to sustain a whole research team, lab chiefs must have several in hand. To have that many successful grants, they must write many more applications. Mulholland says that in the last year she has written 11 grant applications, a process that she estimates has consumed 60 percent to 70 percent of her working hours. None has won funding.

"I do not consider this the most valuable use of my time," Mulholland says. "Like every head of a research group, I hire younger, less-skilled scientists to do the science, while I'm writing the grants. . . . The most experienced scientists have no time to do science and little time to train younger investigators because they have to spend all their time chasing funding."

Once the application is submitted, the review process is agonizingly slow. At NIH, which processes about 25,000 grant applications a year, it routinely takes nine months to get a verdict. If the application failed but received an encouraging evaluation, the author can try to improve the application and go through another nine-month cycle. If it is approved—the experience of less than one in four applicants to NIH—there is a three-to-six-month wait before the money arrives. Because most of the grants that NIH approves are resubmissions, scientists are routinely waiting at least 18 months to two years to get a grant. NSF's grant review process, which examined nearly 30,000 applications last year, is comparably lengthy.

"In this time," Mulholland says, "all the people you have spent two to three years training have been forced to take jobs elsewhere in order to pay their rent and to eat. So if you are fortunate enough to eventually receive funding, you must begin all over again with untrained personnel. This costs time as well as money."

Mulholland herself is about to begin all over again. Because she failed to get a grant, she will have to leave Baylor next year. She considers herself lucky to have found a job at Jefferson Medical College in Philadelphia.

In these days of tight competition for funding, a scientist's track record has to be good. If the ideas financed by the previous grant did not pan out, reviewers will tend to have less confidence the next time around. So to make sure they never fail, scientists say they often resort to a subterfuge. The researchers do the research first, or at least a good part of it, and then ask for the grant.

"What has become all too common," says June Medford, an assistant professor of plant molecular biology at Penn State University, "is to write a grant proposal with the experiments half done so you know that they will work and you know that there are no 'holes' where a reviewer can cut you down."

This is a technique available primarily to established researchers who have prior grant money on which they can "bootleg," as some put it, a new idea. Such diversions of grant money are expected by many granting agencies, which explain that a grant is not a contract. If the results look promising, they are offered in support of a new grant application. Sometimes only part of the results are offered and the rest are held back to deliver as if they resulted from the new grant.

ACCORDING TO MANY SCIENTISTS, THE SYSTEM IS stacked against the most innovative ideas. "The funding agencies aren't interested in what's important," says Steven Frisch, a biochemist with a 1984 PhD from the University of California at Berkeley and now a postdoctoral scientist at the La Jolla Cancer Research Foundation. Frisch says he believes he is on the trail of a major new approach to treating cancer but cannot get funding to pursue it. The funders, he says, are "only interested in what's feasible."

Scientists do not deliberately duplicate one another's work but many do think up minor variations on projects that others have done. Sometimes this is valuable, scientists say, and sometimes it is a waste of time and tax dollars.

In such practical and highly commercial fields as computer science, similar conditions have long prevailed.

"When I got my first proposal [funded] from NSF, a senior professor congratulated me and told me that I was lucky in getting such a creative idea funded and that the next time I should please play it safe and submit a proposal that was a [small] increment over my current research," says Matthias Felleisen, a professor of computer science at Rice University in Houston. "I have since reviewed many proposals," Felleisen says, "and I can confirm that this is the way the game is played."

One of the most regretted losses is the chance to pursue that greatest of scientific methods—serendipity. This is a phenomenon familiar to every scientist: You are doing one kind of research and something turns up that looks more interesting or more important. The natural scientific impulse is to swerve onto a new path and check out the surprise finding.

That is what Mulholland wanted to do when her group discovered that one of the things hormones do to the uterus is switch off the gene that makes amyloid. This is the protein that is produced in excess in the brains of people with Alzheimer's disease. In doing basic science on how the uterus works, she and her colleagues may have found a lead to understanding a very practical problem.

"If this happens also in the brain," Mulholland says, "hormone treatment could reduce amyloid production, which is a major part of Alzheimer's pathology."

Years ago, the scientist says, it would have been easy to get a grant to follow the Alzheimer's lead. Today, it has proven impossible. "Unless you've got a track record in a field," she says, "you're not very likely to get funding to work in it. If we're on to something, we may never find out." ■