



S&T

A quarterly newsletter on research, teaching, management, policy-making and leadership in Science and Technology.

INSIDE:

2. Creating New Chemiluminescent Tools
4. Assessing Environmental Health Risks
6. S&T Briefs
8. Tackling Environmental Challenges
10. Cultivating Success in Mathematics
12. Summer Institutes for Philadelphia Teachers

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Dorothy Wright contributes news and feature articles on science, technology, engineering and general interest topics to a variety of publications, including Civil Engineering, Engineering News Record and Bryn Mawr Now.

The Knowledge Gap in Women's Health

By Dorothy Wright

HEALTH

UNTIL THE EARLY 1990s, women were underrepresented in clinical studies of diseases that affect both men and women, including major killers such as heart disease, cancer and stroke. Research supported by the National Institutes of Health (NIH) into women's health typically focused on the reproductive system, especially during the childbearing years. Progress has been made over the last decade to close the knowledge gap in women's health. Given the lag between the conception of a clinical study and the publication of results — often a decade or more — time will tell what significant findings may emerge as a result of expanded inclusion. Meanwhile, more remains to be done to scale the social, cultural and economic barriers to the enrollment of women and other minorities in clinical studies.

Women-Only Protocols

Guidelines for the inclusion of women in clinical research have been in place at NIH since 1986. Yet in 1990, a U.S. General Accounting Office (GAO) report mandated by the Congressional Caucus on Women's Issues found that women routinely were excluded from NIH-supported medical research. "Women, especially those of reproductive age, were not involved in any meaningful way in studies of universal public health problems such as heart disease, lung cancer and substance abuse," says Donna L. Vogel '71, director of the Fellowship Office at the National Cancer Institute. "Implementation was slow, it was not well communicated, gender analysis of the data was not being done and the impact of the policy could not be determined. Women subjects still were enrolled largely in women-only studies. There was an abundance of data on men in trials of diseases affecting both sexes, but it could not be generalized to women."

As a cardiologist, Elsa-Grace Giardina '61 recalls those days. A professor of clinical medicine at Columbia College of Physicians and Surgeons and director of the Center for Women's Health, she says, "I can actually remember — it's so striking now — in the 1980s having written a proposal to the NIH to study a new modality for treating ventricular arrhythmias, and the reviewer responded to the effect of, 'Why do you have so many women? This is a man's disease.'"

(continued on page 14)



Elsa-Grace Giardina '61, professor of clinical medicine at Columbia College of Physicians and Surgeons

Diagnostics

Creating New Chemiluminescent Tools By Karen Young Kreeger

IRENA Y. BRONSTEIN '67, vice president of high-throughput screening applications at Applied Biosystems/Tropix in Bedford, Mass., entered Bryn Mawr when she was just shy of 15, far younger than her classmates. She was born in Russia and went to secondary school in Poland, where students finish high school at an earlier age than in the United States. "I was always interested in the sciences and thought at one point that I would be a physician, but chemistry was just as fascinating to me," Bronstein recalls. "I was interested in scientific processes that are not reversible, as opposed to, say, physics where they are presumably reversible." This lifelong interest has taken her on quite a journey, from innovative research at Polaroid to cutting-edge drug discovery.

Bronstein majored in chemistry at Bryn Mawr, where she became interested in photochemistry through her studies with Frank Mallory, W. Alton Jones Professor of Chemistry. She pursued this interest as a doctoral student at Johns Hopkins University, where she earned a Ph.D. in molecular photochemistry in 1972.

After Hopkins Bronstein went on to a series of postdocs at the University of Houston, Brandeis University and the University of Maryland Medical Center. In 1976 she accepted a research position at the Polaroid Corporation, Cambridge, Mass.

Corporate Research

"It was an unbelievable company that was doing high-level research at the time," Bronstein recalls. In her nine years at Polaroid, Bronstein wore many different hats, including director of biotechnology, technical manager for photochemistry research, senior research group leader for the Land Laboratory and research group leader for photochemistry and polymer chemistry research. She and her colleagues developed the chemical processes to produce archival-quality Polaroid photos that wouldn't fade.

Polaroid eventually diversified into microelectronics and biotechnology, and Bronstein was appointed one of the heads of biotechnology. This dovetailed with Bronstein's interest in figuring out how to develop biomedical diagnostic devices that didn't rely on using radioactive materials. "Part of what I learned at Johns Hopkins, but probably starting at Bryn Mawr, was a process called chemiluminescence — creating light as a result of a chemical reaction," she explains. She tried to push that research line at Polaroid, but it didn't go anywhere.

In 1984, Bronstein was recruited by a new company, Allied Health and Scientific Products, Andover, Mass. "At the time, Allied was just a building, but it had a lot of money to invest in its start-up operations. Allied was extremely exciting to me because I really hoped to get involved in diagnostics," she says.

Allied also shared Bronstein's interest in developing diagnostic tools based on chemiluminescence. Soon after she joined Allied, however, it merged with another company that decided not to go into health-

biotech

related business. "From the fall of 1985 on, it was just a matter of time before our facility would be closed down," Bronstein recalls.

On a flight back from vacation to attend an urgent meeting at Allied around the time of the merger, a fellow passenger asked Bronstein a question that changed her career track: "If you have such good ideas, why don't you start your own business?" So she did.

Entrepreneurial Success

Her husband, Eugene A. Bonte, now an independent business consultant in the Boston area, helped Bronstein develop a business plan to test whether her idea of using chemiluminescence to replace radioisotopes in biodiagnostic tools would work. She named

Karen Young Kreeger is a science journalist who writes on biomedical and women's health topics, as well as careers in science. Her most recent work has appeared in BioScience, Genome Technology, Muse and The Scientist.

her new venture the Charles Institute, “because I wrote the plan from my husband’s office in Cambridge, overlooking the Charles River,” she explains.

Financial support was probably the greatest challenge. While most biotech start-ups depend on established venture-capital firms for funding, Bronstein decided not to go that route. “We actually raised about a million dollars from so-called ‘angel’ investors — friends, family and individuals,” she explains. The seed capital was enough to rent a lab and hire a synthetic chemist, a former colleague at Polaroid, to synthesize the first set of reagents. This was the birth of Tropix, founded in 1986.

The performance of the fledgling company’s first batch of reagents was better than Bronstein anticipated, and they had many different potential applications beyond clinical diagnostics — such as in medical and biological research, pharmaceutical and agricultural products, environmental testing and food and beverage analysis. Bronstein recognized that Tropix needed additional funding to take advantage of this initial success. “I put up all the personal money I had saved,” she says. “Our rent was guaranteed on my credit cards, and it stayed that way for several years!”

Bronstein also decided to find a corporate partner to generate licensing revenue to support Tropix. Through a consultant, Tropix found a diagnostics company in Japan that was planning a new product line. “I remember our meeting very clearly,” she says. “They brought one of their most important kits, which measured a specific thyroid hormone and required a lot of sensitivity to detect it at low levels. We used their kit and ran the test with our reagents. The results were so outstanding that when we asked our prospective partners where they’d like to go to dinner, they were too excited to eat. They wanted to know immediately how much money we wanted!” The company eventually bought a license to use Tropix’s reagents in the Far East, and also funded Tropix for more research and development.

Over the next 10 years Tropix grew to become a world leader in chemiluminescent detection technologies for the life sciences, with more than 2,500 customers. The company has developed more than 150 new reagents and kits used in the detection and analysis of biological materials. Bronstein holds more than 100 patents and has about 170 publications in scientific journals.



Irena Y. Bronstein '67

Full Circle

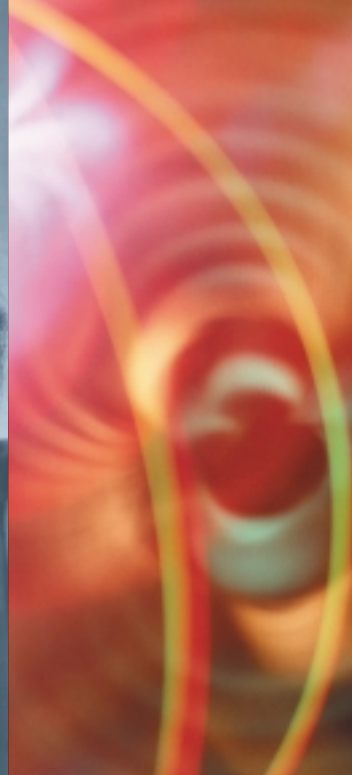
In 1996 Tropix was acquired by what was then Perkin-Elmer Corp. and set up as a wholly owned subsidiary of Applied Biosystems. Today Applera Corp. is the holding company for Applied Biosystems and Celera Genomics. Celera is best known as the company that succeeded in sequencing the human genome in 2000.

As vice president and general manager of high-throughput screening applications at Applied Biosystems, Bronstein says her career has come full circle. “Chemiluminescence is now a part of our core business that generates very good revenues with high growth margins.” The high-throughput biological applications she oversees essentially measure the effectiveness of potential drugs in the quest for better medications.

Although Bronstein did enjoy working in the small environment of her own company, there’s no denying that having access to a worldwide infrastructure that a multinational corporation can bring “is of great benefit,” she offers. Applied Biosystems gives her different types of business advantages — access to diverse R&D projects, market support and distribution sites.

Bronstein hasn’t been in the lab for more than four years now. She’s not sure whether she really misses it, probably because her new challenges as a biotech executive compensate for the excitement of scientific discovery. Her job now is to oversee product development and strategize the positioning of products in the market.

It has been a gratifying and at times bumpy journey, Bronstein acknowledges. “You have to be prepared for almost anything, but it’s satisfying when it works.” ■



The high-throughput biological applications she oversees essentially measure the effectiveness of potential drugs in the quest for better medications.

Health Risks

Assessing Environmental Health Risks

By Karen Young Kreeger

THE CAREER TRACK OF BARBARA BECK '68, a principal at the Gradient Corporation in Cambridge, Mass., has been marked by a series of transitions. She has moved from one discipline to another, and she has held positions within academia and both the public and private sectors. As a biology major at Bryn Mawr, Beck says, she became familiar with a broad range of areas in the biological sciences and received extensive training in the lab. These experiences, along with a solid foundation in basic liberal arts, prepared her for the transitions in her professional life.

"I think that helped me because over time I've felt comfortable transitioning from basic biochemistry research to animal toxicology research, and now I'm not in the lab at all," Beck explains. "I'm involved in the interpretation of scientific data, but I feel comfortable working in a number of arenas in the biological and health sciences, which I attribute to the fact that my biology education at Bryn Mawr was a broadening experience."

After graduating from Bryn Mawr, Beck didn't expect to go on for a Ph.D. right away. "I think that in all honesty we fall into a lot of things in life," she explains. Beck worked in a research lab at Tufts University in the medical school's molecular biology department, a position she obtained with the help of L. Joseph Berry, chair of the Bryn Mawr Biology Department at the time. "Dr. Berry was also helpful in terms of opportunities to do research during the summer and school year," Beck says.

Following a year at Tufts, Beck entered a Ph.D. program in the molecular biology department there, graduating in 1975. She conducted basic biochemistry studies, looking at changes in enzyme activity during the cell-division cycle of bacteria. Beck went on to do postdoctoral work at the University of Massachusetts



Barbara Beck '68

Medical Center and Harvard University, working on basic molecular biology questions about messenger RNA synthesis.

Transition to Toxicology

How did Beck find her way from molecular biology to toxicology, one of her early career transitions? "I realized I really liked working with more applied projects where I can see the results of the work in my lifetime," she explains. Beck also notes that the job market at that time was less than inviting: "This was before the explosion in sequencing and molecular biology and biotech." When she finished her last post-

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doc seven months into pregnancy with no immediate funding in sight and a husband in graduate school, Beck says, “I thought I should be thinking about being more practical.”

With that in mind she took a one-year position as an instructor at Tufts. “During that time I realized I wanted to be more involved in public health,” she recalls. At the same time Harvard was in the process of creating an interdisciplinary program in public health, bringing together people from different fields to spend part of their time on their own research and part on group projects. It was as a Fellow in the Interdisciplinary Programs in Health at the Harvard University School of Public Health that Beck started her work in toxicology. She is still a lecturer in toxicology at Harvard.

toxicology

Public and Private Sectors

After her fellowship at Harvard, Beck became chief of air toxins at the Region 1 headquarters of the Environmental Protection Agency from 1985 to 1987. Why this move from academia to a government agency? “I really enjoyed Harvard and the people there, but in academia you spend a lot of time writing grants. I found it frustrating to spend so much time on a project that, at that time, had less than a 50 percent chance of success. The success rate on grants is now even lower.”

Beck did receive an offer of an assistant professorship at Harvard, which she turned down. “People there still mention to me that I was one of the few people to ever do that,” she says.

Beck accepted a position at Gradient, an environmental consulting agency, and has been there since the late 1980s. At the EPA, she gained an appreciation of the difficulty of being a regulator, “but it was also somewhat frustrating working at a regional level where you have to take guidance from headquarters rather than develop your own programs,” she says of her decision to move into the private sector.

Branching Out

As Gradient’s point person for toxicology and health-risk assessment, she now has the opportunity to branch out. The company deals with assessing the risk of environmental chemicals. Gradient’s clients include private corporations, law firms and municipalities. Beck’s work there has included risk assessments of hazardous waste sites and interpreting animal studies with respect to human exposures. She is presently involved in a large-scale analysis of potential risks for pressure-treated wood. She recently gave a presentation to Congress on the risks of low-level arsenic exposure in drinking water, describing recommendations from a National Academy of Science report on arsenic risk.

In 1996 Gradient was acquired by a large engineering firm, which Beck describes as “not a happy marriage.” In 1999, Beck’s and another partner’s employment agreements were about to expire. They talked to the CEO of the engineering firm, tendered their resignations and offered to buy Gradient back. “The negotiation process almost gave me an ulcer,” recalls Beck. “It was nerve-wracking and expensive, but clearly the right decision.”

Beck is now in the midst of yet another new stage in her career — business partner. As one of the three major owners in Gradient, her responsibilities go beyond the conduct and oversight of the technical work. An important part of her responsibilities include client interaction and business development. “As a niche, high-end consulting firm, much of our work comes in as sole source and via referrals,” she explains. “What this really means, in terms of business development, is that I need to be able to identify a solution to a technical problem in that initial interview, often on the basis of limited and confusing information.”

As an owner, Beck finds herself watching the bottom line, tracking trends in revenues and profits, and participating in major corporate decisions, such as expanding into new business areas: “There’s always a new challenge to address.” She notes that she works more now than when she was a graduate student, but that it’s different when you actually are an owner of the business. ■

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S&T Briefs

Hall of Fame I

Elaine Surick Oran '66, senior scientist for reactive flow physics at the Naval Research Laboratory, Washington, D.C., was inducted into the **Women in Technology International Hall of Fame** on June 20. Oran was recognized by WITI as an engineering pioneer who uses computer numerical simulations to make fundamental advances in our understanding of combustion and propulsion, atmospheric physics, solar physics and astrophysics. At NRL, she leads a team that has invented and applied many of the algorithms and computer methodologies for accurately simulating reactive flows. Oran's current work focuses on simulating microfluids — the dynamics of flows in micro- and nanodevices — the physics of detonations and supernovae, and high-performance computing and parallel architectures.

The WITI Hall of Fame was established in 1996 to recognize and honor women who make outstanding contributions to science and technology. With the 2002 inductees, the Hall of Fame includes 45 distinguished women.

A chemistry and physics major at Bryn Mawr, Oran went on to earn her master's (1968) and Ph.D. (1972) degrees in physics at Yale University. She has authored more than 300 research publications and is a fellow of the American Institute of Aeronautics and Astronautics and the American Physical Society. Oran is a past recipient of the Arthur S. Fleming Award, the WISE Award in Science, the Oppenheim Prize and the Zeldovich Gold Medal of the Combustion Institute.

Hall of Fame II

Julia Ward '23, Ph.D. '40 was inducted into the **National Security Agency's Cryptologic Hall of Honor** at the National Cryptologic Museum in Baltimore on June 13. NSA's Hall of Honor was created in 1999 to "pay special tribute to the pioneers and heroes who rendered distinguished service to American cryptology."

Ward was one of six people honored at the ceremony for outstanding contributions to American code-breaking during World War II and the years immediately following it. The College received a copy of the

plaque commemorating the achievements of Ward, "who set reporting standards and used early information-management techniques to support cryptology."

Ward began working for the College in 1923 and held a variety of deanships; she earned her Ph.D. in history in 1940. She joined the Signal Security Agency, the U.S. Army's cryptologic organization, in 1942, as a librarian in the agency's reference section. By 1945 Ward was chief of the reference section. According to the statement prepared by the museum, Ward transformed the section from a poorly organized unit of limited scope into a "highly respected organization to which other federal agencies came for information." She was one of the highest-ranking female officers of the NSA until her death in 1962.

Institute Director

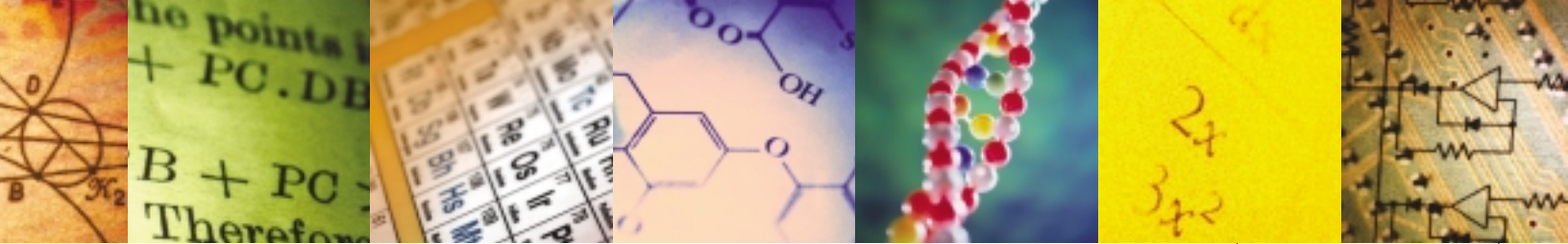
Judith H. Greenberg, Ph.D. '72, became acting director of the **National Institute of General Medical Sciences**, Bethesda, Md., on May 3. She previously



directed the NIGMS Division of Genetics and Developmental Biology, with a budget of \$428 million in fiscal year 2001.

NIGMS is one of the National Institutes of Health, the principal biomedical research agency of the federal government, and has a budget of \$1.5 billion. It supports research and training in the basic biomedical sciences with the goal of increasing our understanding of fundamental life processes to help lay the foundation for advances in disease diagnosis, treatment and prevention.

"NIGMS has recently embarked on a number of exciting new initiatives, including structural genomics, pharmacogenetics, integrative and collaborative approaches to research, and complex biological systems," Greenberg says. "I am committed to seeing these and our other activities continue to flourish, and I am fortunate to have the help of the institute's talented and exceptional staff."



Greenberg is a member of the American Society of Human Genetics and the Society for Developmental Biology. Her career and research were profiled in the January 2002 issue of *Bryn Mawr S&T*.

Scientist Named Provost



Ralph Kuncl joined Bryn Mawr as provost on June 1. He previously was vice provost for undergraduate education at Johns Hopkins University, and professor of neurology and pathology at the Johns Hopkins School of Medicine, where he spe-

cialized in neuromuscular disease, including amyotrophic lateral sclerosis and myasthenia gravis. Kuncl received the 2002 Distinguished Service Medal from the University of Chicago, where he earned his Ph.D. (1975) and M.D. (1977) degrees, for his seminal discoveries on the role of glutamate in ALS and the development of experimental drugs for ALS.

During the 2000-01 academic year, Kuncl was an American Council on Education fellow at Bryn Mawr, where he completed a study on the success of women's colleges in producing future Ph.D. scientists, mathematicians and engineers. He also assisted Nancy J. Vickers, president of the College, on Bryn Mawr's *Plan for a New Century*.

"Dr. Kuncl has an impressive academic background and a distinguished record of accomplishments," Vickers says. "He understands the importance of interdisciplinary collaboration and opportunities for faculty renewal in sustaining the intellectual life of a college community like ours. He will bring a fresh perspective to the role of chief academic officer."

EDGE Expands

Rhonda J. Hughes, Helen Herrmann Professor of Mathematics, received a \$187,000 ADVANCE Leadership Award from the **National Science Foundation** to expand **EDGE — Enhancing Diversity in Graduate Education**. Hughes launched EDGE in 1998 with Sylvia T. Bozeman of Spelman College to help women succeed in graduate-school mathematics programs through a variety of mentorship and academic support initiatives. The new award will continue the work of Bryn Mawr College to promote the next generation of women in the mathematical sciences by building on Hughes' success in developing and implementing effective strategies to achieve this goal.

"We will use the ADVANCE Leadership Award to identify ways to advance women graduate students in mathematics into leadership positions in science,



engineering and mathematics," Hughes says. "We will help them connect to a network of more senior women who can give them critical information and support as they start a career."

The EDGE expansion plan includes four components: a publication program to broadly disseminate information about successful strategies for increasing the retention of women in graduate mathematics programs; a capacity-building initiative that will establish a three-tiered mentoring program; a 2003 symposium to provide a forum and workshops on successful institutional and individual paradigms for retention and advancement of women in mathematics; and support for Hughes' research on functional analysis and operator theory, with increased involvement of undergraduate and graduate students in her research.

For more information, visit the EDGE program Web site at <http://www.brynmawr.edu/Acads/Math/edge/edge.html> and see the April 2001 issue of *Bryn Mawr S&T*. ■

Providing Solutions

Tackling Environmental Challenges

By Barbara Spector

INFORM INC., founded by Joanna DeHaven Underwood '62, has been a major force in the American environmental movement since its doors first opened 27 years ago. The independent research organization, which assesses industry's effect on the environment and citizens' health, has been lauded not just for its focus on describing problems, but also for identifying solutions and presenting them objectively. While INFORM tackles many technologically complex problems, it aims to present its findings in language that is easy for policy-makers and the public to understand. It also helps companies, government agencies, community groups and environmental organizations to implement its proposed solutions.

INFORM, which is based in New York, has received the prestigious Environmental Protection Agency Administrators' Award and two regional EPA awards. Underwood herself was a member of the Eco-Efficiency Task Force of the President's Council on Sustainable Development during the Clinton administration, among other notable appointments.

Feeling the Pride

Looking back at her career, Underwood reflects, "How I got here was very step-by-step. My interests have taken me in this direction — I just put one foot in front of the other."

At Bryn Mawr College, Underwood studied European history and history of art. "What I learned was how exciting it was to learn, and to think your way through problems to find answers," she says.

The faculty's emphasis on "what young women learned, and how they learned" helped Underwood find her voice. "The intimacy of the community was very supportive," she says.

Underwood's mother, Helen De Haven Guiterman '28, also attended Bryn Mawr. "More and more over the years, that continuity grew to mean a lot to me," Underwood says. "I still feel the pride."

Tools of Reporting

Inspired by a love of writing and research, Underwood began her career as a journalist. In 1970, she became co-director of a new organization, the Council on Economic Priorities, which used statistics to compare businesses' practices in areas of social concern. The position enabled her to leverage her reporting skills for the benefit of the public. She was the co-author of "Paper Profits," a landmark study of air and water pol-

lution in the pulp and paper industry that compared various companies' pollution-control efforts.

By 1974, Underwood had perceived a need to move beyond identification of environmental problems and statistical corporate comparisons toward a focus on why these problems existed and how they could be solved. She considered joining another organization, but she couldn't find one that shared her goals. Some focused on criticism but failed to propose solutions; others were too conservative for her approach, declining to identify polluters by name. She concluded that there was a need for a new group that would use "the tools of reporting" to promote positive change.

Her years of activism have taught her to take a long view, Underwood says. She notes that protection of the environment first became a high priority in the United States in the early 1970s. The EPA was a nascent organization; the Clean Air Act and the Clean Water Act were newly passed. "We thought that if we could identify all the sources of pollution and set stan-

pollutants

Barbara Spector writes on science and technology as well as business topics. She is the executive editor of Family Business magazine and former editor of The Scientist.

dards for safe levels of exposure, then businesses with all their technological prowess would find the answers, and we would be able to implement them quickly,” Underwood recalls.

Viewed from the perspective of history, this reasoning seems naïve indeed, Underwood notes. Today, the use of hundreds of toxic chemicals such as mercury, lead and polyvinylchloride (PVC) is still pervasive because safe levels of exposure to these substances cannot be determined — rendering government regulators unable to set exposure standards. “EPA has not figured out how to take these chemicals out of commerce,” she notes.

Fossil-Fueled Economy

Environmental challenges extend beyond waste to the destruction and contamination of resources — situations that can’t be remedied merely by creating a new landfill, building an incinerator or picking up litter, Underwood says. Environmentalists now recognize that what’s needed is a broader, more systemic way of assessing economic systems in order to get to the root of the problems.

“We developed the industrial way of life in one tiny century,” Underwood notes. “It was based on a massive use of fossil fuels, for energy, for transportation and for chemical production. While this has given us a world of new materials and products, it is a very extravagant way of living on the earth — and it’s not sustainable.”

Underwood’s organization has been a major proponent of cleaner alternatives to gasoline and diesel fuels, which pollute the air and have contributed to widespread flare-ups of asthma attacks in children and respiratory distress in the elderly. It is sometimes challenging to get the message across in the era of the sport-utility vehicle, Underwood observes. “The SUV is an anachronistic idea,” she says. “It’s a sad use of technology based on ego value.”

Natural-Gas Alternatives

As a first step, INFORM advocates a transition to vehicles that run on natural gas, which is composed

primarily of hydrogen, is 90 percent less polluting than petroleum and is plentiful in the United States. While consumers are likely to have trouble finding fueling stations that offer natural gas, this cleaner fuel is a viable alternative for fleet vehicles such as buses, taxis and garbage trucks if a municipality builds the needed refueling infrastructure, Underwood notes. INFORM has initiated clean-fuel outreach programs focusing on bus, truck and taxi fleets in New York and across the country.

In areas where natural gas isn’t available to consumers, electric hybrid vehicles are a great alternative, Underwood notes. This technology combines a conventional engine with an electric motor, enabling oil-based fuel to last longer. In the future, Underwood expects fuel-cell vehicles — powered by pollution-free and renewable hydrogen — to become a reality. Hydrogen can be extracted today from natural gas. However, she notes, more research needs to be done on how to use a gas fuel before hydrogen becomes a reality for consumers.

The growing presence of natural-gas refueling stations for vehicles is providing an opportunity for researchers to refine systems for transporting, storing and delivering a gas fuel for transportation. “The system that is enabling us to use natural-gas vehicles today will facilitate the use of hydrogen tomorrow. And one day we will extract hydrogen from water, a source that will be limitless,” Underwood notes.

Underwood is optimistic about the progress that can be made toward improving air quality, given a strong level of public commitment. “We can actually see the path to pollution-free renewable transportation,” she says. “We are close to tackling these problems in the right way.” ■



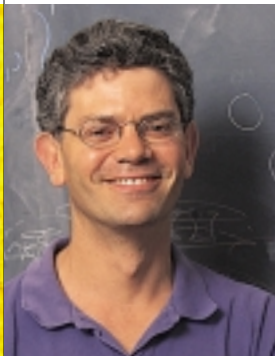
Joanna DeHaven
Underwood '62

Today, the use of hundreds of toxic chemicals is still pervasive because safe levels of exposure to these substances cannot be determined — rendering government regulators unable to set exposure standards.

Mathematics

Cultivating Success in Mathematics

By Dorothy Wright



Victor J. Donnay



Lisa Traynor

BRYN MAWR IS ONE OF the most successful colleges in the country in encouraging women to pursue undergraduate study in the sciences and mathematics. One-third of the College's juniors and seniors are science majors; in the academic year 2001–02, 20 percent of the senior class majored in the natural and physical sciences, and 12 percent majored in mathematics.

"This year we had a 'bumper crop' of math majors," says Victor J. Donnay, associate professor and chair of the Mathematics Department. "Since 1990 we have had about 20 math majors each year, or roughly 6 percent of each graduating class. So we have had a successful history of attracting and retaining students in math."

Considering that less than one percent of college students nationally majors in math, Bryn Mawr is doing the right things to attract and retain women in this field.

A Culture of Success

Bryn Mawr actively encourages women to go into fields that traditionally are not popular among women, including mathematics. "We make a determined effort to encourage women in math — not only strong math students, but also those who might consider themselves 'non-math types' or who might have had a bad experience with math in secondary school and don't really think they can do it," Donnay says.

Associate Professor Lisa Traynor agrees. "Our entry-level courses are taught by dynamic faculty members who are wonderful in encouraging women to pursue mathematics," she says.

One of these women is Namrata (Minnie) Das '02, a math major. "I didn't set out to become a math major at Bryn Mawr," she says. "Then I took a preliminary calculus class with Instructor Mary Louise Cookson. She's just amazing — she's so excited about math, and she makes everyone feel like they can do it. I realized how much I love math."

Professor Paul M. Melvin believes careful mentoring is essential as students advance. "There is a large chasm that must be crossed in advancing from introductory courses into the core major courses," he explains, "so we are particularly sensitive to students

during their 'middle years,' remembering to encourage them to keep trying because we know they *will* eventually succeed in making the jump."

Supportive Environment

In fact, Donnay says, the faculty is committed to the success of every student — not only the math "whiz kids." "At large, research-oriented universities, math professors have a tendency to present the material and, if a student has trouble and can't figure it out, well, that's too bad. Here, we make a big effort to have a support system in place — problem sessions, office hours, extra help — to help everyone succeed."

For example, Rhonda Hughes, Helen Herrmann Professor of Mathematics, runs a number of programs designed to make math and science education an appealing and accessible option for women students. She is the co-director, with Sylvia T. Bozeman of Spelman College, of EDGE (Enhancing Diversity in Graduate Education). Hughes says EDGE "prepares female students academically and psychologically for the challenge of graduate school in male-dominated disciplines."

"Rhonda's insights into how to support students and set up programs that will help them move along has influenced the whole department," Donnay says.

Assistant Professor Leslie Cheng '92 recalls Hughes' influence on her own career. "When I was an undergraduate, I thought I'd major in one of the humanities. Then I took Calculus I with Rhonda, and I loved it so much I became a math major," she recalls.

The department's pedagogy clearly works. "Time after time we have seen traditionally 'weak' or even 'math-phobic' students blossom into successful math majors," Melvin says. "Students realize that we are here to help them realize their potential, rather than stand in their way with rigid standards that do not necessarily represent true mathematical ability."

Research Opportunities

The department offers undergraduates the opportunity to participate in faculty research over the summer and in preparation for honors theses. "We involve

Dorothy Wright contributes news and feature articles on science, technology, engineering and general interest topics to a variety of publications, including Civil Engineering, Engineering News Record and Bryn Mawr Now.

undergraduates in ways that allow them to use the knowledge and skills they have, while increasing their expertise,” says Donnay, whose work focuses on chaotic properties of dynamical systems, including geodesic flow on surfaces and billiards. “They might work on a simpler case of a problem that a graduate student would work on, for example, or perform numerical studies on the computer, even if they might not yet be capable of proving a theorem.”

The faculty has a broad range of research interests. Hughes has worked with undergraduate and graduate students on projects involving wavelets, operator theory and functional analysis, and stochastic processes. Other students have worked with Traynor on research in symplectic and contact geometry, focusing on the study of how basic shapes of space can deform with respect to equations that are motivated by physics. Melvin involves students in his work in geometric topology, focusing on the classification and properties of three- and four-dimensional manifolds, which are the models for our physical universe and for space-time. Associate Professor Helen G. Grundman involves students in her work in algebraic number theory and algebraic geom-

interactions

etry, devising ways of using number theory to better understand and classify certain geometric objects.

“When students get to work on a research project doing something that they become knowledgeable about, it is a great motivator and a confidence builder,” Donnay says.

Talking Math

A memorial fund for John Oxtoby, a mathematician who taught at Bryn Mawr from 1939 to 1979, enables the department to send majors to math conferences, where they may present their research. “These opportunities to ‘talk math’ are very important in learning math,” Donnay says.

Students also have informal opportunities to talk math, including Grundman’s Distressing Math Collective, a group of Bryn Mawr and Haverford students who get together to talk and learn about interesting mathematical paradoxes and unusual topics that aren’t covered in classes.

Students exhibit a wide range of interests, including applied math. New courses offered by the department appeal to those with a practical or interdisciplinary bent. For example, Melvin’s and Traynor’s introductory knot-theory course reflects an area of active research with applications to the study of gene patterns in DNA. Cheng’s seminar for senior math majors on mathematical finance explores a discipline that is being used in the stock market to price options and derivatives.

Students also have the opportunity to take a variety of interdisciplinary courses as math electives, including mathematical and computer modeling courses taught by professors in the Chemistry and Biology Departments, and econometrics, which is offered in the Economics Department.

Role Models

The Math Department’s graduate program also provides undergraduates with role models. “Undergraduates may take graduate courses, which puts them in contact with students who have made a commitment to advanced study,” Donnay says.

Donnay says Cheng also is a positive role model for undergraduates. “I think there is a correlation between this year’s ‘blip’ of 38 majors and the fact that Leslie joined the department in 1998. Undergraduates are inspired by Leslie, who is both a Bryn Mawr graduate and a young, female mathematician.”

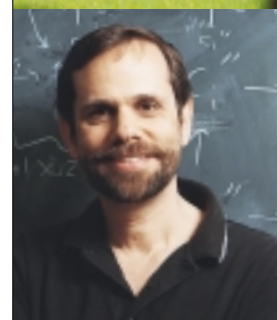
Students also have been inspired by a series of colloquia featuring Bryn Mawr math alumnae talking about their careers and the contribution of their math education to their success. “I think the colloquia have contributed to the jump from 20 majors to 38 majors,” Donnay says. “Students now better understand how important mathematics is to success in a wide range of careers.”

Recent graduates, like alumnae over the past 40 years, have gone on to graduate school in mathematics and the sciences, and to careers in teaching, industry, government, and independent research and policy centers. “In terms of the ‘real world,’ we hear from businesses that abstract thinking and quantitative skills are much in demand,” Donnay says.

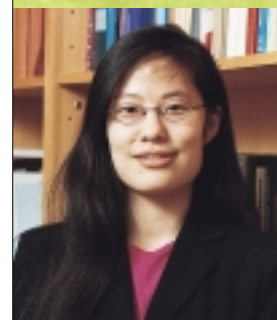
A culture of success for women in science and technology, excellent teaching, careful mentoring, research opportunities, interdisciplinary courses and positive role models — it all adds up to a successful mathematics program at Bryn Mawr. ■



Helen G. Grundman



Paul M. Melvin



Leslie Cheng '92

Education

Bryn Mawr's Summer Institutes for Philadelphia Teachers

By Barbara Spector

THIS SUMMER MARKS THE 12TH anniversary of Bryn Mawr College's Summer Institutes for Philadelphia Teachers, a program designed to help city educators recognize that the purpose of scientific inquiry isn't to be "right" but to become "progressively less wrong."

Paul Grobstein, Eleanor A. Bliss Professor of Biology, started the institutes in 1990. Faculty members in other departments — including chemistry, computer science, mathematics, physics, psychology and the education program — have also played major roles in their evolution. A goal of the program, Grobstein says, is to reinforce the notion that the scientific process — testing a hypothesis, observing the deficiencies in that hypothesis and trying it again — is fun, and everyone already understands how to do it.

"A major theme of the program is to get teachers to be comfortable with being wrong and to convey that comfort to students," Grobstein says. Learning occurs more readily when teachers and students are able to relax and enjoy the investigative process, he notes.

"The course enhanced what I already knew empirically from working with students," says Karen Cohen, an English teacher at Lincoln High School. "A fully engaged learner does not just memorize isolated facts, but learns through active involvement with ideas — dealing with uncertainty and ambiguity — and attempts analytically and intuitively to get a better understanding of those ideas. Moreover, emotion plays a vital role when tapping into prior knowledge to make new connections or understandings sustainable over time."

Claudette Stone, assistant principal at the Philadelphia High School for Girls, says the program has provided crucial professional-development opportunities for her and for other faculty members at her school. "We need to keep current in what's out there," Stone says. The program, she notes, is "a good way to network, and it also lets us know what's happening in the universities and what's expected of our students."

2002 Agenda

Bryn Mawr College operates the program under a grant from the Howard Hughes Medical Institute. Each Summer Institute is a two-week program during which teachers from the School District of Philadelphia come to the Marion Edwards Park Science Center to interact with College faculty. Faculty members serve as facilitators; instead of lecturing, they share with participants their perspectives on enhancing science and mathematics education.

"Rather than treating the teachers as students, the faculty engage the teachers with an integrative learning approach," Grobstein says. "They involve them in the kinds of experiences they might use in the classroom."

This year the College will host two Summer Institutes. "Brain and Behavior," directed by Grobstein, is taking place July 8–26. "Bridging Cultures: Science and Inquiry Throughout the Curriculum," to be held July 22–August 2, will be co-directed by Kimberly Cassidy, associate professor of psychology, Jody Cohen, lecturer and acting director of the education program at Bryn Mawr and Haverford

Colleges, and Paul Burgmayer, a former industrial researcher who has a Ph.D. in analytical chemistry.

"Brain and Behavior" — which has been held each year since the Summer Institutes began — explores ways to incorporate advances in brain research into curricula as well as the implications of these advances for educational theory and practice. "Bridging Cultures," a new program, will focus on integrating science with other curricula.

Leveraging Experience

Jody Cohen says the institutes' content, "is connected to their daily life. We don't spend two weeks lecturing or ignoring the fact that they're bringing expertise as well as questions about their practice."

For example, Cohen says, a fifth-grade teacher



Paul Grobstein

creativity



would bring to bear what she already knows about her pupils when investigating potential science projects. “She’s constantly using her experience to raise real-life questions about what the new material and curriculum planning would look like,” Cohen says.

Over the years, the Internet has emerged as a key component of the institutes. Participants increase their comfort level with the Web by searching, developing online materials and investigating ways of using the Internet as a classroom adjunct.

College faculty members help teachers recognize that a lack of resources to purchase the latest high-tech equipment does not necessarily prevent development of an effective science curriculum, Grobstein says. “What you’re really trying to do is help people learn to think,” he explains. “You can do that with almost anything.”

Deepak Kumar, associate professor of computer science, has been involved with the institutes for more than five years. He has helped teachers develop entertaining classroom exercises to teach sophisticated concepts like artificial intelligence and robotics — his area of research interest — without the use of computers or high-tech equipment.

In one activity, each of four volunteers plays the role of a robot component: the brain, left arm, right arm and eyes. Blindfolds and grocery bags are used to disable all body functions but the one each volunteer represents — the “arms” are blindfolded and the “brain” is covered by a grocery bag. The various parts must coordinate with each other to perform a simple task: putting one cardboard box atop another.

“The brain has to coordinate with the eyes to give instructions to the arms,” Kumar says. When four people try to interact as one robot, “all the problems with robotics become apparent, and a lot of interesting things happen,” he explains. “It’s also fun to do with the kids.”

Creative Context

Jody Cohen says that participants “tend to develop a community among themselves” during the two weeks

of the program. “Getting to talk to other teachers in that sustained, creative context can be a transforming experience,” she observes.

During the academic year, Grobstein often visits participants’ schools to host in-service days or speak to students in their classrooms. Lincoln High’s Karen Cohen invited him to speak about the brain in the context of a literature unit on “The American Dream,” in which students explored various perspectives on gender differences.

“Although I teach English,” she says, “I am not a stranger to the sciences and strive to familiarize students with science concepts and history as they relate to literary themes and issues. With that objective in mind, I participated in the Summer Institutes so that I could better approach the daunting task of creating meaningful and novel learning activities for my students.”

Grobstein believes that the Summer Institutes program not only serves pre-college educators but also benefits the College’s own academic programs. Interacting with pre-college teachers has led College faculty members to re-assess their own teaching. “It’s been enlightening to realize that the difficulties one faces in reaching our students are similar to the obstacles encountered by Philadelphia middle-school or high-school faculty. In both cases, the students think differently from the teacher,” he explains. “The trick is to understand how the students are thinking, then figure out how to get from here to there and make them comfortable.”

“Another benefit,” Grobstein adds, “is increased interaction and mutual support among College faculty engaged in rethinking our own science curricula. I learned a lot from working with Liz McCormack [associate professor of physics] last year, as I did from Victor Donnay [professor of mathematics], Alison-Cook-Sather [assistant professor of education], Deepak Kumar and others in previous years. There is genuine enthusiasm for finding still better ways of working with our own students, and the networks generated by the Summer Institutes are playing an important role in that. Together, we can get less wrong too.” ■

Barbara Spector writes on science and technology as well as business topics. She is the executive editor of Family Business magazine and former editor of The Scientist.

“I can actually remember — it’s so striking now — in the 1980s having written a proposal to the NIH to study a new modality for treating ventricular arrhythmias, and the reviewer responded to the effect of, ‘Why do you have so many women? This is a man’s disease.’” — Elsa-Grace Giardina ’61

Knowledge Gap

(continued from page 1)

From Guidelines to Law

Following the 1990 GAO report, NIH guidelines were strengthened to ensure inclusion of women and minorities in NIH clinical studies. In 1993 they were made law with passage of the NIH Revitalization Act, which requires that women and minorities be included in clinical research and that clinical trials be designed and carried out to determine whether the variables under study affect women and minorities differently from other subjects in the study. Exclusion is allowed if there is a substantial scientific rationale for doing so; cost is not an acceptable justification. Researchers must actively recruit women and minorities as study participants. NIH further clarified the guidelines in 2000 and 2001.

“I think the law has enormously impacted the way researchers write grants now,” Giardina observes.

In fact, Vogel says, “Since the 1993 law, the number of female and male subjects in NIH-funded studies involving both sexes is about equal, excluding studies of single-sex/gender conditions,” Vogel says. “We are now able to get meaningful data on diseases and conditions that affect both men and women, including sex/gender differences in incidence, severity, access to care and response to treatment.”

The 1990 GAO report also prompted the establishment of the Office of Research on Women’s Health (ORWH) at NIH. ORWH has three major mandates: to strengthen, develop and increase research for women’s health in order to eliminate gaps in knowledge and determine the research agenda for women’s health; to ensure that women are represented in NIH studies, especially clinical studies; and to increase the number of women in biomedical research careers.

Progress and Change

The Women’s Health Initiative (WHI), which was announced by ORWH in April 1991, is one of the

largest clinical studies ever conducted. The 15-year project will cost more than \$635 million and involves more than 160,000 women ages 50 to 79 at 40 clinical centers around the country.

One component of this study is evaluating the effect of a low-fat diet in preventing heart disease and breast and colon cancer. Another is looking at the effect of long-term hormone replacement therapy (HRT) on heart disease and osteoporosis, and whether or not it increases the risk of breast cancer. A third is evaluating the effect of calcium and vitamin-D supplementation in preventing osteoporotic fractures and colon cancer.

“The initiative is a major step forward,” says Barbara V. Howard ’63, president of the MedStar Research Institute and a WHI principal investigator. “We have a very diverse cohort of women geographically, ethnically and in terms of prior health issues. The three clinical trials are the first to address these questions with a long-term, large cohort. Clinicians have been prescribing HRT for years on the basis of trials that went no more than a year or two.”

Progress in closing the knowledge gap in women’s health will take time to appear. “Sometimes it takes a long time to begin to see changes,” Giardina says. “It might take 10 years from the time you conceive of a study until the time you publish the article. There’s no question about it: the efforts made on a federal basis to enroll more women are beginning to pay off. I think it’s slow, but I think it’s beginning to pay off.”

Minorities and the Poor

Other gaps remain in clinically based knowledge of disease and health risks. “By and large, clinical studies are still based on upper-class white populations,” Howard says. “Despite the legislation requiring inclusion of minorities, there has been real difficulty in actually making it happen.”

One reason is a pervasive mistrust of the medical community. “People do not want to be guinea pigs,” says Terri L. Cornelison ’81, a program director in the



Leslie E. Kossoff

Barbara V. Howard '63,
President, MedStar
Research Institute

National Cancer Institute's Division of Cancer Prevention and an assistant professor of obstetrics and gynecology in the Division of Gynecologic Oncology at Johns Hopkins University School of Medicine. "There is a general mistrust of individuals involved in the medical profession. There is a feeling based on historic experience that minorities may receive a different quality of care and may be exploited. These barriers are hard to surmount."

Jo Anne Earp '65, chair of the Department of Health Behavior and Health Education, University of North Carolina School of Public Health, maintains that the gap between rich and poor is a societal problem that must be solved. "As a public-health researcher, I am much more worried about poor women and men than I am about limited opportunities for upper- or middle-class women," she says. "I think our priorities should first be to close the racial and economic gaps, although in many developing countries those socioeconomic differentials are also gender differences."

Poor women are coping with practical issues that

make it difficult for them to participate in research. "I work at Columbia Presbyterian Medical Center in Washington Heights, which has a very high Hispanic population," Giardina explains. "If you sit in the cardiac clinic, you'll see a lot of children. The children are there because our patients are babysitting for their grandchildren. To ensure their continued participation in clinical studies, we may need to provide transportation or cab fare, and offer a room where the kids can play while their grandmothers are seeing the doctor."

What can be done? "The first thing we need to do is help people understand the crucial importance of representation in a study," Cornelison says. "If their population is not represented, the knowledge gained may not benefit their health care."

research

Building Community Trust
Howard has conducted numerous studies over the years involving women, African Americans, Native Americans and other minority groups. She is chair of the steering committee and a principal investigator

Building Community Trust

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(continued on page 16)

About Our Sources

Terri Cornelison '81 is a program director in the Breast and Gynecologic Research Group of the Division of Cancer Prevention at the National Cancer Institute, assistant professor of Obstetrics and Gynecology in the Division of Gynecologic Oncology at Johns Hopkins University School of Medicine, and a gynecologic oncologist practicing in the Washington, D.C. area. A chemistry major at Bryn Mawr, Cornelison received an M.D. at Yale and a Ph.D. in molecular and cellular oncology at George Washington University.

Jo Anne Earp '65 is department chair and professor of health behavior and health education at the University of North Carolina School of Public Health. She is a medical sociologist whose research interests focus on the role of social and attitudinal factors in explaining variation in health behaviors, particularly early detection of cancer and other women's health issues. Earp majored in English at Bryn Mawr and earned an Sc.D. in Behavioral Sciences at Johns Hopkins University School of Public Health.

Elsa-Grace Giardina '61, professor of clinical medicine at Columbia College of Physicians and Surgeons and director of its Center for Women's Health, majored in history at Bryn Mawr. She earned an M.D. at New York Medical College. Giardina is the principal investigator on several grants that focus on the presentation of women with heart disease and the biological effects of medications and hormones on the heart. As director of the Center for Women's Health, Giardina is responsible for sex/gender health education of medical students and house staff of the

College of Physicians and Surgeons. She practices cardiology in Manhattan.

Barbara Viventi Howard '63, president of the MedStar Research Institute, Washington, D.C., majored in biology at Bryn Mawr and received a Ph.D. in microbiology at the University of Pennsylvania. She is a principal investigator for NIH's Women's Health Initiative and has conducted studies of health risks in women, African-Americans, Native Americans and other minority groups.

Donna L. Vogel '71, director of the Fellowship Office at the National Cancer Institute, majored in chemistry at Bryn Mawr. She earned an M.D. and Ph.D. in developmental biology at the Albert Einstein College of Medicine. Vogel has conducted clinical and basic research in the National Institutes of Health's intramural research program and has had leadership roles in training and career development, clinical research and minority/disability issues.

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S&T

Knowledge Gap

(continued from page 15)

for the Strong Heart Study, a large longitudinal and family study of heart disease and diabetes in Native Americans, which began in 1988. “Ours is one of the few successful studies in this ethnic group,” she asserts. “There’s an absolute, cardinal rule if you want

to do studies in minority communities: you have to ask their advice and you have to take it.

“With the Strong Heart Study, we’ve worked very closely with the tribes to make this a community-led study. In our WHI trial, we’ve really worked hard to go into the

African-American community to gain their confidence.”

Earp also advocates this type of approach. Her team recently studied the effectiveness of a lay health adviser network in increasing mammography screening among African-American women ages 50-plus in rural North Carolina. The researchers trained local women to become health advocates encouraging their peers to seek mammograms. “These were the powerful women in those communities — the pastors in the churches, the movers and shakers,” she explains.

Community-wide mammography use increased 6 percent, while low-income women in intervention counties showed an 11-percentage-point increase above that by low-income women in comparison counties.

Increased Representation

Ultimately, closing the knowledge gap in women’s health will also depend on increasing the representation of women and other minorities in the health professions. “We need to place more health care providers who look like the participants we are trying to study,” Cornelison says.

Howard agrees: “There’s a real gap in the number of Ph.D.s and M.D.s coming out of most of the minority communities and going into research careers.”

Can colleges such as Bryn Mawr help close this gap? “Without a doubt,” Vogel asserts. “I found that being a science major at Bryn Mawr was a tremendous opportunity. Bryn Mawr gave everybody an opportunity to be heard, to participate and to be motivated to pursue careers in science and medicine.”

The role of women’s colleges in increasing the number of women in leadership positions in science

community

and technology careers was a major theme of a recent Bryn Mawr symposium on “Women in Science” (see Bryn Mawr S&T, *January 2002*). Toby M. Horn ’72, Office of Academic Services, District of Columbia Public Schools, said, “Women’s colleges and small liberal arts colleges have the best potential to encourage women to major in math, science and technology.” ■



Donna L. Vogel '71 (l.), director of the Fellowship Office at the National Cancer Institute

Jo Anne Earp '65, chair of the Department of Health Behavior and Health Education, University of North Carolina School of Public Health