Is There a 'Female Style' in Science?

Though female researchers are reluctant to discuss the subject in public, in private it's a hot topic.

The most memorable lesson Indiana University archeologist Anne Pyburn took away from a grant-writing seminar held by her university last summer had nothing to do with the fine points of securing funding. She learned much more, she says, about the stark differences between how men and women set out to achieve goals in the scientific arena. "We were sitting around the table talking about how to approach a funding agency for the first time," Pyburn recalls. One man in the group said he would get right on the phone to the program director, to "touch base" and find out if his proposal was appropriate. All the men in the room agreed, Pyburn adds, but all the women recoiled. "The gender difference among these 18 people was absolute," says Pyburn. "The men all thought it was normal [to call], but the women all thought it was sleazy."

Pyburn was so impressed by the contrast that she decided to carry out some informal research of her own. She's been asking her colleagues the same question ever since and continues to find them split along gender lines. Why? Her explanation is that women, in their efforts to break into the inner circle of science, want to be sure they play by the rules, avoiding any suggestion that their success may be due to special treatment rather than to merit. Men, she thinks, are more comfortable in the predominantly male culture of science, so a phone call to the (almost certainly male) head of a funding committee feels right and natural.

Pyburn's experience scratches the surface of an issue that is very real for virtually all the female scientists contacted for this article—the feeling that women, on average, run their labs, interact with colleagues, and pursue their careers in characteristically female ways, probably as a result of their cultural conditioning. If such a "female style" exists, it is certainly not absolute, and many researchers can tick off exceptions: women who operate more like the average male scientist, and men who seem to fit the putative female mold. Furthermore, there is no way to evaluate the science that a "female style" creates—whether it's better or worse than the science produced by the dominant male model. Nonetheless, many female scientists do feel that their style is not as readily accepted in the inner circles of research, and they argue that barriers to their approach must be broken down if they are to achieve fully equal status in the world of science.

Yet concerns about how that kind of talk will be perceived by the male establishment make many women hesitant to discuss the subject at all. "It's a kind of hush-hush topic," says Caitilyn Allen, a plant pathologist who also teaches in the women's studies program at the University of Wisconsin, Madison. The reason, she says, is that the accepted ways of going about science have been defined by men. "Women are afraid that if they discuss the possibility that they are doing science differently, it will be assumed that the science they are doing is not as good," she says. But while they may not often discuss it publicly, says Allen, female researchers talk about the issue among themselves, "and there is a sense that there probably are some differences."

But not everyone is convinced that there is a "female style" of doing science. And the skeptics include at least one leading female researcher in the sociology of science—sociologist Harriet Zuckerman of the Andrew W. Mellon Foundation in New York. "I've heard the same anecdotes," says Zuckerman. But she remains unconvinced that they affirm the existence of a specifically female style. "Anecdotes are a kind of evidence, but they are not evidence of whether something is really there, but rather of what people believe is there," she says.

It is as yet impossible to resolve this issue scientifically, since only a handful of studies address the question. But interviews with a range of female researchers indicate that some of them feel strongly that in matters ranging from lab management to the choice of research topics, women, on average, approach things differently than men.

DUANE HALL

Not your father's laboratory. Molecular geneticist Lillie Searles with grad students Allen Comer *(left)* and Lara Glenn *(right)*. Searles avoids pitting students against one another.

Running a lab

Molecular geneticist Lillie Searles wasn't thinking in terms of "women's science" when she became an assistant professor at the University of North Carolina 6 years ago. But she says she did make a conscious decision that she wasn't going to follow the conventional models for running a research lab. "I decided I was going to have to do this in a way that reflected who I am," she says.

For Searles, that meant taking a

No More Stressed-Out Supermom

"There's just no allowance in the system right now for women to have a family and do research," says Pennsylvania State University molecular anthropologist Linda Vigilant.

Vigilant, 28, knows both research and motherhood. After a knockout performance as a graduate student in the Berkeley lab of the late Allan Wilson, where she was an author on several landmark papers that established the "mitochondrial Eve" hypothesis, Vigilant came to Penn State in 1990 with her husband, Mark Stoneking, a molecular anthropologist she met in Wilson's lab. Stoneking came to Penn State as an assistant professor on the anthropology department's tenure track. Initially, Vigilant was a full-time postdoc in the same department, using mitochondrial DNA to trace the ancestry of Africans and other modern populations.

But after 2 years, with a new baby at home, Vigilant decided too much was enough. It was "extremely difficult," she says, "trying to adjust to having a new baby, putting time in at the lab and at home. I felt frustrated. I couldn't do as good a job as I wanted at either place. I couldn't be in the lab as much as I wanted or at home as much as I wanted." Something had to give, and what gave were the long hours in the lab. Last year the anthropology department offered her a half-time research associate position so she could spend more time at home with her son, Colin.

In one sense, Linda Vigilant is on an unusual path. Plenty of women in American universities are in part-time, non-tenure-track positions. And her job is a renewable non-tenure-track, 1-year appointment. But many women who drop off the tenure track don't expect to get back on. Vigilant does. She continues to publish, and, though she concedes she "might not be as prolific" as she would be working full-time, she insists "the quality of the research is there." She was a co-author on a recent paper proposing a new method for dating the time when the last common maternal ancestor of modern populations lived.

Combining high-quality research and motherhood makes Vigilant feel "very lucky." Yet she knows her part-time work could be looked on askance when it comes time for a try at tenure later on. Even more disconcerting, she's had to face disapproval from successful female researchers who combined full-time research and motherhood. "There's not as much acceptance from some of these women for not following the traditional track," says Vigilant. "They say, 'I toughed it out, so should you.'"

In fact, though, Vigilant is toughing it out—she's just doing it her own way. She continues struggling to find ways to be both a mother and a researcher without contorting herself painfully. The next barrier she wants to break down is the one that makes it difficult—if not impossible—for new mothers to attend scientific meetings. She's particularly peeved at the Gordon conferences, key insider get-togethers in biology, whose organizers refuse to allow children under 12 near the cafeteria or conference proceedings. When Vigilant wrote to protest, the Gordon conference organizers responded that they barred children because of liability insurance and because they thought children could be a "distraction" to scientists at the meeting. "Who's going to pay the price for that?" asks Vigilant. "Women, obviously."

SCOTT GOLDSMITH

Maternal lineage. Linda Vigilant cut back her research, which exploits DNA to trace the maternal descent of modern human populations, to spend more time with her son, Colin.

If Vigilant has her way, women will soon be paying a smaller price for the way the system works. "I think women are tired," she says, "of feeling they have to make a choice between having no children or being stressed-out superwomen. A lot of questions are just starting to get raised about how women can do both. Everyone seems to be finding her own way." Especially Linda Vigilant.

–Ann Gibbons

more personal approach to her students. As a black woman, Searles remembers feeling inadequate and out of place early in graduate school. Rather than just show her students her present, successful self, Searles, who recently received tenure, shares her early experiences with her students—especially the women—to show them that feelings of inadequacy and isolation can be overcome. "I try to make it clear that it's OK to feel that way," she says.

Rather than fueling her students' competitive fires by setting them against one another—something that's often done in high-pressure labs—Searles adopted a lab management style in which she consciously refrains from encouraging rivalry among her students or holding them to up to absolute standards for performance. Instead, she says, she lets people develop in their own ways. "I feel like different graduate students have different styles and different ways of being effective," she says. Though she's reluctant to label her style "uniquely female," Searles admits that "to the extent I've been influenced by my experience as a female, that is certainly reflected in how I deal with people."

Despite Searles' hesitance to categorize her lab management style as female, she may indeed have chosen a style favored by women, at least according to a small study directed by sociologist Henry Etzkowitz of the State University of New York at Purchase. Etzkowitz and student Carol Kemelgor investigated lab management styles of faculty in a medical school microbiology department. "We found there were two styles by which the investigators were running their labs," says Etzkowitz. Male faculty members were more likely to have students "competing with each other for the professors' attention," he says, while students in women's labs generally felt less competitive pressure. In preliminary results from a larger study of nine departments, Etzkowitz has found evidence that, like Searles, many female faculty members feel additional responsibility for giving

extra encouragement and support to female students, although, unlike Searles, many have difficulty finding time to follow through on that responsibility.

Noncompetitive juices

One reason female researchers may be less likely than male colleagues to set up competitive situations among students is the fact that there seems to be less intrinsic appetite among female researchers for competition. There are abundant anecdotes suggesting that women, more than men, shun fierce competition in their scientific careers. Those anecdotes seem to indicate that whereas many male researchers adopt career strategies that involve going precisely to where the competitive fires are hottest, women often seek ways to reduce competition, placing more emphasis on scientific results than on glittering prizes.

"I've heard the same anecdotes, but they are not evidence of whether [a female style of science] is really there."

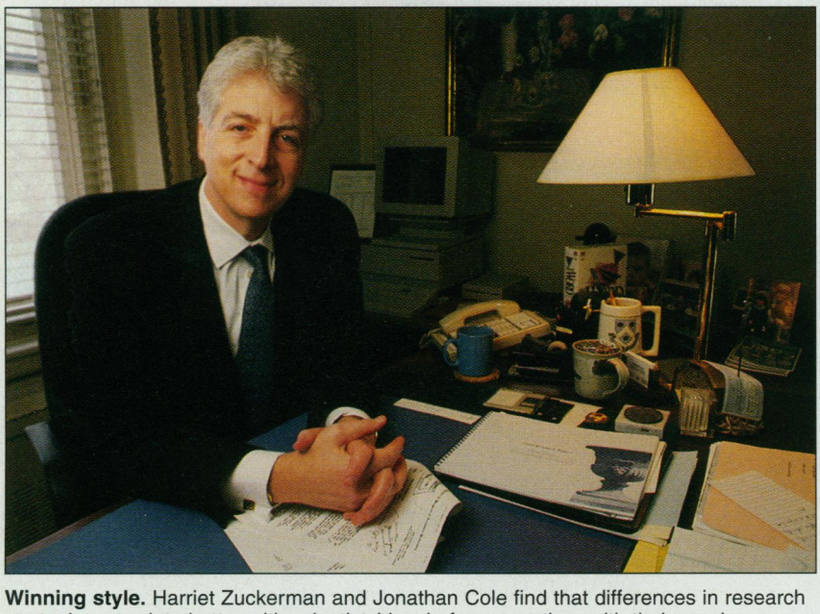
–Harriet Zuckerman

"It's my personal experience that women tend to stay away from controversy or competition," says biological oceanographer Sallie Chisholm of the Massachusetts Institute of Technology (MIT). "I have seen examples of female graduate students wanting to step aside if people are getting close to what they are working on. I'm not saying that women aren't able to compete, but they are not as comfortable with it as men are."

SHARON GUYNUP

Mathematician Jenny Harrison, who recently settled a drawn-out lawsuit with the University of California, Berkeley, over sex discrimination, agrees that competition isn't what drives her. Although she has solved several "hot" problems that mathematicians were competing to be the first to solve, Harrison says it is not the urge to compete that attracts her to a problem. Indeed, she says she often prefers to find a mathematical topic that is her own. "I don't think in terms of beating out people," she says. "I think in terms of what is true, what is the most wonderful thing I can think of to work on." It isn't that she's any less ambitious in terms of her career than her male colleagues, says Harrison; it's just that her way entails "ambition without direct competition."

SHARON GUYNUP



Winning style. Harriet Zuckerman and Jonathan Cole find that differences in research strategies correlate better with scientists' level of success than with their gender.

Do men—or at least a high proportion of highly successful male scientists—consciously opt for direct competition, and is this therefore a critical difference between males and females in approaching science? Scattered statistical data suggest the answer might be yes. Harvard science historian Gerald Holton and postdoc Gerhard Sonnert are just completing "Project Access," a study of the relative access of women and men to scientific careers. As part of the project, they interviewed 200 people, half of them women and half men, all of whom had once held prestigious National Science Foundation or National Research Council postdoctoral fellowships. One trend that emerged from those interviews, says Sonnert, was that the women were more likely to adopt a "niche approach" in choosing research projects.

"Women tend to try to find a well-defined area where they can develop mastery and deal with a relatively limited number of colleagues who are interested in the same field," says Sonnert. The opposite approach, he says, which seems to be favored by a higher proportion of men than women, is "to pick hot topics, where there is a race on between research groups."

One reason women may be less concerned with "hot" topics has to do with how they view their careers. Holton and Sonnert found that the women interviewed for Project Access seemed to view science in less careerist terms—that is less as a vehicle for financial stability and professional status—than men do. That makes sense, says Radcliffe president Linda Wilson, because "our whole social heritage hasn't focused on women as breadwinner or provider." That means, adds Wilson, who was trained as a chemist, that "men are much more conscious of what will advance their career, because they are much more oriented to do that."

The putatively typical male emphasis on careersmanship became clear to solid-state physicist Alison Chaiken, now at Lawrence Livermore National Laboratory, when she interviewed for an academic job a couple of years ago. "The guy taking me around said they had a lot of 'dead wood' in this department…people who publish only three to four *Phys-Rev-B* [papers] a year, and that's all." His point, Chaiken thinks, was that *Physical Reviews B* is a journal for competent—but not splashy—results. Chaiken says she was "astonished" that he considered researchers with that kind of publication record to be dead wood. "I would be happy with three to four *Phys-Rev-B* [papers] a year," she says. "I don't have to rate an article in *Science* every year to feel successful." In general, says Chaiken, she looks at her work in terms of what is needed to solve a problem, rather than what is needed to produce a flashy paper.

Is Chaiken's view typical? Yes, according to a study of 700 female and 2500 male scientists and engineers at 24 U.S. companies, performed by Nancy DiTomaso of the Rutgers University Graduate School of Management. DiTomaso found that the women placed less importance on professional recognition than their male colleagues did. And, in fact, several studies have found that female scientists publish only half to three-quarters as many papers as male scientists (although, by

itself, this observation doesn't prove the women don't want to publish more). Intriguingly, in one such study Holton and Sonnert found that while women published less, their papers were nevertheless cited at a higher rate. One interpretation of these results, says Holton, is that "women tend to take more seriously the internal requirement to turn out very [thorough] articles rather than just turning out a lot of articles."

"The criteria by which we assess excellence fit well with the way men behave, and they are different from the way women behave."

—Linda Wilson

Alternative explanations

But the idea that women adopt different strategies than men do in picking scientific problems is contested by Zuckerman of the Mellon Foundation. In a study done with Jonathan Cole of Columbia University, Zuckerman says she and Cole found "very marked differences in the criteria scientists use in choosing their problems, and the kinds of problems they study." But, she says, the differences are better correlated with the scientists' standing in their field than with their gender. Eminent scientists, she says, "typically go for the really important problems," even if they are difficult or hotly pursued by many labs; less eminent scientists appear to feel they can't afford the risk of failure.

Cole and Zuckerman have also found, like Holton and Sonnert, that women publish fewer papers than men do. Zuckerman says she and Cole cannot yet explain this difference, though she says it is not linked to motherhood; nor is it due to differences in the quality of their graduate education.

Those who disagree with Zuckerman and think there is a specifically female style of doing science point out that there is a flip-side to the apparent avoidance of direct competition: willingness to collaborate. Women repelled by the image of science as "an individualistic, lone-wolf enterprise" find that "there can be a lot of comfort as well as productive science in a good collaboration," says the University of Wisconsin's Caitilyn Allen.

And those collaborations are most satisfying, many women say, when they can be forged with other female scientists—because men are less likely to embrace the concept of equal collaboration without turf struggles. Rockefeller University neuroscientist Mary Beth Hatten recalls sitting around discussing science with a male colleague, when it became clear to both of them that a particular experiment could shed light on both their projects. To Hatten, it seemed like an ideal opportunity to collaborate. "I made this comment: 'Of course, when we do this, we can do it together,'" she recalls. "He seemed to bristle, and said, 'Of course, we have shared interests, but we'll have separate projects.'"

Hatten adds that the male scientist "wasn't being unpleasant, he was just defending his territory." She thinks that's a general phenomenon. Men, she says, "want clarity all along—what's yours and what's mine. I think women are quite comfortable without that." As a result, she says, she has, over the years, had many fruitful collaborations with women into which turf problems didn't enter. In those collaborations, Hatten says, "we would talk about what we were going to do, and then we'd do the experiments. We didn't spend time discussing who owned what."

According to Rutgers' DiTomaso, the discomfort women feel in collaborations with men may stem in part from the different priorities women bring to those efforts. Not only are men more interested in advancing their careers, she says, but men and women frequently take different approaches to conflict resolution. In response to a question about how they deal with conflicts, she says, women in her study were more likely to say they listen to all perspectives and try to come up with a compromise, while men were more likely to say they try to persuade others to adopt their point of view. Mix those two strategies together in a working group, says DiTomaso, and the women are bound to feel overlooked, unheard, even squeezed out.

It doesn't even take a collaboration for the male and female approaches to cause static, says vertebrate paleontologist Dawn Adams of Baylor University. Adams works on the biomechanics of dinosaurs, a field in which many different reconstructions are possible from the same fossil data and disagreements are rampant. "The way I construct it is probably not perfectly right, and the way someone else does is probably not right either," says Adams. But Adams insists that her female colleagues are not so heavily ego-invested in who is right. "That's just not the issue," she says. "The issue is to try to work together to get a clearer picture of what is going on. The guys will not do that....Their attitude is: 'You cannot possibly be right, because I am.'"

In general, Adams says she has found that "women seem to feel that if you have 10 people working on something, that's super, because more people will generate more ideas and a more synergistic effort. I've tried to say that as pointedly as I know how at three different meetings, but [the men] just don't hear it."

The access problem

None of these anecdotes, impressions, and small studies can settle the question of whether women have their own style of doing science. But many think they do, and they are concerned that this style—because it contrasts so radically with the competitive strategies of their male colleagues—will prevent them from reaching science's elite levels. Says Radcliffe president Linda Wilson, "Women are fully capable of playing science the same way men do." But the cards are stacked against them, she adds, because "the criteria by which we assess excellence or achievement fit well with the way men behave, and they are different from the way women behave."

DiTomaso has data suggesting that Wilson is right. Of the stylistic traits she looked at, those more common in men, such as arguing people over to their viewpoint in a conflict and putting high emphasis on professional recognition, are traits that are clearly favored by supervisors when writing evaluations or recommending scientists for promotion.

Wilson says she would like to see changes in the system to make it more amenable to the way women operate. Such changes, she says, would benefit not only women but science itself. Take the productivity criteria used for tenure decisions—criteria that often work against women. "If people fall into the trap of looking for length of publication record, you may get someone who is good at optimizing the number of publications per amount of new knowledge produced, but you may not get the person who is making the most important [contributions]," Wilson says. Science benefits from diversity of viewpoint, she adds, and "if the science culture or work structure were somewhat different, [that would] enable a broader segment of the population to contribute well."

Wilson's idea of changing the system sounds good,

Writing a New Script for Science

Ten years ago, Keiko Nakamura began dreaming of a concert hall for science. "In a concert hall the specialist plays music and audiences come and enjoy the playing. I think scientists can do their research and lay people can come and enjoy what is going on," she says. It's an offbeat idea—watching researchers do their thing on a stage. But this summer the concept will become reality, when the $25 million (¥ 3 billion) Biohistory Research Hall (BRH) opens in the suburban city of Takatsuki, midway between Osaka and Kyoto.

Though Nakamura cringes at the term "science museum," the hall is modeled after innovative science museums such as San Francisco's Exploratorium and the Ontario Science Center in Toronto. It will combine public aspects of a museum, such as high-tech exhibits and glass-walled laboratories for people to watch research in developmental biology and cell biology, along with private facilities, including a library, private research offices, and meeting rooms for symposia.

If the concept of science theater is a first, it isn't the only first in the career of Nakamura, who at 57 is professor in the School of Human Sciences at Waseda University in Tokyo. In a chemistry class at the University of Tokyo in 1958, her professor showed her a picture of DNA. She recalls: "I had never seen such a beautiful molecule before. I started to make a model with my classmates from clay and bamboo sticks. It was 2 meters high. I think it was the first model in Japan of DNA."

In spite of such ingenuity, it wasn't easy going for a woman in chemistry in Japan. "Chemistry was so interesting at that time," she says. "Plastics and new synthetic fibers were being invented. Many chemical industries were growing. So all of my classmates—boys—were invited to enter companies. But there was nothing offered to me....So I thought it would be better for me to go into an academic field."

The next year Nakamura started graduate school at the University of Tokyo in biochemistry, concentrating on phage genetics. In the mid-60s she joined the National Institute of Health in Tokyo. She left her career for 5 years when she had her children (a daughter and a son), a decision she says many Japanese women in science still make because "there is no good system to support young women who have babies."

In 1971, Nakamura finally landed a job with a chemical company—though not as a chemist. Her professor at the University of Tokyo, biochemist Fujio Egami, was starting the Mitsubishi-Kasei Institute of Life Sciences, an innovative bioresearch center near Tokyo financed by Mitsubishi Chemical. Egami invited Nakamura to head a new Laboratory of Social Life Science. "In the early '70s," she says, "we suffered from environmental problems, such as Miyamata disease [mercury poisoning due to industrial pollution]. Egami felt it was necessary to think about the relationship between science and society." In her new role she followed the development of technologies such as genetic engineering and lectured and wrote books explaining the life sciences to adults and children.

Those books caught the eye of the president of Waseda University, who invited Nakamura in the mid-1980s to be professor in the newly created School of Human Sciences, made up of the life sciences, psychology, and social science. In addition, out of the experience of explaining the workings of science to a lay audience grew the notion of a place where the public could watch how science works.

Her partner in that endeavor is Japan Tobacco, to which she became an advisor 2 years ago, when the tobacco monopoly was looking to expand into pharmaceuticals and other life sciences (*Science*, 29 January, p. 556). Japan Tobacco sponsors the BRH, whose aim, Nakamura says, is to broaden both science and society. "Researchers do their work with such a narrow view. They want to make some new invention or discover some new facts. And society only wants to utilize the results. They don't want to know what scientists are thinking. I don't think the relationship is very good." Nakamura is well placed to make it better.

–Toomas Koppel

DENNIS B. GRAY

Big-budget production. Keiko Nakamura with a model of the Biohistory Research Hall, where scientists will "perform" for the public in glass-walled labs.

Toomas Koppel is a Tokyo-based science writer.

says Mildred Dresselhaus, a solid-state physicist at MIT and former president of the American Physical Society. But the mores of any particular community evolve slowly, says Dresselhaus, and such changes in the scientific ethos won't be effected overnight. "For at least one generation more, we are going to have to play by the men's rules," she insists. And that's why she trains her female students to excel under those rules, with faith that "as women get more numerous, they will have more input into what the rules really are...and the [system] will become more friendly to women."

To many senior members of the profession, such as Dresselhaus, being a scientist meant jumping into a world where toughness is a virtue, colleagues are for competing with, students had to sink or learn to swim, and signs of "femininity" were better kept hidden. But more and more of the younger women scientists of today are questioning whether science has to be that way. They're beginning to envision a time when a critical mass of women will be reached, and the rules themselves could begin to change. They are eager, in the words of Baylor University neuroscientist Sarah Pallas, "to change science" rather than changing women "until they fit this funny mold that has been created in their absence." Although female scientists are not shouting out those thoughts at public gatherings where their male colleagues are present, in hallway conversations among themselves they are beginning to wonder if they are the generation that could break the mold once and for all.

–Marcia Barinaga