

Women and Science Roundtable - Gotsch Symposium on Women and Work - October 25, 2003:

Introduction: Cherilyn Lacy, Associate Professor of History

Women have had many paths to scientific careers. A common perception holds that women's entry into the world of scientific research is a recent phenomenon, but this overlooks the fact that in the first century or so of what was later termed the Scientific Revolution, scientific inquiry was an amateur practice rather than a formal career. Thus, the question of who could or could not engage in scientific research was determined not by gender so much as by wealth and social status. Outfitting a laboratory with equipment and spending considerable time on observation or experimentation required greater resources and leisure than the average man (or woman) possessed. Within this context, science was predominantly an aristocratic pursuit or required royal patronage. Aristocratic women were able to participate in the scientific dialogue by drawing on their wealth and social influence. A well-known example was the *salons* of the seventeenth and eighteenth centuries, where elite sociability was combined with the exchange of ideas. Margaret Cavendish (1623-1673), the Duchess of Newcastle, hosted one such salon and she considered herself a peer of the many male scientists with whom she debated at these gatherings. Not only did she use her influence to gain admittance to lectures by Robert Boyle at the Royal Society in 1667, but in the previous year she published her own critique of the experimental method, *Observations Upon Experimental Philosophy*.

However, the fact that an exception had to be made for the Duchess of Newcastle to attend a lecture at the Royal Society highlights the role that institutions played in excluding women from the scientific community. With the advent of scientific academies such as the Royal Society in London (established in 1662) and the Académie Royale des Sciences in Paris (established in 1666), women's ability to participate in scientific research or publication grew increasingly restricted. Once the site of scientific inquiry shifted from private facilities (funded by independent wealth) to facilities maintained by a state, municipality, or later by universities, many women found it difficult to gain access to these facilities (except in the case of women who had indirect access through a husband or male relative). The case of Maria Winkelmann (1620-1720), a German astronomer who worked at the Berlin Academy of Sciences with her husband, Gottfried Kirch, is particularly illustrative. It was her husband who held the official post of astronomer at the Academy, and thus in 1702, when Winkelmann discovered a previously unknown comet, credit was nonetheless given to her husband. Moreover, after his death in 1710, the Academy refused to consider Winkelmann for the post, despite her experience and accomplishments, simply because she was a woman.

This trend continued with the professionalization of science during the nineteenth century, when scientific research divided into a wider array of specialized disciplines which generated full-time careers that required years of advanced study at the university level. This coincided with the development of what has been termed by some historians the "cult of true womanhood" in the Victorian era, when social theorists drew upon and distorted Darwinian biological theories to argue that women were *by nature* suited only to bearing and raising children, as well as to maintaining a home. The exclusion of women from scientific inquiry, then, was an integral part of the historical emergence of scientific research as a professional career.

But to what degree does this affect women scientists in the present day? Is this all "past history," or has this past history left a lingering imprint on the scientific disciplines and institutions into which women are entering in greater and greater numbers? A roundtable discussion by four women scientists on the Hartwick faculty -- two in biology, one in chemistry, and one in computer science -- revealed interesting insights about the generational differences in the experiences of women trying to enter a previously "male" arena, as well as the continuing influence of cultural expectations about women's roles in society.

Laura Malloy, Professor of Biology

In 1988, Sheila Widnall (1), then President of the American Association for the Advancement of Science, wrote an article about various studies of students and science, including the Illinois Valedictorian Project, which evaluated students' self-perceptions of their own intelligence and their potential to pursue scientific careers. High school valedictorians--men and women who started college with similar grades and career goals--shared similar self-perceptions. However, in the sophomore year, despite comparable academic performance, women students began to doubt themselves and perceiving themselves as weaker students. Male students' perceptions did not change, but by their junior year in college, the majority of young women who intended to be scientists abandoned that goal.

These data are more than 15 years old, and I can't speak to what the same study would demonstrate today. However, when I first saw them, I was dumb-struck--because I had decided, as a sophomore undergraduate, even after earning straight A's in chemistry that I would not major in science. When I saw how my life had matched the statistics, I reexamined the motives and influences that had shaped my career. I looked at science from new perspectives and realized that analytical work that we do as natural scientists, while it allows us to make reasoned generalizations about the natural world, can also lead us to ignore useful information. I learned from my feminist colleagues that narrative is one way to obtain nuanced information that is lost through statistical and graphical analysis. So the data in Widnall's article provided an eye-opening

overview, since it resonated with my experiences, which illustrate how social contexts shape professional outcomes. Here's my story.

My parents never anticipated that I would internalize so completely their message that education was important. My father, a potato farmer turned construction worker, loved nature and saw education as leading to a better life. My mother, who from the age of seven cared for her disabled father while her mother worked, understood how to solve problems creatively and knew that women had to be able to take care of themselves. Together they made our home a place where study and thought were important.

I was an outstanding high school science student, particularly in mathematics, which, to me, was intuitive play. I did very well in other science courses and pretty well in English. Since math seemed almost too easy, and I didn't know what people did with it, I decided to become a chemist. (It didn't hurt that two of the chemistry teachers in my high school were women.) I also met a young man interested in science and engineering. I didn't wonder why everyone encouraged him to go to engineering school, and why, though my math grades were far better than his, no one encouraged me to consider a career in engineering. We fell in love, and I chose the college where he went.

I started college with an introduction to chemistry, I turned away from a science major for three reasons--low self-esteem, the political climate, and my boyfriend. My self-esteem suffered in chemistry class. Though earning As, I thought I was failing because I couldn't finish a lab in three hours. At age eighteen, I thought that if you couldn't finish a standardized lab in 3 hours, then you couldn't be a scientist – I wasn't good enough. The second force influencing my thinking was the political climate in 1969, which warned about selling out to the "military industrial complex." Though I found chemistry intellectually stimulating and didn't understand what the military industrial complex was, I didn't want to sell out to it. Finally, my boyfriend and I went to college together because we wanted to get married. He was a year ahead of me in college so I was concerned that if he went off for a year before I graduated, I might be history. I decided to finish college in three years. I could do that if I majored in English and philosophy, not science, because of labs.

The boyfriend was a good bet, since we recently celebrated our 30th wedding anniversary, and I am glad not to be working for a large chemical company. However, when now I see how the larger social structure shaped my future. My insecurity about whether I was fast enough had a gender dimension. Speed is a highly valued male characteristic in stereotypically male fields. Marriage and family were, and are, integral to the life script for women in our culture.

I graduated from college, married, and used my math skills as a computer programmer for an insurance company. My husband and I went back to school part-time while we worked full-time. He had decided against

engineering, majored in English, and went to graduate school in German literature. I decided that, if he was moving toward the humanities, I would move back toward the sciences. I didn't want to compete with him and wanted to work in a collaborative discipline like science. While working as a computer programmer, I took courses equivalent to an undergraduate biology major. Then my husband decided to go to graduate school in Buffalo, so I inquired about biology there.

I walked into the biology department and told a man sitting behind the main desk in the office that I wanted to go to graduate school in biology but didn't have a biology degree, just biology courses. When I mentioned that I had been a computer programmer for an insurance company, the man jumped up from his chair, came around the desk and put his arm around my shoulder. He said, "If you know something about computers I want you in my lab."

Without a feminist consciousness at that time, I interpreted the hug, not as patronizing, but as a confirmation and a welcome. It communicated to me-- "You've got what I want; you can do this; you don't have to apologize." It began my path to legitimized credentials in science. However, while my program in Buffalo worked out really well, my husband's didn't. He transferred the University of Virginia, and after a year in a commuter marriage, while I completed a master's, I followed him there to earn a Ph.D. program in physiology. A pattern arose--I would follow my husband and sometimes fit in my interest in science and sometimes not. Eventually I finished my Ph.D. at the University of Virginia and obtained a job as an assistant professor at a small liberal arts college in a city 400 miles from where my husband worked. During my first semester there, when I started to behave like a professor rather than a student, I came to the realization that many external forces had influenced my career.

Susan Carbone, Assistant Professor of Computer Science:

When I graduated from high school in 1965, I decided to live at home and attend Queens College. Martin Luther King, Jr. had led a Civil Rights march from Selma to Montgomery; the Apollo manned space explorations were undertaken; there were riots in Watts; India was at war with Pakistan; the US began airlifting Cubans on Freedom Flight; American troops were being increasingly deployed to Vietnam as combat troops; the anti-war movement had begun with the burning of draft cards, and two war protestors set themselves on fire in front of the United Nations and the Pentagon in protest to the war.

The world was in turmoil: my male friends were being drafted and sent to war if they did not carry a minimum of twelve credits in college; yet, for me, as a woman, there were not a lot of options. Expectations and rules for women were still those of an earlier generation. At my college, women were required to wear skirts to school regardless of the weather. If we wore slacks the instructor could

(and did) ask us to leave and not return until we were appropriately dressed. It was not until my senior year that the women's dress code was dropped.

My career options were equally limited. Since most women were expected to marry and have children we were expected not to have careers, but to find a husband with a career. He would support us, and until then we could go to school and find jobs. Therefore, the perfect jobs for women were teacher, librarian, nurse and secretary. I was advised to become a teacher so that, if I continued to work after I had children, I would have the same vacations as they did and be home to take care of them. There was no childcare or daycare at that time.

These career options seemed too restrictive to me. I wanted to become an archeologist, but I could not reconcile the desire for traveling and exploring with the equally compelling wish to be a wife and mother. Still not wanting to fall into the teacher-librarian-nurse-secretary niche, I majored in sociology, thinking that I would work in adoption and place babies in loving arms.

In my second year of college, amidst peaceful takeovers and sit-down anti-war demonstrations, I married a first year medical student. Our parents supported us as we completed our educations. When I graduated from Queens College in 1969, I could not find work as a social worker--all the adoption agencies required a master's degree. I wanted to get a job to support my husband and myself while he finished medical school, but I was totally untrained and had no experience.

I applied to an insurance agency in New York City that advertised jobs and training for college graduates. They gave me a series of tests and determined that I would make a good computer programmer. They paid me a great salary and sent me to school for a year to learn to write programs in COBOL for their IBM mainframe computers. I discovered that they were right – I was good at programming. I stayed with this company for two years, while my husband finished medical school and his internship. During that time I became a computer scientist. I not only wrote programs but began designing programs for others to write and managing projects and other programmers.

In 1971 my husband was drafted into the air force as a flight surgeon. He was assigned to a flight team on Cape Cod. I left my job and found another, a one-hour commute. Nine months later our squadron was moved to another base in western Massachusetts so I left this job and found another, again, a one-hour commute. Meanwhile, I was developing skills as a computer scientist, but this all still felt temporary. As soon as my husband's air force commitment was finished, we planned to return to New York where he would specialize, and we would settle down and have a family.

In New York, I again found yet another computer science job in the corporate world, and my husband finished his education so he could begin his career as a doctor. Somewhere along the way, in the mid 1970s, I realized that I

was living his dream and had lost my own. I stayed with him until he finished his schooling and was accepted on staff at a NYC hospital. I wanted to make sure that he could survive on his own before I set out on my own to find my place in the world. I had become quite good at what I did and wanted to find a way to pursue that and have those children I still wanted.

Over the next several years I married someone else and began a family. By 1978 the world had changed--men and women worked together as partners, sharing the work of supporting and raising a family. With the help and support of my husband, I was able to be home with my children and pursue my career. When my children were small, I left the corporate world and applied my skills, talents and education in private business enterprises.

In 1982 my family and I moved to Mount Vision, New York where we renovated a 100-year-old farm and ran our family business while I taught computer science part-time at the State University at Oneonta. After five years we moved from the farm into Oneonta and opened a retail store where we installed a point-of-sale computerized system, which was then a new technology. I accepted work long distance from friends in the computer industry and installed computer systems. After several years my husband began teaching his trade while I began teaching part-time again, now at Hartwick College. While at Hartwick I have completed a master's degree in information science and moved from part-time to full-time.

When I began my education I had no idea that I could become a scientist or that I would be any good at it. Through working in the corporate world, I realized the goal of fulfilling my potential and becoming a woman in science. It is currently in the world of higher education that I am able to pursue that goal and help others find their places in the world.

Meredith Newman, Associate Professor of Chemistry and Geology:

I was in high school and college during the 1970s, a time of Gloria Steinem and the Equal Rights Amendment. I was encouraged by my parents and society to pursue an education and a career. However, I believed that I had to choose either a career or a family. My parents are conservative religious fundamentalists so I was sent to a religious boarding school to meet and marry a young man of my parents' religion. I completed my undergraduate degree in biology and art at a small private religious college near Chattanooga, Tennessee, a college with no female science faculty members.

Despite my parent's expectations, it never occurred to me to take the boys I dated seriously or concentrate on much other than my career. Both of my parents have college degrees: my mother was an elementary school teacher, and my father was a physical therapist. They were very supportive of my career choices at a time when many of my female classmates were in college primarily

for an MRS degree.

Since the late seventies and early eighties were not prosperous, I had difficulty finding a job after finishing my BS. I became a laboratory technician in the Department of Reproductive Endocrinology at the Medical College of Georgia. In a lab with no windows, I started every morning by euthanizing mice and removing their testicles. I made \$10,000 a year, and between rent and student loans, my money was budgeted so tightly that, if I had a flat tire, it was all over. The professor I worked for consistently concluded that, if my experiment worked, it was because he had planned it well; and if it failed, it was because I had not performed it correctly. I decided he had a much better job than mine so I should go to graduate school.

I decided to pursue a graduate degree in environmental engineering at Clemson University and take the required math classes at night. There I met my husband. We both finished our masters' degrees and decided to teach at a college or university and earn our Ph.D.s. I was the first woman accepted into and graduating with a Ph.D. in environmental engineering from Clemson. Whether or not I was applying for admission to the Ph.D. program solely to stay near my boyfriend was discussed by the faculty prior to my acceptance. At that time all of Clemson's engineering faculty were men. However, my advisor was great. I still consider him a friend.

My husband finished his degree first and accepted a post-doctoral position at Oakridge National Lab, four hours from Clemson. I remained at Clemson another year-and-a-half to finish my degree. My husband and I saw each other on weekends. I was offered a post-doctoral position at the University of Geneva in Switzerland, and my husband moved to Switzerland with me. At the time he did not have a job there, but after we moved to Switzerland, he found a position with EWAG, the Swiss equivalent of the EPA, four hours away by train so we saw each other on weekends. After living in Switzerland for two and a half years, we completed our post-doctoral appointments and returned to the U.S. There we had great difficulty finding positions in the same location. I received more job offers than did my husband, partly because female engineers were in short supply. We eventually ended up working at the Idaho National Engineering Lab.

While interviewing for and working in industry, I felt discriminated against and stereotyped because I was a woman. I was offered a position at a consulting firm in Seattle, Washington. In an interview with a company vice-president, he asked me about my research at the University of Geneva, which I described. He asked if I thought I would use the same equipment and methods in this position. I said "no" because the work I had done in Geneva was much more specialized than that done at the consulting firm. Then he asked if I could type. I assumed this was a joke so I laughed and said "no." He said that, if I couldn't type, I couldn't use a computer. I was floored and did not accept the position.

At my next job I was one of only a few women scientists at the Idaho National Engineering Lab where the primary form of gender discrimination was being ignored. I had to be persistent to have my ideas heard. I also was asked to give more presentations than my male colleagues because I was “the woman.” My husband and I still wished to teach at a college or university and continued to apply for such positions. We continued to find it difficult for both of us to get positions in the same location. Meanwhile my husband and I were offered temporary positions at Clemson University.

While at Clemson I accepted a tenure track teaching position at Hartwick College. My husband was offered a yearly appointment at Hartwick. He was later offered and accepted a tenure track position at a college in Washington State. I have taught eight years at Hartwick, and it has been very welcoming to me as a woman, accommodating such issues as dual career couples.

Mary Allen, Associate Professor of Biology

I have benefited enormously from the women in science one generation ahead of me. My path was made much easier by the battles these women fought and won. I don't think that all of the earlier prejudices regarding women's abilities to succeed in science have completely disappeared, but they were certainly less common by the time I started my career.

I grew up in Santa Fe, where my father was an M.D. When I was very young, my mother stayed at home. Later she finished a B.S. in business and began working outside the home. My parents instilled in me, as a child, a great love for the outdoors that sparked my early interest in biology. Later I had good female role models: my junior high and high school biology teachers and my high school chemistry teacher were all women, of whom I was fond. Science ran in my family. Besides my father, my uncle and one grandfather were M.D.s and my other grandfather had a Ph.D. in chemistry.

In 1989 I graduated from Lafayette College with a B.A. in biology. My freshman biology professor was a wonderful storyteller who really made me fall in love with the field and kept me in the major. I flirted briefly with the idea of medical school, but research experiences convinced me to pursue graduate study. There I never felt I was treated differently because I was female, but it was good to have a female professor in my major; she was the *one* female biology professor. She served as an important role model, although at the time I was not fully conscious of her impact. I was naïve about the difficulties women experienced in science: no one had told me about women's struggles in science or elsewhere, and I had not experienced them myself. My understanding of them came primarily from my mother, who had told me that when she first started college, at age eighteen, the only choices for women were to become teachers or nurses. I remember feeling amazed by this limitation and glad that it no longer

applied to me.

I went directly from undergraduate to graduate school and earned my Ph.D. in biology from Florida State University in 1997. While at FSU I decided to teach eventually at a small, private liberal arts college so I needed a terminal degree. Several very strong women faculty at FSU became important mentors to me, along with some valuable male mentors. There I learned to speak out, which is necessary to succeed in science: be aggressive or you will simply be talked over. The culture of science is hard for passive personalities, but I had a generally positive experience in graduate school and greatly enjoyed the intellectual sparring that was common.

In graduate school I met my husband, and we began to tackle the dual career couple quandary. He and I were in the same program--his field is aquatic ecology and mine, microbiology. A year after we were married, he finished his Ph.D. and taught at Florida A&M. Then he moved to Maryland for a one-year postdoctoral position, while I finished my dissertation in Tallahassee. We lived apart for six months and hated it enough to decide not to do it again. I was also influenced by my mother's death two years earlier.

To stay together, my husband and I had to find two academic positions in the same place. We were both committed to teaching at small, private liberal arts colleges but not selective about geographic region. We each applied for separate jobs, and for those rare ones that suited us both, we submitted two applications and indicated in our cover letters that we were interested in a split position. We decided that the first one with a good offer would take that job and try to negotiate a position for the other person; or the other person would find an alternative in the area. After three years, if the captive spouse wanted to move for a good job offer, we would move to that job and start again to seeking a position for the spouse who would have just left a position behind.

We each received separate tenure-track job offers. There was no job for me where my husband received his offer, but at Hartwick, where I received mine, he was hired as an adjunct. For three years we worked with Susan Gotsch, then Vice President of Academic Affairs, to design a split-position policy for the college.

In 1999, the college offered us a 1 ½ time tenure track split position. Simply put we each work approximately ¾ time and are evaluated for tenure separately. We wanted this arrangement, rather than two full-time tenure track positions, to spend more time with our children. Since our first was born in 1999 and our second in 2002, we have been able to share their care, each of us staying home one-and-one-half days during the week.

Two hurdles I faced in my career were the dual-career couple quandary and balancing child-birth and rearing with expectations of an academic position. I was very fortunate to find Hartwick College, where Susan Gotsch helped me overcome these hurdles through the split-position policy. Hartwick is a family-

friendly environment, but many women in academics, particularly at larger research intensive institutions, face an expectation that they will not let child-rearing interfere with their work. In many places getting pregnant before achieving tenure is looked down upon. To be successful, women must forgo pregnancy for at least five or six years.

Science has let women in the door but in ways that force them to work as men traditionally have. Often our expectations of work and productivity do not match the desire of parents to spend more time with their children. This may partly explain data that show more women completing bachelor's degrees in science, but few continuing for terminal degrees. Academic science needs to alter expectations of productivity for men and women in the early years to match the desires of many to raise families. I think this would result in the retention of more women, reduce early burnout, and result in greater productivity later in women's careers.

Maternity leave policies at academic institutions also make the balancing of child-bearing and work difficult. Maternity leave at Hartwick is typically nine weeks, which is not unusual. Most academic terms, however, are thirteen weeks long. So unless a woman can be so fortunate as to "plan" the birth of her child to coincide with the beginning of a summer term, the birth will invariably fall sometime during a regular term. Consequently, the woman must return to full-time teaching half-way through a term or leave a course part-way through. The only other alternative is often unpaid leave.

Whenever professors enter or leave half-way through a term, it is disruptive and hurts student learning and professors' effectiveness. Longer maternity leaves that correspond more realistically to an academic calendar would be a good investment in a woman who would become loyal to the institution, remain there for many decades, and in this way "pay back" the institution for the leave time.

Conclusion, Cheryl Lacy

Four narratives from women scientists describe the varied paths that ultimately led to successful careers in their chosen fields of expertise. Together, they offer some evidence, anecdotal though it may be, of advances that have been made toward eliminating barriers that had once excluded women from scientific inquiry. In the span of a generation -- significantly, one that coincided with the feminist and civil rights movements of the 1960s and 1970s--some hurdles to women's entering scientific professions had diminished. The feminist challenge to institutions and cultural norms that prescribed rigidly gendered roles for men and women in society--like the challenge by civil rights activists against systematic, legally institutionalized racial segregation-- helped alter the social context in which science was practiced. As Sandra Harding has argued, "modern

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science has been constructed by and within power relations in society, not apart from them" (Harding 81). Like any human activity, the pursuit of scientific inquiry has been organized within particular institutions which, in turn, have been shaped by the worldview of those (primarily elite white men) who created and maintained them. The present organization of scientific research within the university and state-funded or corporate laboratories until recently reflected nineteenth century cultural norms, which held that women's minds were less rational than men's and that women were inherently designed for marriage and motherhood (Russett 104-129).

In all of the narratives recounted at this roundtable, the question of reconciling a career with marriage held a significance that it has not tended to have for male scientists. Historically, married men maintained active careers in science without provoking debates about whether or not it was possible for a man to juggle both at once. Quite simply, it was not perceived as a serious conflict because, during the nineteenth century, the middle-class cultural expectation that women belonged in the home while men belonged in the public sphere of political, economic, and intellectual activity became so naturalized that, for many, it assumed the status of an unquestioned, biological *fact*. For women, however, the conflict between marriage and a career was seen as irreconcilable well into the twentieth century. Even after the perceived dilemma ceased to be a reason for excluding women from scientific careers altogether, for the first generation of women scientists the choice continued to be framed in terms of "either/or": *either* marriage, *or* a career. In some cases, such as those recounted by Drs. Laura Malloy and Susan Carbone, there was the opportunity to integrate a career with a family, yet the prevailing expectation that the husband's career came first seemed to linger.

While it is clear from the stories told by Drs. Meredith Newman and Mary Allen that women scientists are no longer daunted by the choice between a career or a family -- and, indeed, that the challenge of balancing work with family is of concern to both women and men alike -- there is still progress to be made. The fact that pregnancy is often perceived as an obstacle or unwelcome distraction from research at larger research universities, and that the burden of dealing with it is often placed on women's shoulders (and in the familiar terms of the "either/or" choice), demonstrates the lingering effect of cultural norms that originally tailored scientific careers to white, economically advantaged men. Certainly, scientific research is not so inflexible as to be suited only to one model of organization, and it is possible to imagine many creative solutions that would allow the accommodation of pregnancy and childcare needs to scientific careers. An excellent example is provided by the shared position held by Dr. Mary Allen and her husband, a solution to the career needs of the increasingly common *scientific couple*. It was negotiated during Dr. Susan Gotsch's term as Vice President of Academic Affairs at Hartwick College, and as such it highlights the

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significant role that gender, racial, and socio-economic diversity of personnel can play in bringing new outlooks to institutions and their operation.

While each of the narratives shared at this roundtable represents advances made in scientific careers by those from a historically excluded population, they nonetheless all reflect experiences of white, middle-class women who had access to a good educational preparation. This mirrors the demographics in the sciences today, where African-Americans, Hispanic Americans, Native Americans, and people from low-income households remain in disproportionately small numbers among those with Ph.D.s in a scientific field and in most science faculties. The need to address this imbalance and provide support for students from historically underrepresented groups interested in pursuing scientific careers highlights the importance of mentoring, a theme in stories shared by the roundtable participants. In many cases, confidence in one's abilities and resolve to pursue a career in a scientific field benefited from the encouragement of a mentor within the sciences or a family member who did not see gender as an obstacle to scientific acumen. Opening the door to scientific careers for women (and men) of all backgrounds and creating the opportunity for an even more diverse array of narratives is a task that remains to be achieved, but one that could progress even more readily through the active outreach of women scientists and administrators, as well as through the continued critical examination of economic, social, political, and cultural factors that influence access to careers in science.

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