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A Woman Like You

Women Scientists and Engineers At Brookhaven National Laboratory

Careers in Action

Cover: Photograph taken in commemoration of Tenth Anniversary of Brookhaven Women in Science Organization.

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WOMEN IN SCIENCE AND ENGINEERING

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Careers in Action

BROOKHAVEN NATIONAL LABORATORY, ASSOCIATED UNIVERSITIES, INC.

Contents

A Woman Like You — on the Frontiers of Science and Technology

Have you considered a career in science or engineering? What are work and home life like for women who have already entered these fields? In the following pages you will meet women who work at Brookhaven National Laboratory in a variety of challenging research roles -- from biologist and environmental scientist to safety engineer, from patent lawyer to technician.

If you find their work stimulating and interesting, and would like to explore a future for yourself in one of these fields, contact the guidance or career counselor at your high school or college, attend a career day at a near-by research center, or apply for a student program at such an institution. Educational requirements for careers in science and technology range from an Associate's Degree, through Bachelor's and Master's Degrees to a Ph.D. or equivalent. The guidance or career counselor can provide course prerequisites for the subject which interests you.

The United States needs talented women to fill the high-tech jobs of the future, and you will find wide-open opportunities for your abilities.

About Brookhaven National Laboratory

Brookhaven National Laboratory is a multi-program laboratory which carries out basic and applied research in the physical, biomedical and environmental sciences and in selected energy technologies. The Laboratory is managed by Associated Universities, Inc., under contract with the U.S. Department of Energy. Brookhaven and the other national laboratories, because of their enormous research resources, can play a critical role in education and training of the workforce.

If you would like information on educational and internship programs at Brookhaven National Laboratory, please contact the Office of Educational Programs, (telephone 516-282-3054) or the Office of Equal Opportunity (telephone 516-282-3318) at Brookhaven National Laboratory, Upton, N.Y. 11973. There are a number of programs for students at the high school, college, and post-graduate levels (including returnees to the work place).

Environmental Sciences

Environmental Sciences at BNL involve expertise in many scientific disciplines within several divisions and groups of the Department of Applied Science: the Environmental Chemistry Division, the Oceanographic and Atmospheric Sciences Division, the Biosystems and Processes Sciences Division and the Analytical Sciences, which include the Mathematical Sciences Group, the Biomedical and Environmental Assessment Group and the Injury Prevention and Analysis Group.

Environmental sciences include programs that study the environment and the impact of human activities upon it. Major studies are underway to determine the origin, transformation and ultimate fate of pollutants, and their effects on the atmosphere, the oceans and the biosphere.

A major new area of study is global change research, in which air-sea interactions and the role of aerosols, trace gases and clouds in regulating climate are key considerations in developing credible mathematical models of global change. Research is directed towards determining the processes that govern the constant conversion of inorganic carbon to organic carbon, and vice-versa, in water, on land and in the atmosphere. By learning about these processes, scientists may discover how to moderate man's influence on the greenhouse effect.

Carmen M. Benkovitz

Carmen Benkovitz is a Senior Environmental Science Associate within the Environmental Chemistry Division of the Department of Applied Science. These programs study the effects of human activities on the atmosphere, oceans, and land. Ms. Benkovitz studies what is emitted from energy-producing activities and the effect of these emissions on the quality of the air we breathe and on the acidity of the rain and snow. Her current research focuses on global change; the effects of clouds on climate is one of the most important questions being addressed by this research.

Ms. Benkovitz's initial training was as a chemical engineer; she anticipated working for industry in the research and development of new products. After obtaining her B.S. equivalent in chemical engineering from the Universidad de Villanueva, Habana, Cuba, she married and started a family. Her M.S. studies in chemical engineering from Columbia University overlapped with the birth of her last three children. After working at BNL as a principal investigator for several years in various projects, and realizing the importance of a Ph.D. in this field of work, she entered the Ph.D. program in the Department of Applied Science at New York University (NYU). She is now working on her dissertation project, with thesis advisors both at NYU and at BNL.

Ms. Benkovitz believes that women must realize that aiming for a career in science is as much their right as anyone. She says, "Since my sophomore year in college I was the only woman in almost all my courses; I did not expect any preferential treatment because of my sex, but I did not allow any discrimination because of my sex either. It is my opinion that if you are comfortable with your decisions and your performance, this will be transmitted in your interactions with most people. However, you must be prepared for the obtuse exceptions; handling these without a confrontational or defensive attitude would be the best solution. In all circumstances, you should be prepared to stand up for your rights. You must always be very clear about what you expect from your personal and your professional lives. It is not always easy to set a course *a priori*, so you must be flexible enough to admit you made mistakes and to undertake their correction. Nobody is superwoman; all members of the family should be involved in supporting these decisions."

Monica A. Mazurek

Monica Mazurek is an Assistant Chemist in the Environmental Chemistry Division of the Department of Applied Science. Her research interests include: 1) sources and global distributions of carbonaceous aerosols; 2) organic aerosol emissions from biomass combustion; 3) trace analysis of organic pollutants; and 4) environmental geochemistry. Her current projects involve sources of visibility-reducing aerosols to the Grand Canyon National Park, where air pollution has become a serious problem, and the chemical analysis of carbonaceous smoke aerosols from large-scale biomass burning.

Dr. Mazurek has an A.A. in prepharmacy from Pasadena City College, a B.S. in chemistry from the University of California at Los Angeles, and a Ph.D. in geochemistry from

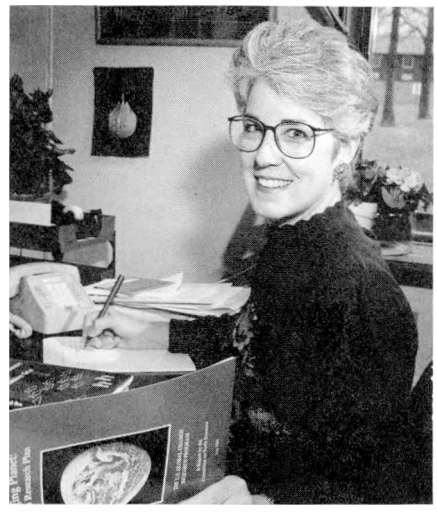
the University of California at Los Angeles. She was a post-doctoral research fellow in the Environmental Engineering Science Department at the California Institute of Technology in Pasadena, California. Dr. Mazurek is currently an adjunct faculty member in the Environmental Engineering Science Department at Caltech.

Anne F. Meinhold

Anne Meinhold is an Environmental Research Associate II in the Department of Applied Science. Her research focuses on assessing the risks to human health and the environment associated with environmental pollution and hazardous waste, with an emphasis on water pollution. This research involves studying contaminants that are transported through the environment, and assessing the potential health consequences associated with exposure to toxic or carcinogenic chemicals. Ms. Meinhold works with a group of scientists and engineers who perform environmental risk assessments.

Ms. Meinhold has a B.S. in biology from the State University of New York at Stony Brook and an M.S. in environmental science from the University of North Carolina. She chose graduate study in environmental science because it combines her interests in human health and ecology/biology. This field also allows many opportunities ranging from research to working for an environmental consulting firm or a government agency.

Ms. Meinhold does not find day-to-day problems associated with being a woman in science. However, she feels that women, and young women in particular, have to work harder to be perceived as professionals in fields still dominated by men.



Sharon L. Smith

Sharon Smith is an Oceanographer and Deputy Division Head in the Oceanographic and Atmospheric Sciences Division of the Department of Applied Science. Ongoing or anticipated research programs in this division have two themes: regional oceanography and ecological questions. In regional oceanography, Dr. Smith and a group of scientists completed the field portion of a Department of Energy (DOE) investigation known as SEEP (Shelf Edge Exchange Processes), in which they demonstrated that there is no exchange of materials between the continental Shelf and Slope. The group also completed a National Science Foundation (NSF) and Office of Naval Research (ONR) co-sponsored program investigating the Greenland Sea (regional polar oceanography), and funding is expected to continue for this research in 1992.

Dr. Smith has a B.A. in zoology from the Colorado College, an M.S. in zoology from the University of Auckland, New Zealand, a Ph.D. in zoology from Duke University, and a D.Sc. from the Colorado College. She was awarded a Fulbright Fellowship and an NSF Fellowship at the end of her undergraduate studies. The Fulbright took her to New Zealand's seashore, to a Master of Science degree, and to a continuing interest in the sea. A fortuitous connection with her Ph.D. mentor at Duke University guided her into her career interests.

Dr. Smith says, "Difficulties are without sex! My advice is what was identified for me in the citation in which I got a D.Sc.: 'She shows us we can make important discoveries while having a very good time.' It is imperative that one enjoy one's work in a career; when that is true the rest falls into place."

Biology and Medicine

The biological sciences have entered a new era in the past ten years following the discovery that genes could be manipulated through recombinant DNA technologies. Studies in biochemistry, genetics, cell biology, and molecular structure have been unified by the powerful tools of molecular genetics.

Research in the Biology Department is directed to studies of structure and function in complex biological molecules, energy conversion and growth in plant cells, and the molecular effects of radiation and carcinogens. The department operates research facilities at the National Synchrotron Light Source and the Scanning Transmission Electron Microscope which are used by scientists from many countries to study molecular structure. Many staff members hold joint appointments at the State University of New York at Stony Brook and supervise students' doctoral research at Brookhaven.

Scientists in the department study the organization and expression of diverse genomes including adenovirus 2 which infects human lungs, T7 bacteriophage which lyses bacterial cells, a bacterium related to the pneumonia pathogen, genes in human cancer cells and in the crop plant, corn. X-ray crystallography, small angle x-ray and neutron scattering, ultraviolet synchrotron radiation, and quantitative scanning transmission microscopy are used to determine three-dimensional atomic structure and other molecular details of proteins, DNA, and protein-nucleic acid complexes.

The Medical Department, one of the nine scientific departments at BNL devoted to research, has made, and continues to make, valuable contributions to the field of medicine. In the 1960s, Brookhaven researchers working on neurological diseases formulated an effective therapy using L-dopa which has made the course of Parkinson's disease less tragic. Carrying on this tradition and expanding the field of research, the department has made notable progress in developing medically useful radionuclides and radiopharmaceuticals designed to diagnose and treat diseases, particularly cancer, heart and brain disorders.

Current exciting projects in nuclear medicine and radiotherapy are the improvement of methods for the early diagnosis of coronary artery disease and brain tumors, and documentation of the physical and psychological effects of cocaine and alcohol on the brain and body. Other research programs focus on the mechanisms of disease caused by x-irradiation and the by-products of energy generation.

The Occupational Medicine Clinic is a separate organization, one of whose major functions is to ascertain that Laboratory employees and prospective new hires are "fit for duty."

Catherine L. Lawson

Catherine Lawson recently joined the Biology Department as Assistant Biophysicist where she is developing a research program in protein structural studies using the methods of x-ray crystallography. Her aim is to discover how the structures of specific proteins relate to their biological function. Her current work involves the structural analysis of a DNA-binding protein which becomes activated when the amino acid, L-tryptophan, binds to it.

Dr. Lawson became interested in structural aspects of biology at the University of Rochester where she received her B.S. in neuroscience, She received her Ph.D. in biophysics and theoretical biology from the University of Chicago in 1987. She chose for her postdoctoral training a laboratory at the University of Groningen, The Netherlands, that had great expertise in those techniques she still needed to learn. She also was attracted by the opportunity to live in Europe and broaden her cultural experience.

Dr. Lawson notes that women have been active in x-ray crystallography of proteins since the field began in the 1950s. This fact had a strong positive influence on her career decision-making. Her husband is a research scientist, who has consistently encouraged her to pursue her career goals. In matters of household management, they share the chores, or alternatively, they share neglect of the chores.

Betsy M. Sutherland

Senior Biochemist Betsy Sutherland of the Biology Department holds a B.S. in biology and an M.S. in cytochemistry from Emory University, and a Ph.D. in molecular biophysics from the University of Tennessee. She was a postdoctoral fellow in the Department of Molecular Biology, University of California, Berkeley. Before coming to Brookhaven, she was an Associate

Professor at the University of California, Irvine. She has been on the staff of the Biology Department at BNL since 1977.

Dr. Sutherland's work has focused on studies of how ultraviolet radiation produces genetic damage in human cells and how human cells limit the biological consequences of such damage. In particular, she developed a strategy, now widely applied in the study of DNA repair, that involves combining enzymes having specific DNA repair functions with DNA damaged or modified by different physical or chemical agents. In 1985, Dr. Sutherland became the first woman to receive the Department of Energy's prestigious E.O. Lawrence Award.

One of her current research projects, funded by DOE's Human Genome Initiative, involves a technique to cut DNA at specific sites. In nature, DNA is cut by enzymes called endonucleases. She and her collaborator, Gary Epling, a professor of chemistry at the University of Connecticut, Storrs, recently developed synthetic scissors, that is, synthetic endonucleases that cut DNA at locations for which there are no natural enzymes to cleave the DNA. The synthetic scissors will aid in the basic research of mapping, cloning, and sequencing human DNA.

Laura Sbarra

Laura Sbarra, Staff Physician in the Occupational Medicine Clinic, renders routine physical examinations at the clinic. She also performs special projects, assists employees with long-term illness, and evaluates possible disability situations.

Dr. Sbarra received her B.S. in genetics from Cornell University and her M.D. degree from the Medical College of Pennsylvania. Her decision to become a physician was easy, since it was her desire for as long as she can remember. For Dr. Sbarra, the most rewarding part of being a doctor is being able to help people in their time of need. Continuing education and training are important in the field of medicine, and she participates as time allows.

Dr. Sbarra says "Combining a career with a family is difficult, but very rewarding. A supportive, involved spouse is extremely helpful. Be prepared for periods of stress, but be flexible and organized—things will work out."

Prantika Som

Prantika Som is a Scientist in the Medical Department, where she engages in research on development and evaluation of radiopharmaceuticals and whole-body autoradiographic microimaging. Her primary interest is studying the heart blood flow and metabolism in non-coronary artery diseases and cocaine abuse.

Dr. Som holds a D.V.M. from the University of Calcutta, and a Sc.M. in Pathobiology from Johns Hopkins University. She was also a Fellow in Radiology (Nuclear Medicine) at Johns Hopkins University. Although Dr. Som trained as a veterinarian, she chose nuclear medicine research as a career because the newer inventions in biomedicine also attracted her.

Dr. Som says that "Women scientists have to work harder to get recognition than their male counterparts. Although a professional life engaged in research is very demanding, it is also very fulfilling."

Nora D. Volkow

Nora Volkow is a Scientist in the Medical Department, where she engages in research dealing with the use of Positron Emission Tomography (PET) to investigate the reinforcing, addictive and toxic properties of drugs of abuse. Her work is mainly focused on the investigation of cocaine, alcohol and marijuana. This research is part of the PET program at BNL which investigates biochemical and physiological abnormalities in psychiatric and neurotic patients.

Dr. Volkow earned an M.D. from the National University of Mexico, and did her residency training program in psychiatry at the New York University Medical Center. Dr. Volkow selected medical school and psychiatry because she wanted to learn about the human brain and its disruption in mental illness. While in training, she started doing research with PET since this was a technique that allowed investigation for the first time of neurochemical and functional parameters of the normal brain.

Safety & Environmental Protection

The Safety and Environmental Protection Division (SEP) encompasses a wide range of expertise to promote and monitor safe and environmentally sound work practices. The disciplines required include the following examples.

- **analytical chemistry**
- **ecology**
- **geology**
- **health physics**
- **industrial hygiene**
  - **different engineering disciplines (environmental, industrial, safety)**
- **quality assurance.**

The division ensures that federal, state and local regulations for both worker and environmental concerns are upheld. Its functions include monitoring facility operations and incorporating programs aimed at maintaining a healthy indoor and outdoor environment both on-site and off-site.

Experts in the division provide personnel monitoring and instrument maintenance services to assist in the determination of exposure to a wide range of potentially harmful agents. A comprehensive sampling and analysis program for both radioactive and nonradioactive effluents is conducted in order to evaluate the impact of the Laboratory's operation on the environment. To further support this program, aquatic and terrestrial ecological studies are carried out.

Nicole Bernholc

Nicole Bernholc is an Industrial Hygienist in the SEP Division. She has an M.S. in environmental health/industrial hygiene, professional certification in the field of industrial hygiene (CIH), and is certified with the Asbestos Analytical Registry as a certified asbestos counter. She assists SEP building safety representatives to recognize, evaluate, and control health hazards in the workplace. The work includes a full spectrum of activities, such as evaluations of noise, rf and magnetic fields, ventilation design, chemical storage, and problems with chemical and dust exposure. Her job includes project reviews that are in the design stage, for health issues as well as assisting established users to work safely.

Another aspect of her job involves research for the Department of Energy through the Center for Chemical and Physical Hazards. This center operates as a hot line to the DOE, when other facilities require more information on chemicals. Along with keeping up her professional development, Ms. Bernholc finds maintaining her sense of humor and sharpening her negotiation and personal interactive skills is critical for the job. She has recently chaired BNL's Employee Relations Committee. For recreation, she enjoys running, swimming, dancing, and playing piano.

Martha Heine

Martha Heine is an Asbestos Analyst. In this capacity, she sets up and operates a laboratory to analyze asbestos bulk and air samples. Ms. Heine has a Bachelor's degree in biology from Wagner College. She spent 32 years in the Medical Department at BNL as senior technician working with a group studying hypertension. She was closely involved in developing the animal model for hypertension that was later distributed to the scientific community. In her new area of expertise, Ms. Heine is registered with the Asbestos Analyst Registry as a certified asbestos counter and accredited to identify asbestos in bulk samples. Identification of asbestos is particularly important today, after indications of potential serious medical problems in people exposed to this element, which has been widely used as an insulator.

Kathleen McIntyre

Kathleen McIntyre has a B.S. in biology from the University of Pittsburgh and an M.S. in health physics from Rutgers, State University of New Jersey. Ms. McIntyre started work at BNL in 1980 as an Environmental Laboratory/Field Monitoring Technician. She became interested in health physics, a multidisciplined field that deals with protecting humans and the environment from the harmful effects of radiation.After re-

turning from her first maternity leave, she was promoted to Health Physics Associate and worked for the environmental monitoring, HP and Marshall Islands section. In 1986, she accepted responsibility for coordinating the US Department of Energy's Region I Radiological Assistance Program (RAP). The RAP is tasked with responding to radiation emergencies at the request of State or Federal agencies; exercises, training, working groups, and on-scene response are primary functions. She was involved in screening American students returning from the Chernobyl area after the Chernobyl nuclear incident. Her most memorable assignment with RAP was as the Coordinator for off-site field analysis during a NASA shuttle launch that carried a plutonium power source.

More recently, she has been working with the Health Physics section on the implementation of radiological protection standards, reviewing experimental design, and training. She is currently studying for Health Physics Certification.

Her job involves travel, after-hour meetings, and "drop what you're doing and run" assignments. She would have difficulty in maintaining a high quality of work if it were not for her husband's support for her career and their family. Ms. McIntyre has two children, and, as well as being involved with their school activities, is involved in BNL activities such as the Saturday Morning Science Program and baseball.

Annette Meier

Annette Meier is an Environmental Technician in the Safety and Environmental Protection Division. Her background is a B.S. in marine science from Southampton College, where she was involved in sampling cruises on Long Island Sound for a private environmental consulting firm. These cruises were made to collect background data on water quality to identify the fish and invertebrates around the Shoreham Nuclear Power Plant and record their stages of development.

At BNL, Ms. Meier's responsibilities include collecting air, soil, and groundwater samples as part of the environmental monitoring program. The program keeps close watch on areas of contamination from past and present practices, while updating procedures to maintain a safe and clean environment for years to come. Her interest in environmental field work came about from her outdoor activities such as fishing and bird watching.

Computer Science

Computer science is the study of the theory and the applications of computers. It is one of the fastest growing fields in science and is an integral part of almost every facet of society.

Computer professionals are involved in the analysis of a problem which leads to the design, evaluation, and implementation of the computer system. Because computer specialists are needed in every field, the career opportunities are endless. Employment for professionals with a bachelor's, master's, or doctoral degrees ranges from areas in business and industry, to universities, and in government research facilities.

At BNL, computer specialists are critical to the success of scientific and technical projects and administrative support programs.

At the Computing and Communications Division, computer professionals help plan and develop future data processing facilities and tools, operate the Laboratory's major central computer and communications networks, and provide programming and systems support labwide.

In the Department of Applied Science, computer analysts help design, manage, and mathematically analyze large databases for oceanographic and atmospheric sciences programs.

Programmers in the Risk Assessment Program of the Department of Nuclear Energy debug and run computer codes to validate probabilistic models and help develop new approaches to risk assessment.

In the Alternating Gradient Synchrotron (AGS) Department, system analysts develop programs to control, monitor, and display the parameters of the AGS beam.

Outside the scientific realm, programmers in the Management Information Systems Division design, implement, and operate on-line and batch processed systems for procurement, job cost analysis, accounting, budgeting, personnel services, and other business functions at the Laboratory.

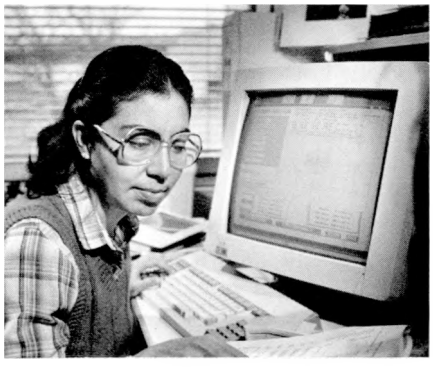
Susan Eng

As a Computer Specialist at the Computing and Communications Division, Susan Eng is involved with the support of scientific and engineering computer workstations throughout BNL. Her responsibilities include the networking of these distributed workstations, system and data administration, and constantly being on-call as a part of a troubleshooting team. Initially, this project was to aid in developing and using CAD/CAM (Computer Aided Design/ Computer Aided Manufacturing) tools for engineers to produce more accurate drawings and speed production of a design via powerful, graphics workstation computers.

Ms. Eng has a B.S. and M.S. in computer science. Although her desire, growing up at the start of the Space Age, was to study astrophysics, she changed her major in her second year of college to computer science with a minor in earth and space science. Reflecting on the job market at the time, she felt that a career in computers offered greater possibilities, which could still lead her into astrophysics. After finishing her B.S. degree at the State University of New York at Stony Brook, Ms. Eng obtained an M.S. at the Polytechnic Institute of New York while working fulltime.

Studying computer science at a time when there were equal numbers of males and females in the field, Ms. Eng has not experienced much in-

equity in school or at work. However, since this field is growing rapidly, time off for family or health reasons are of major concern. Ms. Eng states that "Due to the change in structure of the typical American family, women have become an integral part of the work force in practically every field—employee policies inherent in the system today just don't provide for this change. These women are entitled to the same opportunities men hold for *having-it-all*...a well-cared for family as well as a fulfilling career."



Rosario Enriquez-Leder

Rosario Enriquez-Leder is a Programmer/Analyst at the Alternating Gradient Synchrotron (AGS) Department. She uses her background in physics and computer science to design and implement software programs that automate the operation of the accelerators. She also presents visual information about the physics processes of interest to the experimenters and helps to maintain the network of computers that support the whole operation.

During her last year in high school, Ms. Enriquez-Leder debated between studying physics or the history of art. She chose physics because it was a challenge and reasoned that she could always have art as a hobby but not the other way around. With an M.A. in Physics and a minor in Computer Science, from the State University of New York at Stony Brook, Ms. Enriquez-Leder's goal is to become a project leader.

In a work environment which is often male-dominated, she has found obstacles dealing with acceptance as a professional. However, Ms. Enriquez-Leder feels that "as more females join male-dominated fields, then slowly attitudes toward women will have to change." As for balancing personal and professional life, she stresses being prepared, because "the better prepared one is, the better the job one is able to find, and the larger the number of choices one has available to satisfy your particular life style."

Veronica Evans

With an early interest in math and chemistry, Veronica Evans pursued a degree in chemistry and worked at BNL in that field for about five years. During that time, she went back to school to study mathematics, her second love, which ultimately led her into the field of computer science. She obtained an M.S. in computer science from the State University of New York at Stony Brook.

As a Computer Analyst in the Computing and Communications Division, Ms. Evans designs programs and systems to assist users in the various scientific and administrative tasks that are crucial to the success of a research facility. She is investigator and problem solver from the initial design phase, through the development phase to the final implementation of the software.

Ms. Evans' greatest challenge throughout her career was to be assured that her young children were well-cared for while she was at work. Today, her children are away at college, but previously, in a family where both parents worked, Ms. Evans received the support she needed, and still does, because, she says, "Everyone pitches in at home."

Nancy Fallon

Nancy Fallon is a Senior Systems Specialist at the Safety and Environmental Protection Division. Her tasks include developing a local area network for the division, leading a computer support group that provides database administration and programming, and other data services for industrial hygiene, environmental monitoring, and building safety services.

Her career in computer science began at the Grumman Research Division in programming/data analysis, and she taught mathematics for two years. Ms. Fallon holds an M.A. degree in mathematics from the Michigan State University, where she also took computer science courses to enhance her knowledge of the field. She expects to combine her education and professional skills into a training/consulting role.

Ms. Fallon's advice to those seeking a career in computer science is to be diverse and gather as much skill as possible. She adds, "The more training you have, the more flexible your work-life can be. Don't let outdated stereotypes limit your interests." She believes that women need support for child care that can only come from child care services, flexible work schedules, and a spouse who is understanding and encouraging.

Elizabeth McBreen

Elizabeth McBreen is an Advanced Computer Analyst in the Physics Department. She is a System Manager of the local area VAX computer cluster for various experiments. Ms. McBreen has a B.A. in mathematics and a M.A. in computer science. Since high school she has been very much interested in the study of mathematics, physics and computers. Before coming to BNL she worked for IBM as a Programmer, and feels that she has made the right career decision. Her children are grown up now, so she has a much easier time dealing with her personal and career goals. When she feels stress at work, she exercises.

Engineering

The field of engineering encompasses a variety of subdivisions closely interrelated with the rest of the sciences. Some of these subdivisions are mechanical, electronic, chemical, electrical, medical, and safety engineering. The people who work in these disciplines come from a variety of backgrounds, and it is not unusual to find someone crossing boundaries from one engineering field to another.

Mechanical engineers work on power generation, heating, ventilation, plumbing, automobile design, fluid and solid mechanics. They can work on design, construction, or research.

Chemical engineers work on environmental control, prescription drugs, fertilizers, plastics, gasoline, cosmetics, and detergents. They can either work on research, create new materials and substances, or perform laboratory analysis.

Electrical and *electronic engineers* work on analysis, designing, and fabricating electrical systems and electronic components. Digital watches, antennas, networks for telecommunication, telephones, computers, and transmission systems are some of the products in which the work of these engineers is involved.

Medical engineers work on designing, developing, and building systems used in hospitals and clinics, on apparatus to monitor breathing, electrocardiograms, encephalograms, blood pressure, intravenous or other delivery of medication.

Safety engineers work in industry and government, ensuring that products that are developed, from prescription drugs, to safety seats, are safe. They also inspect buildings, bridges, and check for exposure to carcinogens and other substances.

At BNL, engineers work in many different areas, from the Laboratory's mammoth research tools, such as the particle accelerators, to the Plant Engineering Division, utilizing many of the sub-specialties within engineering, such as electrical engineering and chemical engineering. Because of the diversity and sophistication of BNL's research programs, there are rare opportunities for engineers who can help advance technology and provide scientists with the special research assistance they require.

Lori Bower

Lori Bower is a Project Engineer in the Safety and Environmental Protection Division that oversees the radiological protection, industrial hygiene and safety programs at BNL. She creates databases for daily use by the Safety Representatives and is responsible for formalizing and coordinating the standard operating procedures used by the safety representatives and technicians.

Ms. Bower has a B.S. in chemical engineering and has worked in the nuclear power plant field. Ms. Bower chose engineering because she was always interested in math and science, and she knew it was a profession that could be used in many types of companies. Eventually, she would like to obtain a Professional Engineer license.

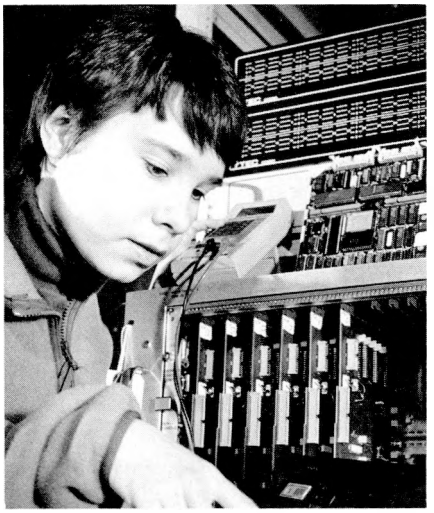
Ms. Bower feels that she has not faced problems with prejudice because she is a female in a "man's field." However, she feels that the biggest problem is that companies with a large percentage of men can be conservative in responding to the needs for flexible work schedules that are desirable for many women professionals with family responsibilities. Ms. Bower believes that it is definitely possible to combine a career as an engineer and a family life. She is married and has a two-year-old son. She and her husband work together to make sure that their personal and professional lives are happy.

Susan Hobbie

Susan Hobbie is a Staff Engineer in the Alternating Gradient Synchrotron (AGS) Department. She designs electronic systems for computer control of equipment that forms part of the particle accelerator referred to as the Booster. She is responsible for original design, installation, and maintenance of the systems assigned to her.

Ms. Hobbie has a Bachelor of Engineering degree from the State University of New York at Stony Brook.

She was familiar with engineering from childhood on; her father was an engineer. When she went to college she discovered that she had a talent for engineering and enjoyed it as well. She has gained experience from her work at BNL, but wants to continue her education to obtain a Master's degree.



Ms. Hobbie does not feel that she has been subjected to discrimination because she is a female. She is married to an engineer; she feels happy about it because they can share their job experiences, but they always avoid competition with each other.

Wai Lin Litzke

Wai Lin Litzke is an Associate Staff Engineer in the Safety and Environmental Protection Division. She has a B.S. in chemical engineering from Columbia University. From there she obtained experience in quality assurance engineering at a manufacturing firm and gained experience as an assistant engineer in environmental work with Suffolk County. In that capacity, she became familiar with environmental regulations addressing hazardous material storage and water pollution concerns. At BNL she is in the field of environmental compliance; she helps to obtain stack emission permits for various on-site operations, reviews facility operations for environmental impact on air and water, and emergency response. Her work periodically takes up nights and weekends for personal and written responses to emergencies (since there is a response time requirement to the County). She is also taking courses to obtain an M.S. in civil engineering with an emphasis in environmental engineering.

Ms. Litzke finds that initially she must break down the preconceived stereotypes of professionals persons may have in their interactions. She is married, with no children at this time, and enjoys playing guitar, sailing, and volleyball.

Patricia Williams

Patricia Williams has a Bachelor's in mechanical engineering from the State University of New York at Stony Brook. In her current position as a Safety Representative, she acts as a liaison between five separate divisions with the Safety and Environmental Protection Division, providing them with information on safe work-practices, audits for compliance with BNL, DOE, Federal, State, and County regulations.

She became interested in safety engineering when working for the Department of Defense. In the future, she hopes to obtain an M.S., to be certified as a Safety Professional, and to obtain her Professional Engineering license.

Ms. Williams finds that, in a traditionally male profession, most of the difficulty initially lies with having her judgements accepted. She finds that a supportive spouse is essential to balancing a career and a family. Setting priorities becomes an important aspect in balancing work and family, all taking discipline. Work often exceeds the normal 8:30 to 5 workday, especially during preparation for upcoming meetings. In her spare time she participates in aerobic exercise.

Chemistry

Chemistry involves problem solving — the whats, whys, and wherefors of the substances that comprise our tangible world: for example, our medicines, detergents, plastics, dyes, cosmetics, preservatives, fuels, and fibers. The chemist asks questions such as what is a substance? What are its properties? How is it made? Can I detect small quantities of it? Is it "useful"? Does it have unwelcome side effects? Can these be circumvented? Can I tailor-make new substances in a way that maximizes their desirable properties and minimizes their undesirable properties? Thus a chemist is a person who is curious, persistent, creative, and able to think analytically.

The traditional image of a chemist is of someone in a white coat standing at a lab bench surrounded by boiling and foaming evil-smelling liquids. Although many chemists do spend — and enjoy — hours "at the bench," much of today's chemistry involves working with sophisticated instrumentation and computers.

The field of chemistry is made up of several interrelated subdivisions — inorganic, organic, analytical, physical, nuclear, theoretical, biological, and medicinal. Very often a chemist finds herself drawing on knowledge and techniques in several of these subdivisions in the course of her work. A solid math and computer background is helpful, as well as familiarity with physics, electronics and/or biology, depending on one's subspecialty. A chemist should also be able to write and speak effectively and clearly, and should enjoy working with her hands.

The research programs at Brookhaven encompass a broad range of experimental and theoretical approaches directed towards a fundamental understanding of the properties and reactions of nuclei, atoms and molecules. The special facilities, apparatus and techniques available at BNL are employed to make unique contributions to the well-recognized fields of organic, inorganic, and physical chemistry. Less familiar areas—for example, nuclear and radiation chemistry, radio-pharmaceuticals, and the use of neutron diffraction and scattering to study solids are also investigated.

Carol Creutz

Carol Creutz, an inorganic Senior Chemist in the Chemistry Department, focuses her research towards developing chemical systems that convert solar energy into fuels. Specifically, she studies the reactions of transition-metal complexes when they are exposed to heat and light.

Dr. Creutz has a B.S. in chemistry from the University of California at Los Angeles and a Ph.D. in inorganic chemistry from Stanford University. Before coming to Brookhaven, she was an Assistant Professor of Chemistry at Georgetown University. She became interested in chemistry as a career because of the stimulating freshman lectures at UCLA. She found that she liked research because "it can be like a detective/mystery novel."

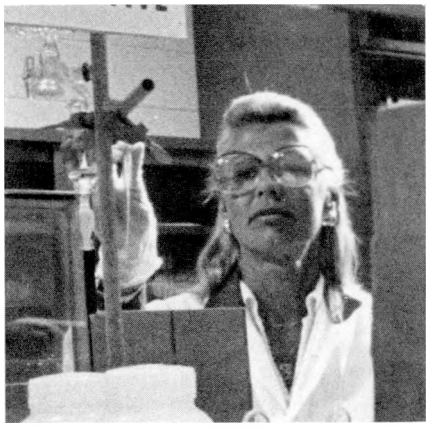
Dr. Creutz is married to a physicist who also works at BNL and has a daughter. She thinks the most difficult time for professional women who have children is when the children are small; that is, until the children are about 7 - 8 years old. During that time good child-care support is essential. Later on, coping with a career and children becomes a little easier.

Joanna S. Fowler

Are mental illnesses that are usually classified and diagnosed on the basis of behavioral symptoms also characterized by physiological

changes to the brain? How do drugs such as anesthetics, alcohol, cocaine, or heroin affect the physiology of the brain? Joanna S. Fowler, an organic Senior Chemist in the Chemistry Department, is developing diagnostic tools to study these and other questions of brain biochemistry. She synthesizes molecules with radioactive atoms — radiotracers — that provide images of brain metabolism using Positron Emission Transaxial Tomography.

Dr. Fowler's interest in chemistry began with taking college chemistry courses and was reinforced by a summer research program sponsored by the National Science Foundation. She obtained a B.A. in chemistry at the University of Florida and a Ph.D. in chemistry at the University of Colorado. Before coming to Brookhaven, she did postdoctoral research at the University of East Anglia in England.



Eena-Mai Franz

Eena-Mai Franz is a nuclear chemist currently doing applied research in the Department of Nuclear Engineering in the field of nuclear waste management, an area of great environmental and social concern. She has had extensive experience in nuclear and radiochemistry while at Brookhaven, having previously participated in studies of high energy nuclear reactions and the production of new isotopes. This research involved the use of several of the large, unique facilities at BNL: the Cyclotron, the Alternating Gradient Synchrotron, and the High Flux Beam Reactor.

Ms. Franz was born in Estonia. After immigrating to the United States, she attended Upsala College in New Jersey and graduate school at Purdue University. She has also taken graduate courses at Columbia University. Active in the American Nuclear Society, she was president of the Long Island Section in 1989-1990.

Louise Hanson

When nature seizes on a good thing in the form of a molecule, it tends to use it over and over again for many different purposes. For instance, the red pigment in the blood that carries oxygen is closely related to the green pigment in plants responsible for photosynthesis. Louise Hanson, a physical chemist in the Department of Applied Science, tries to understand how natural systems modulate the properties and functions of these versatile molecules, to make it easier for chemists to design synthetic systems with tailor-made properties.

Dr. Hanson holds B.S. in chemistry and M.S. degrees from the University of Michigan and a Ph.D. from the University of Washington. She also studied for a year at the Philipps University in Marburg, Germany with a Fulbright scholarship. Before coming to Brookhaven, she did research in biophysics at the National Institutes of Health and taught analytical chemistry at The American University. She has two children, a son and a daughter. Her husband is a crystallographer/ computer analyst who also works at Brookhaven.

Dr. Hanson says "From the time I was a small child helping my mother (a crystallographer) map out the atoms in crystal structures, I have been fascinated by molecules. In those days, computer graphics were essentially nonexistent, so huge tables of numbers had to be plotted by hand onto large sheets of drawing paper. My mother spread the paper out on the dining room table and held the corners down with tall brass candle sticks. Drawing in the contours once the numbers were plotted was the best part."

Physics

The study of physics is at the heart of both modern science and technology. The goal of physics research is to discover, understand and use the fundamental laws of nature. At Brookhaven, physics research is carried out at three levels: the study of solids and liquid matter that we can see and touch, to determine the physical behavior and relationships between atoms and molecules of which the matter is composed; the study of the subatomic nuclear matter that forms the core of the atom; and the study of the still more microscopic constituents of the neutrons and protons that make up nuclear matter.

A physicist usually specializes in either theoretical or experimental physics. The experimental physicist performs experiments to investigate the relationships and behavior of matter, while a theoretical physicist is primarily concerned with the mathematical descriptions and predictions of these relationships and behavior. For progress to be made, theoretical and experimental physicists must work together.

Much of the experimental physics research done at Brookhaven on all levels is performed using one or other of the big sophisticated machines at Brookhaven. These facilities include the National Synchrotron Light Source (NSLS), which is the world's largest synchrotron radiation center; the High Flux Beam Reactor (HFBR), which is an intense source of neutron beams; and the Alternating Gradient Synchrotron (AGS), which is the world's most versatile accelerator and can produce intense beams of secondary particles, such as mesons and antiprotons.

Some of the physics research programs are engaged in investigations of matter at a fundamental level, while others are applied to problems of practical importance in society. There is certainly a great variety of areas of physics in which to become involved. Some of these areas overlap with other disciplines, and the opportunities to interact productively with scientists in other fields are many.

Robin Appel

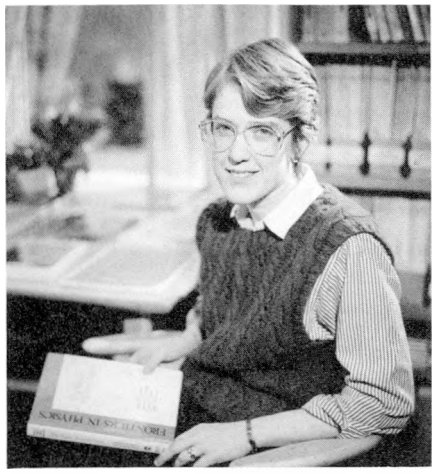
Robin Appel is a graduate student in high energy physics in the Alternating Gradient Synchrotron (AGS) Department. She helps run the experiments at the AGS and analyzes the results on the computer.

Physics is her second career. Ms. Appel first embarked on a career in social work, but decided to pursue her interests in physics at age 32. This decision required both undergraduate and graduate courses in physics. She received her B.S. degree in physics from the University of South Florida and an M.S. degree in physics from New York University. Ms. Appel is working towards her Ph.D. in physics. She hopes to continue doing scientific research.

On the subject of aspects of her work as a woman in science, Ms. Appel says, "I suspect it is a little more difficult to be taken seriously as a woman in science." She also feels that science is a very demanding career and that one must be willing to sacrifice one's personal life to a certain extent.

Sally Dawson

Sally Dawson is a member of the high-energy physics theory group in the Physics Department. She works independently on problems associated with explaining the results from high energy physics experiments. Her



B.S. is in physics/math from Duke University, and she holds both M.S. and Ph.D. degrees in physics from Harvard. After obtaining her Ph.D., Dr. Dawson was a research associate at Fermilab in Chicago for two years and then at Lawrence Berkeley Laboratory for three years. She came to BNL in 1986. Dr. Dawson is married to a physicist and has two young children.

Vinita Ghosh

Vinita Ghosh is a Physics Associate in the Material Science Division of the Department of Applied Science. Her work involves mathematical modelling and computer simulations to complement the experimental work done by her colleagues. She has studied different kinds of solid state physics problems, including storage of hydrogen in metals, ordering and migration of defects in aluminum superconductors and photoconductivity in amorphous silicon. She is currently working on positron backscattering from different materials. Developing appropriate theoretical models involves writing complicated mathematical equations and solving them, usually with the help of a computer.

Dr. Ghosh was born and raised in India. Her undergraduate studies were at the University of Delhi. Her biggest dilemma in college was whether to major in physics, chemistry, or math; she finally settled for a major in physics with minors in chemistry and math. She did her Ph.D. at the University of Rochester, N.Y., in solid state theory. Along with physics courses, she took graduate courses in algebra, statistics, and calculus. She also learned computer programming there, but most of her computer knowledge was acquired on the job at BNL. She feels that doing research is a constant learning experience and each new problem is an exciting challenge.

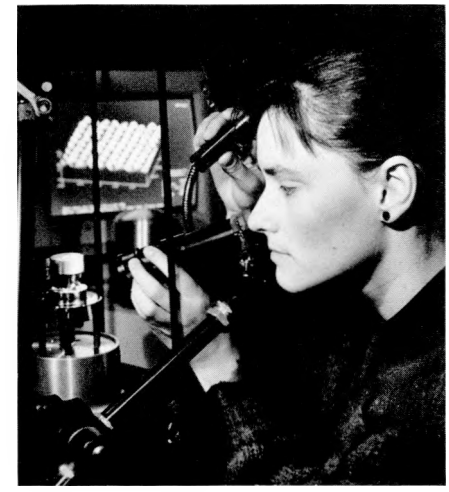
Being a woman has not hindered Dr. Ghosh's career in any way. She is married to a physicist who also works at BNL, and they have two very active school-age children. She loves to spend time with her children - jogging, swimming, reading or just talking. She says, "It is often difficult for me to do all the things I want to do, but I keep trying. If I had to live my life again I would still like to have both a family and a career."

Materials Science

Materials science explores the properties of metals, alloys, semiconductors, superconductors, ceramics and polymers. Understanding materials' properties and characteristics is becoming ever more important as our technology becomes more complex. Materials development and engineering advances often go hand in hand. For example, improvements in semiconductor technology have lead to the increasing miniaturization and power of computer memories and processors. At national laboratories, like Brookhaven, advances in superconducting alloys have led to the development of extremely powerful magnets for particle accelerators.

Questions asked by materials scientists include: How well does a given material withstand environmental and mechanical insults? What are the electrical and magnetic properties of a given material? What effect does fabrication have on the materials' properties? Are the observed and/or desired properties of a given material governed by the atoms on its surface or in its bulk volume?

Materials' properties are measured using instrumental analyses. A person entering this field should have a strong background in math, the physical sciences, and computers.



Alison Davenport

Materials science has enabled Alison Davenport to apply fundamental science to very practical problems, such as corrosion (rust). She is developing techniques using x-rays at the National Synchrotron Light Source at Brookhaven, and scanning tunneling and electron force microscopes to study corrosion effects in wet environments at atomic precision.

At high school Dr. Davenport was always interested in chemistry, but when she became an undergraduate, she took a course in materials science, which she found very interesting, "because it was more directly related to the world around me."

Alison came to Brookhaven as a postdoc from Cambridge, England, where she earned both her B.A. and Ph.D. degrees in materials science. She is currently an Assistant Scientist in the Department of Applied Science. She feels that it has been a positive advantage for her to be a woman in a scientific discipline with traditionally few women because people tend to notice and remember her and her work more easily.

Geraldine Lamble

Gerry Lamble is the Operations Manager and Resident Beamline Scientist on an X-ray beamline, X-11, at the National Synchrotron Light Source (NSLS). The beamline is designed to use a technique called X-ray Absorption Fine Structure, which yields structural information about a great variety of materials. Dr. Lamble oversees the operation and development of the line, making sure it runs smoothly and providing assistance when necessary. In addition, she has her own allocation of beam time, to pursue her own research interests. Presently, she is involved in investigations of metal-metal multilayers, particularly at the metal-metal interface region. Recently, she and her colleagues at North Carolina State University engaged in a project to look at metal silicide formation.

Dr. Lamble has a B.Sc. in physical chemistry and a Ph.D. in surface science, from Liverpool University, United Kingdom. Her Ph.D. experiments were done at Daresbury Laboratory, near Liverpool, which has an X-ray source similar to the NSLS at BNL. She came to BNL in 1987 as a Research Associate for North Carolina State University, based at the NSLS, to study interfaces of metals. She is very happy in her work, because it involves interacting with a lot of different personalities, yet she also has the freedom to continue her own research.

On the subject of difficulties of being a woman in science, Dr. Lamble says, "I think traditionally there have been psychological barriers for women in science, as in any other male-dominated field. Probably two of the most important attributes for a scientist are the ability to reason and the ability to be objective. There is no evidence to suggest that men should intrinsically be any better than women at these things. I think that everyone needs role models and women in science have traditionally been few and far between. However, times are changing. We see stereotypes being broken all the time in society. There are many more women in science now than there were, say, ten years ago." Dr. Lamble is married to a physicist is also works at BNL. They share the daily chores in and around the house and make a point of coordinating their schedules so that they can spend time together.

Research Support Specialties

In addition to the careers described in the preceding pages, BNL women can also be found in a wide variety of other jobs that support the research effort. Two of the women described in this section, Heather Hartmann and Eva Emmerich, provide technical support for particle accelerator design and operation. Another, Margaret Bogosian, has an unusual job which combines legal and scientific expertise—she is a patent attorney, who now heads Brookhaven's Technology Transfer program. A fourth specialist profiled in this section is an Editorial Assistant who edits technical writing, and also puts out a monthly newsletter.

Margaret C. Bogosian

Margaret Bogosian is Deputy Manager of the Office of Technology Transfer and BNL Patent Counsel. The Office of Technology Transfer is responsible for obtaining patent protection on BNL inventions and for fostering commercialization of these inventions through licensing to industry. The office is also responsible for industrial use of the BNL user facilities, such as the National Synchrotron Light Source and for industry sponsored research at BNL.

Ms. Bogosian embarked on a premed program, intending to obtain a Ph.D. in biochemistry and to conduct medical research. However, she realized in undergraduate school that research was not her interest. She was interested in the business part of research. Therefore, she decided to go to law school and received her degree from Fordham University School of Law. Ms. Bogosian worked in the pharmaceutical industry and the non-profit research environment, where she was involved in the business and legal aspects of research.

Ms. Bogosian believes that the science and research field is still predominantly male, and that it is difficult for women to gain acceptance of their abilities and to advance. It is also difficult to find female colleagues. With regard to the necessity to balance personal and professional lives, Ms. Bogosian says, "Women must realize that other people in their lives must share responsibilities; try not to be 'superwoman'."

Eva Emmerich

Eva Emmerich is a Senior Designer in the Alternating Gradient Synchrotron Department in a group that designs particle accelerators. She has designed magnet measuring coils for the Isabelle project, magnets for the Superconducting Super Collider (SSC), RF cavities for the Booster project, and currently, she is finishing the design and documentation of the whole Vacuum System in the Booster tunnel. Her desire was to be a medical doctor, but she grew up behind the "Iron Curtain" in Czechoslovakia, and due to the political and religious beliefs of her parents, she could not go to the university. Thus, she attended an industrial technical institute and upon graduation, worked as a mechanical designer of chemical plants.

While in Europe, Ms. Emmerich did not encounter difficulties being a female in a technical area. When she arrived in the United States, Ms. Emmerich could not speak English fluently, and there were very few females in the engineering field; she

had to work much harder than her male colleagues to be recognized as a very capable individual.

Ms. Emmerich has a daughter in college, and she feels that they have shared good quality time together; balancing her professional and personal life has been possible. She strongly advises young women considering marriage to look for a partner who would be very supportive of women as professionals, and who would be willing to share the household chores and the care of the children.

Heather Hartmann

Heather Hartmann is a Technical Associate in the Alternating Gradient Synchrotron (AGS) Department. She is responsible for building, testing, and maintaining systems which support the overall operation of the accelerator. She leads the technical support for the Polarized Proton Timing, HITL Bump/Inflector, AGS Vacuum Upgrade, and some of the Analog, Digital Multiplexer systems. Ms. Hartmann went into science because she felt she would like it. She progressed from a wirer/solderer and construction technician, to designing electronic circuits. Ms. Hartmann is presently attending the State University of New York at Stony Brook, part-time, working toward a BS in electrical engineering. Upon receiving her degree she would like to work more on design and less in construction.

Ms. Hartmann has advanced in spite of skepticism from some of her male colleagues about the quality of women's opinions and their technical abilities. She feels that she has had to work harder to receive the same recognition as her male colleagues; she has been expected to "give in" when conflicts arise and has had to fight the suggestion that work for women is just "a hobby".

Ms. Hartmann has one child (a second child is expected shortly) and knows that balancing responsibilities is difficult at times. She feels that society has moved into an era when parenting and professional responsibilities cannot be taken as separate issues. As the workplace realizes the importance and value of the contributions from women, Ms. Hartmann believes that women will achieve the recognition they deserve.

Katherine Vivirito

Katherine Vivirito is Editorial Assistant in the Editing Section of the Technical Information Division (TID). She has a B.A. in professional writing and literature from Southampton College. Ms. Vivirito edits scientific and technical manuscripts, such as abstracts, journal articles, manuals, BNL reports, field work proposals, symposia, and lectures, and she indexes symposia. Some BNL authors use the editorial service for help with their early drafts, therefore Ms. Vivirito rewrites text, especially manuals. She is also editor of TID's newsletter Inform, which is part of the company newsletter Link.bnl.

Besides experience gained from editing books and papers, Ms. Vivirito is taking additional science courses, and she plans to start her master's degree soon.

Credits

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