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ABSTRACT

The Minority Research Initiation (MRI) awards are one-time grants for underrepresented minority investigators who have not previously received Federal research support as faculty members. This booklet highlights 105 minority investigators who graduated from the nation's top research universities. They are creative and productive contributors to science and engineering capability in the United States. Awardees in this booklet received their MRI grants from fiscal year 1981 through fiscal year 1988. (PR)

MODELS OF EXCELLENCE

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MODELS OF EXCELLENCE

DIRECTORATE FOR
SCIENTIFIC, TECHNOLOGICAL, AND INTERNATIONAL AFFAIRS
RESEARCH INITIATION AND IMPROVEMENT DIVISION
MINORITY RESEARCH INITIATION PROGRAM

NATIONAL SCIENCE FOUNDATION
1990

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This publication was prepared by the staff of the Division of Research Initiation and Improvement (RII). Dr. Joseph G. Danek is the Division Director. RII is a division within the Directorate for Scientific, Technological, and International Affairs (STIA), headed by Dr. F. Karl Willenbrock, Assistant Director.

Special ackowledgements are given to the late Dr. Tommy E. Wynn who served as the Minority Research Initiation (MRI) program manager for fiscal year 1989 and who coordinated the initial administrative groundwork for this publication and to Dr. Robert H. Harvey, who served as the MRI program manager from fiscal year 1985 to fiscal year 1987. In addition, this publication acknowledges the efforts of the many other individuals who motivated the MRI awardees and served as mentors throughout their careers.

The National Science Foundation's Committee on Equal Opportunities in Science and Engineering (CEOSE), an advisory body to the NSF Director, has provided valuable insight to the MRI program over the years.

The services of a professional writer, Mr. William J. Cromie of Cambridge, Massachusetts, were utilized in the collection of background material for this booklet. Mr. Cromie, who is now a science writer at Harvard University, conducted interviews with each MRI awardee on the following points:

(a) how each became interested in science or engineering;
(b) names of their role models and mentors;
(c) how the MRI award affected their research goals; and
(d) their personal views on how to increase minority participation in science and engineering.

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FROM THE DIRECTOR

To Our Nation's Students:

Our world is increasingly competitive, and our economy increasingly depends on scientific and technical excellence. That excellence, in turn, depends on people—people with education and skills in every area of science and technology. This is the root of our national concern with education. We need qualified people to keep our science and engineering, and the industry that depends on technology, in a position of world leadership.

More and more, a focus on people means a focus on minorities, because minorities are a resource we have not fully used. Minorities have not been drawn to science and engineering in sufficient numbers, and earn far fewer advanced degrees in science and engineering than their relative numbers in the population would indicate.

The Minority Research Initiation program helps to solve this problem by helping talented minority faculty members get started in research careers. More minority researchers can then help train the minority students who will be our future researchers, and can serve as mentors and role models to minority students interested in science and engineering.

The men and women in this brochure demonstrate that research careers can be both exciting and rewarding. Most were first attracted to science well before they entered college, often because a

teacher or friend aroused their enthusiasm. But the path has not been easy; each has had to find the courage to surmount difficult challenges. They have demonstrated what hard work and self-discipline can accomplish, and have earned the right to stand among the best in their fields.

We will need the talents of each of these men and women to build America's technical strength, and to encourage more minority students to follow them in that challenge. The National Science Foundation is proud of the part it plays in making their efforts possible.

Erich Bloch
Director
National Science Foundation

FOREWORD

In 1980, discussions began at the National Science Foundation on the possibility of establishing a program to address the needs of talented minority researchers at both majority and minority institutions in the United States. Although the Foundation already had a program to support research initiation at minority institutions, none was in place for assisting underrepresented minority investigators at all colleges and universities.

In response to this need, the Minority Research Initiation (MRI) program was established in fiscal year 1981. One of the program's major goals is to assist the advancement of talented minority scientists and engineers in academic research careers. Over 95 percent of MRI awardees over the past eight years have remained in academia. In addition, many awardees now hold key administrative positions at their institutions. On a broader scale, the MRI program also addresses the goal of improving the quality, distribution and effectiveness of the United States human resource base.

The MRI awards are one-time grants for underrepresented minority investigators who have not previously received Federal research support as faculty members. The term "minority" refers to those ethnic groups that are significantly underrepresented at advanced levels of science and engineering. The term includes American Indians, Blacks, Hispanics, Native Alaskans, and Native Pacific Islanders. Proposals submitted to MRI are reviewed in the disciplinary programs of the Foundation. Criteria and procedures that are applicable for all proposals submitted to the NSF are used.

This booklet highlights 105 minority investigators who graduated from the nation's top research universities. They are creative and productive contributors to this country's science and engineering capability. Awardees in this booklet received their MRI grants from fiscal year 1981 through fiscal year 1988.

Each profiled awardee gives a candid account of their personal struggles and triumphs to become a successful researcher. How they are personally helping to increase the participation of minority students in science and engineering is also included.

We wish each of these awardees much success as they continue their careers. They are role models for all students but special ones for minorities in the educational pipeline who are considering careers in science and engineering. These MRI awardees have demonstrated that barriers can be successfully overcome if one has the talent, determination, and perserverance to be an active participant in this Nation's research enterprise.

Over the years the Foundation has received inquiries from school districts, colleges, universities, professional societies, and social organizations about the availability of a publication for identifying minority role models in science and engineering. We hope this booklet will satisfy this need.

Roosevelt Calbert
Program Director and Editor
Minority Research Initiation

Dr. Michael Spencer
Associate Professor of Electrical Engineering
Howard University

MRI Award, FY 1981
Presidential Young Investigator Award, FY 1985

Director, Materials Science Research Center of Excellence

Dr. Carolyn W. Meyers
Associate Professor of Engineering
Georgia Institute of Technology

MRI Award, FY 1985
Presidential Young Investigator Award, FY 1989

Dr. Wendell Hill
Assistant Professor of Physics
University of Maryland at College Park

MRI Award, FY 1984
Presidential Young Investigator Award, FY 1988

Dr. Daniel C. Akins
Professor of Chemistry
City College - CUNY

MRI Award, FY 1982

Director, Research Center of Excellence for Analysis of
Structures and Interfaces

Dr. Arturo Bronson
Associate Professor of Engineering
University of Texas at El Paso

MRI Award, FY 1984

Group Leader, Research Center of Excellence in
Materials Science

Biological and Life Sciences

Shirley Blakely
Ph.D., University of Maryland at College Park
Department of Biochemistry
Howard University
Washington, D.C. 20059

Dr. Shirley Blakely grew up on a farm in Alabama with a burning curiosity about what she saw around her. "I always wondered about things such as how crops grow and how fertilizer works," Blakely recalls. She enjoyed chemistry in high school, but never believed that her interests and curiosity would lead her to become a scientist.

Blakely continued to take science courses at Tuskegee University in Alabama, where she majored in dietetics. "I particularly enjoyed biochemistry," she remembers. "In my junior year, it occurred to me that biochemistry was something at which I could make a living." It was too late to change, however, and Shirley received a B.S. in dietetics in 1966. "I did not do as much science as I wanted to do when I worked as a dietician, so I decided to go to graduate school," she explains.

She enrolled at the University of Maryland in College Park. There she did thesis work on carbohydrate nutrition and earned a Ph.D. in nutritional biochemistry in 1979. Blakely taught for a year at Gallaudet University in Washington, D.C., then worked for a year in industry before moving to the Howard University College of Medicine, where she is now. "After several years of teaching and research, I had an opportunity to do research in my thesis area," she notes. "I wanted to pursue it independently, so I applied for an MRI grant."

Blakely received a grant in 1988 to investigate how diet and pollutants, such as vanadium, can affect the way insulin regulates energy production in cells. "The award gave me confidence in my ability to carry out a research project," she comments. "It also boosted my professional standing and put me in a position to make a contribution to my area of study."

Dr. Blakely has observed what she calls a "stigma" attached to science and engineering. "Minority students often are encouraged to ignore these careers unless they are gifted and-male," she asserts. "Those who are encouraged often see these careers as too difficult and time-consuming to pursue. To combat this, high schools should expose all students to science and to career scientists who can serve as positive role models. Government agencies and private institutions can help by providing information about programs available to help those interested in these areas, as well as about the long-term benefits of careers in science and engineering."

Godfrey Bourne
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Florida Atlantic University
Boca Raton, FL 33431-0991

When he was a boy in Guyana, Dr. Godfrey Bourne took long nature walks with his schoolmaster father. "This stimulated my natural interest in plants and animals, and I knew from that time on that I would be a biologist," he recalls.

Work on his bachelor's degree at Ohio Wesleyan University and his master's at Miami University in Ohio convinced Bourne that he wanted a career in research and teaching. But he could not move ahead as fast as he would have liked. Lack of funds forced him to work until he saved enough for work on his Ph.D. degree at the University of Michigan. Here, Bourne became interested in the behavior of snail kites, threatened by hawklike birds with a fondness for one genus of snails. Their feeding habits have applications for the control of agricultural pests.

Bourne applied for an NSF grant to continue his work on these birds after graduation. The application was sent to the MRI program. "Without this award, I would not have been

able to continue my research or my career in academia," he says. "The award also contributed to my being asked to review manuscripts for the top U.S. ornithological journals and to become elected to the American Ornithological Union—in short, to be accepted as a scientist."

After the MRI experience, Bourne worked as curator of birds at the Detroit Zoo and as a biologist for the South Florida Water Management District. When he received a call from Florida Atlantic University, he was reluctant to apply because he was already making a good salary. His love of research won over his need for money, however, and he returned to academia.

"Many minorities," Dr. Bourne asserts, "particularly those from poor circumstances, perceive that they cannot make a good living in biology or the other sciences. Those who have a natural interest in science and engineering need to be encouraged, as I was, and educated to the fact that doing what you love is more important than money."

Leo R. Chavez
Ph.D., Stanford University
Department of Anthropology
University of California at Irvine
Irvine, CA 92717

Dr. Leo Chavez approaches the study of migration from a personal perspective. "My family lived in Chimayo, New Mexico, for 300 years," he notes. "Recently, they have experienced the immigration of people from eastern U.S. who came to our village and bought land." Chavez says. "Because of a lack of local jobs, my father joined those who migrated to California to seek a better life. Trying to understand how migrants adapt, and how others adapt or do not adapt to them, led me into anthropology."

Chavez's Ph.D. work at Stanford University took him to Ecuador to study how Indians who migrated from rural areas to towns used their skill as weavers to adapt to new surroundings. Again, there was personal involvement: his family members are weavers who continue the tradition in New Mexico.

At the same time he was writing his dissertation, Chavez began working for the Center for U.S.—Mexican Studies at the University of California at San Diego. As the first employee of the Center when it opened in 1980, he helped interview more than 2,000 legal and illegal Mexican immigrants. Chavez wanted to use this data to compare how households from the two groups adapted and how they participated in the labor market.

"An MRI grant enabled me to do this after I got my Ph.D.," he explains. "The award gave me the time to carefully analyze data that was extremely difficult to collect. I published the analyses, and this led to my being hired by the University of California at Irvine.

Dr. Chavez believes that scientists have the responsibility to share the understanding they gain with the public. To this end, he writes newspaper articles and has helped write and produce two television documentaries. He also works with minorities in elementary and high schools to make them aware of the benefits of education and to encourage them to strive for excellence. "Every minority scientist should do this," he believes, "but it takes more than role models to attract minorities into science and engineering. We need to involve people in this effort from all levels—from the home and kindergarten to universities and state and national legislatures."

Alexander Cruz
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Department of EPO Biology
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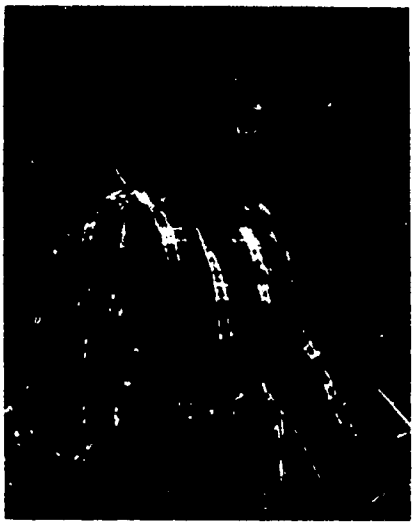
Boulder, CO 80309-0334

Growing up in a Puerto Rican section of Brooklyn, N.Y., Dr. Alexander Cruz combed vacant lots for plants and animals that he could watch or collect. "My parents were very tolerant of turtles in the bathrooms and terrariums in the kitchen," he recalls. Cruz loved to visit his grandparents in Puerto Rico where he observed the rich diversity of tropical species.

In 1960, Cruz was one of the few Hispanics in science classes at City College of the City University of New York. He earned a B.S. in biology there, then went to work as a virologist for the New York City Department of Health. His love of wildlife drew him to parks and bays on weekends, and eventually led to a decision to go to graduate school. "I wanted to do what interested me the most," Cruz says. In 1968, he went to the University of Florida in Gainesville, where he received a Ph.D. in 1973. He then took a faculty position at the University of Colorado in Boulder, where he is now a professor of biology.

During field work in the Caribbean region from 1968 to 1981, Cruz became aware of the movement of the shiny cowbird from South America through the Antilles to Florida. This bird lays its eggs in the nests of other birds, and Cruz became interested in the effect of this invasion on the unwilling host species. He received an MRI award to study questions of reproductive success and ecology related to the shiny cowbird. "Without the award, I would not have been able to do the necessary field work," he comments. "Also, the papers I published were important to establish a reputation and becoming a full professor."

Dr. Cruz has been working to get more minorities, women, and persons with disabilities into science and engineering. He has served on an NSF committee dedicated to this goal, trained minority graduate students in his laboratory, and taught a course for students at his university with poor backgrounds in science. "Most of the latter are minorities," he notes, "and although these kinds of efforts are helpful, we really need to get more people into the pipeline at the early high school levels." To this end, he works with a program to bring high school and college students into the University of Colorado laboratories in the summer. "This project has produced some progress," he says, "but in Colorado as in the rest of the nation, we still have a long way to go."



John P. Davidson
Ph.D., Purdue University
Department of Biology
Tuskegee University
Tuskegee, AL 36088

Dr. John Davidson had no interest in science before he took high school biology in Centerville, Alabama. "I loved the subject and have stuck with it since," he comments. "I owe that primarily to a concerned and competent teacher." His fascination also was reinforced by a tenth grade summer biology program sponsored by NSF.

Davidson entered Fisk University in Nashville, Tennessee in 1960, at age 15, and he received a bachelor's degree four years later. He went on to Tuskegee University in Alabama, earning an M.S. in biology in 1967. He subsequently worked as a laboratory technician at the University of Rochester Medical Center in New York. After three years, he left to attend his injured father and to fulfill an ambition to earn a Ph.D. degree.

Davidson went to Purdue University in Indiana and received his doctorate in 1977. He remained at Purdue for two more years in a postdoctoral position, then did a second postdoctoral appointment at Washington University in St. Louis. In 1980, he returned to Tuskegee where he is now an associate professor in the department of biology.

While working on his Ph.D. degree, Davidson investigated mutations that alter expression of genes that code for amino acids. As a faculty member at Tuskegee, he applied for an MRI grant to continue such research, specifically a mutation that increases the production of histidine in the bacterium

Salmonella typhimurium. "The award gave me the opportunity to establish a research laboratory," he says, "something I probably would have not done otherwise. Tuskegee is mainly a teaching university, which means there is no free time to do research unless you find support." Davidson has continued his research with a Minority Biomedical Research Support grant from the National Institutes of Health.

Dr. Davidson's experience leads him to conclude that the biggest obstacle for both minority and majority students at the college level is a lack of proper preparation in high school. "This is not just a problem for science and mathematics," he asserts, "but for basic literacy as well. Some colleges and universities, including Tuskegee, bring in high school students during the summers to try to makeup for these deficiencies. However, that is too little too late to address the problem adequately."

Emmeline Edwards

Ph.D., Fordham University

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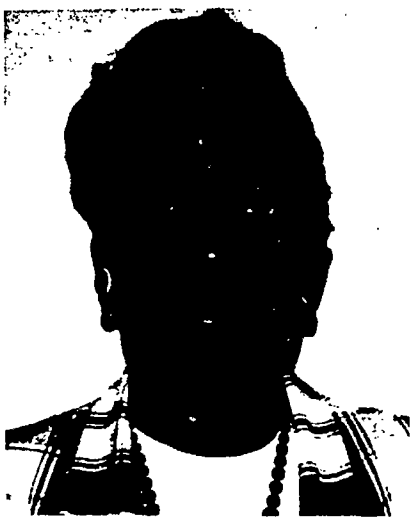
Dr. Emmeline Edwards had no direct contact with science while growing up in Haiti. "My grandfather was a nationally known historian and my parents, both professionals, made education a primary focus in our family," she recalls. "I knew about medicine but had no idea what a career in science would be like." When Edwards came to the U.S. in 1970, she was impressed with the courses in science and mathematics at the College of New Rochelle in New York. "I was attracted to the logic of these courses," she remembers. "I found organic chemistry especially enjoyable and challenging."

Edwards earned a Ph.D. degree in chemistry from Fordham University in New York City in 1983. She concentrated on neurochemistry, then applied her knowledge to research on mental health at the Long Island Research Institute in Stony Brook, New York. When that independent institute closed in 1986, she received an appointment in the department of psychiatry at the State University of New York (SUNY) at Stony Brook. She has worked there since that time.

At SUNY, Edwards applied for and received an MRI grant to study the role that neurochemicals play in coping with stress. Although the experiments are done with rats, her research has applications to the development of more efficacious drugs for treating human depression. "The award permitted me to explore and extend my research interests," she comments. "I was able to accomplish much work because I could hire technicians to help me. This produced publications which have put me into the mainstream of science."

Edwards admits that, as a black woman from Haiti, she was not always readily accepted by her academic peers. "The solution for this, she says, "is to proceed with your career plan, do careful work, and publish. If you do this right, recognition and acceptance will follow."

"Attracting more minorities into science and engineering is a more difficult problem," Dr. Edwards concedes. She believes that, to begin with, "young people should be approached at the high school level or before and encouraged to take courses in science and mathematics. Interested students should then be exposed to research in the laboratories of established scientists. Finally, when an institution hires minority scientists or engineers, it should make special efforts to retain them."



Gregory L. Florant
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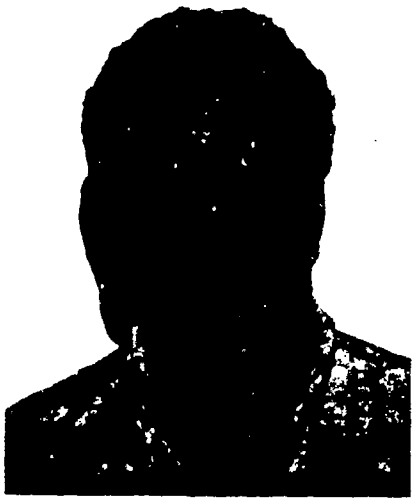

Dr. Gregory Florant was an avid bird-watcher in elementary and high school. "I worked at the Junior Museum in Palo Alto, California, under the tutelage of Ted Chandik, an excellent teacher who started me working with animals," he recalls. Besides working at the museum, Florant was fascinated with falconry, and he read every book on birds that he could find. It was natural for him to do his undergraduate work at Cornell University in Ithaca, N.Y., and work with professional birders at the Laboratory of Ornithology.

As an undergraduate, Florant was introduced to field work at the Rocky Mountain Biological Laboratory (RMBL) in Colorado. There he met biologist Paul Ehrlich and later worked with him in graduate school at Stanford University in California. "I was doing a research project with him at Stanford," Florant relates, "when someone broke into our aviary and stole or released all the birds. I switched to work on the hibernation of mammals and never looked back."

Florant earned a Ph.D. degree in 1978 under the direction of H. Craig Heller, then did postdoctoral research at the Albert Einstein College of Medicine—Montifiore Hospital and Medical Center on neuroendocrine rhythms in hibernators. In 1980, he took a faculty position at Swarthmore College where he applied for an MRI grant. He received an award in 1983 to investigate how mammals store and metabolize fat to survive when their body temperatures drop as low as a few degrees above freezing. Florant became an associate professor at Swarthmore College and is now a full professor with tenure in the biology department at Temple University in Philadelphia, Pennsylvania.

"The grant allowed me to do research that I wanted to do instead of working on someone else's project," Florant comments. "It freed me to work without interruption or worry about finances at RMBL, where I made many valuable professional contacts. (Florant now serves on RMBL's board of directors). In addition, it enabled me to train students, which I think is one of the most important aspects of the MRI program."

"Not enough minorities in high school, or even college, know that the life of a professor is one of the best in the world," Dr. Florant asserts. "If they knew as much about the lifestyles of professors as they do about physicians, firefighters, or athletes, we would not have, I do not think, a shortage of minorities in academic science and engineering. We need more programs to explain that plenty of jobs are becoming available in academic professions where they will have freedom to exercise their creativity and make a contribution to the body of knowledge about the world."

Jose E. Garcia-Arraras
Ph.D., Harvard University
Department of Biology
University of Puerto Rico at Rio Piedras
Rio Piedras, PR 00931

Growing up on the west coast of Puerto Rico, Dr. Jose Garcia-Arraras filled his house with fish tanks and seashells. In high school, he did science fair projects on fish behavior. At the University of Puerto Rico at Mayaguez, Garcia participated in one of the few research projects then available—a National Institutes of Health-sponsored project on insect histology. "This was my first introduction to learning science by experiment instead of lecture," he recalls, "and I liked it."

When Garcia received a B.S. degree in 1976, most of his friends who majored in biology went to medical school. He applied to different graduate schools and different departments because "my interests were broad and I did not know what to specialize in." An application to the biology department at Harvard University was shifted to the physiology department, where he ended-up. "Until I went to Harvard, I did not know that

it was possible to have a career doing research," he admits. "I made the decision to go to graduate school without much focus: research gave me the focus."

Garcia earned a Ph.D. degree in physiology in 1981. He then did post-doctoral work for three years in France and for six months each in Australia and Japan. "In France, I worked on the development of the vertebrate nervous system, using animal embryos," he explains. "In Australia, I worked in the same area with adult animals." When he returned to the University of Puerto Rico at Rio Piedras in 1986, he wanted to continue this research. Garcia received an MRI grant in 1988 to investigate the differentiation of nerve cells in chick embryos.

"The MRI award gave me the freedom to do the research that I wanted to do," Garcia comments. "I like teaching but I do not want to do it exclusively. That would be bad professionally for both me and my students. With MRI support, I can introduce students who are interested in science to research, and they can decide if they want to make a career of it."

Dr. Garcia believes that informing bright minority students about possible careers and opportunities is the most important way to attract them into science and engineering. He notes, "we have started to do this at the University of Puerto Rico by inviting high-schoolers to do laboratory research and to learn about careers that might be personally satisfying for them. One thing we have learned is that this is a long and slow process."

Louis T. Giron, Jr.
M.D., Washington University School of Medicine at St. Louis
Neurology Service
Veterans Medical Center
Kansas City, MO 64128

While other kids watched television or played games, Dr. Louis Giron read the biographies of Marie Curie and Louis Pasteur. "I was not the brightest kid in my class," he admits, "but I worked hard." The effort paid off: Giron was the valedictorian of his high school class and he won a scholarship to Rice University in Houston. At Rice, his natural interest in science was channeled into biology and biochemistry.

Medical school seemed to be the next logical step, and Giron was accepted by the Washington University School of Medicine in St. Louis. Here he was inspired by Dr. Philip Dodge, a professor of pediatrics whom Louis describes as "an eloquent person and an ideal clinical teacher." Dodge had a command of the literature in neurology, an area in which Giron was developing a strong interest.

After medical school, Giron decided to apply for an MRI grant to study the role of a certain class of neurons in the development of the spinal cord. "Receiving the award was crucial for me," he recalls. "It allowed me to start and complete a piece of research that contributed to the reservoir of scientific knowledge. It provided the time and money that I needed to develop a command of the techniques required to do the research."

Giron is now a staff neurologist at the Veterans' Administration Medical Center in Kansas City, Missouri and an associate professor of neurology at Kansas University Medical Center. His research, however, has come to a standstill due to lack of support. "I'm at a crossroad," he states. "I must decide whether to continue the struggle for funds or devote all my energy to the practice of medicine."

Dr. Giron believes that other minorities will face this dilemma as research funds become tighter. "Minorities," he says, "will move to medicine, law, and other professions rather than science unless they see more opportunities to obtain support for the risky business of pursuing new knowledge."

Portia B. Gordon

Ph.D., Albert Einstein School of Medicine

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In high school, Dr. Portia Gordon was torn between mathematics and chemistry. "I liked using deductive reasoning to solve problems," she recalls, "and I enjoyed designing experiments in chemistry honors class. I did not know anything about careers in science, so I thought that I would become a physician."

At Smith College in Northhampton, Massachusetts, Gordon continued studying mathematics "because it was my strongest subject." However, when she took chemistry and biochemistry, the experience reinforced that feeling she had in high school that "this is really what I wanted to do." She continued to take mathematics courses, but dropped the subject when "it became too abstract—too far from the practical and human side of science." In her sophomore year, she studied pamphlets describing careers in chemistry and decided to specialize in molecular pharmacology in graduate school.

Gordon looked for programs in the New York City area where she was raised and chose the Albert Einstein School of Medicine for graduate study. After earning a Ph.D. degree in 1980, she did postdoctoral research at Albert Einstein College's Montefiore Medical Center. There, with the aid of two local grants, she was able to set-up her own laboratory. An MRI grant in 1988 facilitated her research on the role that extracellular secretions by endothelial cells play in the growth and regulation of these cells—work

that bears on changes that take place in arteriosclerosis.

"The award enabled me to do much more than I could have accomplished without it," she comments. "I felt a responsibility to do my best work and to expose as many young people as possible to science. Every summer, I have students from neighborhood high schools working in my laboratory. I even used data collected by one of them in a published paper."

Dr. Gordon believes that this is a major way to increase the number of minorities who choose careers in science and engineering. "Some young people will be turned off by science, but we should provide positive feedback to those who like it," she comments. "These students should be made aware that if they do excellent work, grants will be available to them. More institutions are coming to realize that they need minorities. Opportunities are there for them and the outlook is good."

Eric A. Goulbourne, Jr.

Ph.D., Cornell University

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Dr. Eric Goulbourne has an attitude that he shares with other minorities who want to be scientists or engineers: "If you always try to be the best that you can be then you will overcome all problems that arise, and you will move ahead to your goals."

That is what he did. Goulbourne graduated from Walla Walla College in the state of Washington with a bachelor's degree in medical technology; then he taught high school for four years. He enjoyed teaching but he also wanted to do research. His positive attitude helped him earn a master's degree in microbiology from California State University at Los Angeles. Determined to get a Ph.D. degree but short of funds, he applied for and received a predoctoral fellowship from the National Science Foundation. This took him to Cornell University where he became interested in the physiology of spirochete bacteria.

Doctoral-level work did not satisfy his curiosity about how these organisms move and respond to environmental stimili. An MRI award enabled him to both satisfy that curiosity and to help minority students. "I used part of the funds to bring students to Loma Linda University Medical School from predominately black colleges in the South and expose them to research," he says. That experience resulted in three of the students going to graduate and medical schools at Loma Linda, Ohio State and Michigan State Universities.

Goulbourne, an assistant professor, teaches microbiology to medical and dental students at Loma Linda while he continues his research. He also encourages and recruits minority students to go into science and engineering whenever and wherever he can.

"Plenty of opportunities exist," Dr. Goulbourne insists. "But I am concerned about the small number of minorities studying science at the graduate level. Young people need the help of role models who can show them how to take advantage of the opportunities."

Viola M. Griego
Ph.D., Washington State University
Burrough Wellcome Company
Greenville, NC 27858

Dr. Viola Griego's mother taught her and her twin sister the value of education by example. Their mother, an elementary school teacher, took courses in the summer for 10 years to earn a bachelor's degree. A biology teacher that Griego admired in high school shaped this value into an interest in science. Then, as a sophomore at New Mexico Highlands University in Las Vegas, New Mexico, she took her first course in microbiology and decided that this was what she wanted to do with her life.

Griego stayed at New Mexico Highlands to earn a master's degree in microbiology. (Her twin earned a master's degree in chemistry). From there, she went to Washington State University in Pullman where, in 1978, she received a Ph.D. She went on to a postdoctoral fellowship at Argonne National Laboratory near Chicago, and then to an assistant professorship at Oregon State University in Corvallis.

For her doctoral dissertation Griego studied a bacteria *(Bacillus thuringiensis)* which produces a substance toxic to certain insects. At Oregon State, she received an MRI grant to determine why *B. thuringiensis* is rapidly inactivated by sunlight when it is used as a biological insecticide. When she learned that a tenure track position would be improbable at Oregon State, she moved to Wichita State University in Kansas. While there, she found that the strain of the bacteria used as a commercial insecticide contains an abundance of light-sensitive compounds, a fact unknown up to that time." The award took an enormous amount of financial pressure off me," she comments. "And allowed me to do the research I wanted to do in the way that I wanted to do it."

In 1986, Dr. Griego was invited to present her work at an international meeting. However, she had left academia that year to work in the pharmaceutical industry. "Salaries are a major problem from elementary school to the university level. Combining low salaries with the falling esteem once enjoyed by teachers and professors reduces the number and quality of role models for students. Unless the situation changes, I believe that the outlook for minorities in science and engineering is tenuous."

Jerry Guyden

Ph.D., University of California at Berkeley

Department of Biology
City College - City University of New York
New York, NY 10031

Dr. Jerry Guyden was on the road to medical school when he was detoured by the excitement of research. "I had just graduated from North Texas State University in Denton and accepted to medical school," he recalls, "I participated in a summer research program on the role of air pollutants in initiating cancer. It was so exciting and successful that I decided that research was what I wanted to do."

Guyden stayed at North Texas State to get a master's, then went on to earn a Ph.D. degree in zoology from the University of California at Berkeley, in 1980. This was followed by postdoctoral work at Berkeley and in private industry. He did research at the University of California on the immune system, specifically on how T cells recognize and react to viruses and other foreign substances.

Guyden received a number of offers for faculty posts He chose City College of the City University of New York because, he says, "it combined the opportunity to work at a developing research center with the chance to be a role model for minority students." He applied for and received an MRI grant in 1988. With the award, he started a laboratory for research on immunology. Guyden and his graduate students probed the mystery of how genes produce and regulate T cells. "The MRI award gave me a chance to see if I could do valuable research on my own," he comments. "It gave me a chance to test my own ideas and to be competitive in a very competitive environment. That is all that I could ask for."

Dr. Guyden is also achieving his goal of being a role model. He participates in a summer research program for high school and college students, and travels to talk to minority students about career choices. "We need to identify the kids early who have interest and ability in science and engineering," he asserts. "Often these youngsters are influenced in other directions because they do not see scientists at work, or identify with them as they do with physicians and other professionals in their communities. We need to give scientists and engineers a higher visibility to obtain such identification. One of the best ways to do this is to give them hands-on experience like I had. That excited me, and I know that it will excite others."

Joseph C. Hall

Ph.D., Kent State University

Department of Biochemistry
Pennsylvania State University
University Park, PA 16802

Dr. Joseph Hall grew up in a Harlem ghetto in New York City. He was a gang member and a track star in high school without much interest in science. But one teacher saw potential in this kid who liked to take things apart and earned B's in science without studying. "He turned me on by showing me how to use mathematics and science to solve practical problems," Hall recalls. "He was the first of many mentors—most of them white—who were responsible for turning a black ghetto kid into a Ph.D. in chemistry."

Hall won a track scholarship to Roanoke College in Salem, Virginia. "With the help of teachers who believed in me, I was offered an academic scholarship in my junior year," he remembers. "I decided to take it and quit athletics." He became most interested in organic chemistry and considered going to medical school. However, a research project in biochemistry in his senior year influenced him to consider graduate school. "I found research fascinating," he exclaims.

Hall earned a master's degree in molecular biology from Old Dominion University in Norfolk, Virginia, then a Ph.D. in enzymology from Kent State University in Kent, Ohio. His Ph.D. research involved a study of enzymes that modify the surface membranes of sperm cells, an interest that stayed with him through a postdoctoral fellowship at Pennsylvania State University. Another mentor at Pennsylvania State encouraged him to apply for an NRI grant. He used this award to characterize a protein on the sperm cell membrane which is responsible for recognizing eggs.

"The grant helped me to counter negative prejudice—the expectation that blacks will fail in science," He comments. "That prejudice makes it extra difficult to obtain start-up research funds. I also was able to meet mentors at NSF and learn what becoming a competitive, independent scientist is all about."

Dr. Hall believes that minorities today have difficulty becoming scientists and engineers because: "We teach kids instead of educating them. Explaining how to do a mathematics problem is not as effective as showing them how to use mathematics to solve interesting problems. And you can not get good educators unless you raise their pay; in my opinion the low salaries keep the brightest graduates out of education."

Defield T. Holmes
Ph.D., Ohio State University
Department of Biology
Fayetteville State University
Fayetteville, NC 28302

Dr. Defield Holmes received an MRI grant that allowed him to continue a lifetime interest in studying the mysteries of animal life. He started in elementary school in North Carolina by raising earthworms in his basement. Holmes was fascinated with their behavior, and he did experiments on the reactions of the worms to changes in light.

"A love for and curiosity about animals stayed with me throughout college," Holmes says. He majored in biology at Hampton University in Virginia, then earned a Ph.D. degree from Ohio State University in 1951. He then did post-doctoral research on photosynthesis at the University of Minnesota, an interest that stayed with him the rest of his life. His post-doctoral appointment was followed by 28 years of teaching and research at small, undergraduate schools, where his research was done primarily during the summers.

Holmes applied for MRI support while at his present position as professor of biology at Fayetteville State University in North Carolina. "The grant freed me from a heavy teaching load and let me spend more time at research than I had since my postdoctoral days," he notes. Holmes studies the effects of ultraviolet light on microorganisms in the presence of certain chemicals. "We are trying to determine exactly how ultraviolet radiation kills protozoans and other organisms," he explains.

"It is extremely difficult to obtain sizeable grants when you are a minority at a small school, and teaching responsibilities keep you from doing enough research to publish regularly," Holmes points out. "The MRI award enabled me to overcome these disadvantages. The program is very significant for people like myself. In addition to helping me, it provided an opportunity for me to expose talented students to research—the best way to get them involved in science."

Dr. Holmes believes that more such support is needed. "You cannot be too effective in getting students interested in science and technology, and in maintaining that interest, if you work with antiquated equipment," he comments. "You cannot do state of the art research if you do not have state of the art equipment; students know this as well as professors."

Arnold G. Hyndman
Ph.D., University of California at Los Angeles
Department of Biological Sciences
Rutgers University
Piscataway, NJ 08855

Dr. Arnold Hyndman decided to become a scientist in the seventh grade. "I had a chemistry teacher who made science so exciting that I wanted to do it for the rest of my life," he recalls. "Then my eighth grade biology teacher opened up the horizons of biology and research to me. In addition to making their subjects relevant and exciting, these teachers were personally supportive."

Hyndman was the first to go to college in a family who appreciated the value of education but was never financially able to achieve it. During his senior year at Princeton University, he decided to be a neuroscientist. "I was interested in both biology and education, a combination that led to wanting to know how the human brain works," he says.

Following his Ph.D. degree at the University of California at Los Angeles and two postdoctoral fellowships, Hyndman became an assistant professor in the department of biological sciences at Rutgers University in New Jersey. There he received an MRI grant to look at the toxic effects on visual cells of an oversupply of the neurotransmitter glutamate. "I was able to make good use of a tissue culture model that I had developed earlier, and which allowed me to grow and maintain the retinal cells of chicks," he explains. "The work led to new questions and directions in the area of brain development, and that research has subsequently been funded by other NSF grants."

The MRI award enabled Hyndman to establish himself as a researcher in the early 1980s when cutbacks made the competition for funds very keen. "Everything I have done since the MRI grant has been built on that base," he comments. "I mean this both in terms of research and in providing support and advice for minority colleagues and students." In addition to giving help on an informal basis, he directs the Minority Teaching and Research Career Development Program at Rutgers.

"From the viewpoint of the number of U.S. minorities earning Ph.D.s," Dr. Hyndman notes, "the future looks very grim. However, on an individual basis, I continually meet bright, talented, and motivated kids who, with guidance, could make significant contributions to science and engineering. To insure a supply of such youngsters, it is vital to identify them at the junior high school and high school levels and to give them the kind of stimulation that made such a difference in my life."

Betty Ruth Jones
Ph.D., Atlanta University
Department of Biology
Morehouse College
Atlanta, GA 30311

Growing up on a farm in Hernando, Mississippi, Dr. Betty R. Jones had to grind corn, feed it to the family's chickens, and collect eggs. "Watching chicks hatch frightened me at first," she recalls. "But I grew to like it and to be interested in living things."

In the tenth grade, Jones was selected to participate in summer research at a nearby college. When she returned, her teachers assigned her a science project to determine if horse apples are poisonous. Her science projects won first prize every year until she graduated. Along with good grades in all subjects, the science work helped Jones win a four-year scholarship to Rust College in Holly Springs, Mississippi. During college summers, she worked at Polaroid Corporation in Cambridge, Massachusetts and Argonne National Laboratory near Chicago. She learned electron microscopy in the process, a skill that helped her in graduate school at Atlanta University. With the support of a National Institutes of Health fellowship, she earned a master's in 1975, then a Ph.D. in biology in 1978 from Atlanta University.

Jones went on to an instructor's position at Morehouse College in Atlanta, where she applied for a grant to continue her doctoral research on the life cycle of tapeworms. The proposal reviewers advised her to do more basic research, which she did for three years as a Bunting Fellow at the Harvard School of Public Health. There, Jones switched research to the parasite responsible for schistosomiasis, a condition that infects millions of people in the Third World. After returning to Morehouse in 1983, she received an MRI grant to continue that research.

"If it had not been for the MRI award, I do not know where my research would be," she says. "As a result of it, my students and I received a 1988-89 White House Initiative Award in Science and Technology."

Now an associate professor at Morehouse, Dr. Jones organized an NSF-funded conference in 1987 on ways to increase the participation of minority women in science and engineering. She also has organized an annual program at Morehouse to motivate and interest high school students in science and engineering.

Irving Gilbert Joshua
Ph.D., Pennsylvania State University
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University of Louisville
Louisville, KY 40208

Growing-up in rural Maryland, Dr. Irving Joshua raised chickens. He made the mistake of naming them and treating them as pets. "It was traumatic," he recalls, "when it came time to eat them." Today, Joshua's research is centered on birds, eggs, calcium-metabolism, and hypertension.

Joshua's interest in animals led him to concentrate on vocational agriculture in high school. He went to Maryland State College in Princess Anne with the idea of teaching in this field. However, he remembers, "I became engrossed in the physiology of birds and other animals, and this led me to decide on a career in research." He earned both master's and Ph.D. degrees in physiology at Pennsylvania State University. There, he says, "my interest switched from production-oriented research to basic research."

Joshua received a postdoctoral fellowship at the University of Missouri at Columbia in 1976. He did research on small blood vessels and how they become altered with hypertension. He remained at Columbia for two years after the fellowship, and he worked on the relationship between the cardiovascular system and calcium metabolism in birds.

In 1983, his research group was recruited to the University of Louisville in Kentucky to help build a research program in physiology. Joshua applied for and received an MRI grant to continue his work on calcium metabolism. Birds metabolize calcium more rapidly than humans, so processes that require years in humans can be studied in days in birds. "The MRI award demonstrated that this research is worthy of support," he asserts. "It led to my obtaining other national grants and to becoming an associate professor at Louisville."

Dr. Joshua and his department have developed a program to encourage minority students in middle and junior high school to go into science. "The basic sciences usually do not generate high incomes," he says. "So the best way to increase the participation of minorities is to get them interested early. Most of those who become intrigued with science and engineering at a young age will follow it for fulfillment rather than looking for monetary gain."

Gloria S. McCutcheon
Ph.D., University of Georgia
Edisto Research and Education Center
Clemson University
Blackville, SC 29817

Dr. Gloria McCutcheon remembers her days back in the cotton fields where she worked as a child on her family's small farm. "Thank goodness my situation is very different now," she says. She received a master's degree in entomology at Clemson University in 1978 and a Ph.D. degree, also in entomology, from the University of Georgia in 1987. She is presently a research scientist and serves on the faculty at Clemson University.

She conducts research on parasitic wasps and other organisms that have the potential to control cotton and soybean pests. The bridge between the two worlds was built by her parents' awareness of the importance of education and her natural curiosity about plants and animals.

The combination led her to a premedical track at Clemson University. Rather than going on to medical school, however, McCutcheon took a summer job that changed her course in life. The job at Clemson's Edisto Research and Education Center in Blackville, South Carolina involved studying insects as an alternative to chemical insecticides for the control of such pests as the cotton boll worm and soybean looper. While scientists realize that some chemical pesticides will always be needed in order to provide sufficient food for the human population, we must use minimal amounts as judiciously as possible. "I started working at Clemson in 1973 as a research technologist after receiving a bachelor's degree in zoology," she recalls, "and I have been there ever since except for time that was spent earning two graduate degrees. The work allows me to make a contribution to science by helping to make the environment safer, and it is something that I really want to do."

An MRI award "made research possible that I might not have been able to conduct without the grant," she says. "And the fact that the National Science Foundation thought my idea was worth funding gave me the self-confidence to keep going." Her publications in international journals have contributed significantly to the basic knowledge of parasitic insects that help regulate pest insects in soybean.

In addition to her research, Dr. McCutcheon has found a way to interest young children from rural areas in science and engineering. "When I was in elementary and secondary school in rural South Carolina, teachers had no materials available to make science exciting," she remembers. So McCutcheon is writing proposals that will enable teachers to spend summers with scientists and to develop the tools and knowledge to overcome this problem. "Various government agencies make strong efforts to attract young people to science," she comments. "At the same time, we need more scientists to serve as role models and interact with teachers and children at the precollege level."

Etheleen McGinnis
Ph.D., Purdue University
Department of Microbiology
Meharry Medical College
Nashville, TN 37208

Dr. Etheleen McGinnis describes herself as "a driven person with a hunger for learning and advancing myself." When she was a sophomore in high school, she took biology and quickly decided to focus her drive on the study of living things.

McGinnis was the first in her family to go to college. She won a scholarship to Knoxville College in Knoxville, Tennessee and worked every summer to be sure that she had enough money for books and other necessities.

She planned to be a high school biology teacher until she took an advanced course in microbiology. "I decided to be a microbiologist," she recalls. "At the same time, I started thinking about graduate school and a career in basic research." McGinnis earned a Ph.D. from Purdue University where she studied enzyme regulation in bacteria. She did postdoctoral work at the University of Alabama Medical Center in Birmingham. Her research work there involved the molecular biology of cell aging. In 1980, she took her first faculty post at Meharry Medical College in Nashville, Tennessee.

At Meharry, McGinnis received an MRI grant to expand her work. "The award helped me to realize my lifetime goal—to be a researcher," she comments. "Without it, I would have

taken much longer to start a laboratory and begin publishing my results." Those results opened the way for her to receive a five-year faculty development award from the National Heart, Blood and Lung Institute. She still works hard. "I do the experiments myself when I have no help," she notes.

From Dr. McGinnis' viewpoint, the outlook for minorities in science and engineering is dismal. "It is so extremely difficult to initiate and maintain a career in research. Because of that, we are attracting few talented minorities into graduate programs," she points out. "The MRI program is a tremendous help, so are NSF's Minority Research Centers of Excellence (MRCE) grants. But we must do more, particularly at the high school level, to make minority students more aware of what is required for a career in science or engineering, and to help them achieve that career."

Lycurgus L. Muldrow
Ph.D., University of Tennessee at Knoxville
DEM Science Research Institute
Clark Atlanta University Center
Atlanta, GA 30310

Dr. Lycurgus Muldrow was not interested in higher education until he took biology in high school. "At first I did average work," he recalls, "then I jumped to straight A's as the fascination took hold. By the time I started college at North Carolina Central University in Durham, there was no question about what I wanted to do with my life."

Muldrow feels sure that he would have gone into teaching or clinical work were it not for the exposure to research he had in the summers of his junior and senior years. As part of the National Institutes of Health's Minority Biomedical Research Support program, he worked at Oak Ridge National Laboratory in Oak Ridge, Tennessee. "I participated in original research on the structure of nucleosomes and the effects of co-carcinogens on mammalian cells," he explains. "This really gave me an idea of what research is about and set my course for graduate school."

As a doctoral candidate at the University of Tennessee at Knoxville, Muldrow returned to Oak Ridge National Laboratory to do research on the molecular biology of pathogenic free-living amoebas. After earning his Ph.D. degree, he did postdoctoral work at Morehouse College and the Atlanta University Center. Here, Muldrow worked on a bacterium *(Clostridium difficile)* that causes a severe form of diarrhea. When he joined the faculty of Spelman College, he applied for an MRI grant to continue this research.

"The MRI award was my first major grant, and it allowed me to set up my own research program," he comments. "Once I got started, I was able to obtain several more grants totaling more than $1 million." These included support from the U.S. Army for development of a vaccine against *C. difficile*. The additional funds have enabled him to develop a new technology for production of vaccines. "Development of methods to produce vaccines can be as important as development of the vaccines themselves," he comments.

"My experience demonstrates the value of programs that bring minorities into the mainstream of science," says Dr. Muldrow, now a senior research scientist at the Clark Atlanta University Center. "Were it not for such programs, many good people would be lost to science for extra years or forever. It is vital to continue this kind of commitment to bring minorities to an equal plane. What has been done should be regarded as the beginning, not the end."

Sandra A. Murray
Ph.D., University of Iowa
Department of Neurobiology
University of Pittsburgh
Pittsburgh, PA 15261

Dr. Sandra Murray became interested in biology when she broke a clavicle in elementary school and began to read about anatomy and how the body functions. During her high school years, Murray participated in science classes at the University of Chicago and worked as a laboratory aid in histology at the University of Illinois School of Medicine. "I was exposed to many different aspects of biomedical research and at that point decided research was for me."

Murray majored in biology and minored in chemistry at the University of Illinois Chicago campus while supporting herself by continuing to work in a histology laboratory at the medical school. After receiving her bachelors degree, she moved to Texas Southern University in Houston, where she earned a master's degree while working as a teaching assistant. She earned her Ph.D. degree in anatomy from the University of Iowa school of Medicine in 1980 supported in part by a Ford Foundation Fellowship. She completed Post-doctoral research in endocrinology at the University of California at Riverside and later joined the faculty in the department of Anatomy and Cell Biology at the University of Pittsburgh School of Medicine.

At Pittsburgh, Murray has continued her work in cellular endocrinology particularly focusing on how hormones change cellular responses. She was awarded an MRI grant to study a specific enzyme that is activated when hormones bind to the cell surface. "The award provided support for my research and allowed me to make contributions to the growing knowledge of hormone action," she notes. "I was able to further my own ideas, and to learn from and participate in scientific meetings." Her work led to her promotion with tenure to associate professor of Neurobiology Anatomy and Cell Science at the University of Pittsburgh. Murray also teaches gross anatomy to medical students and has been named the Director of the course.

Dr. Murray is optimistic about the future for minorities in science and engineering. "Minority scientists are desperately needed in order to contribute to research on crucial scientific issues and in the rapidly expanding technologies," she states.

"There is a large reservoir of talented minority individuals that with proper training and opportunities will make a substantial contribution to the advancement of science. We must find a way to harvest these talents or we stand to lose a generation of talented thinkers who are capable of providing a fresh perspective on issues that science and engineering continually raise."

Curtis L. Parker
Ph.D., University of Tennessee at Knoxville
Department of Anatomy
Morehouse School of Medicine
Atlanta, GA 30311

Dr. Curtis Parker was always interested in science, but never thought about getting a Ph.D. until he watched research scientists at work. "After finishing undergraduate studies at Knoxville College, I took a job as a research technician at Oak Ridge National Laboratory," Parker remembers. "I had attended small segregated schools and did not have much opportunity to do science. When I watched these bright, young post-docs doing all that beautiful science, a whole new world opened up to me. I also learned about opportunities that were becoming available to minorities by then (late 1960s). The combination stimulated me to go to graduate school."

After earning his Ph.D. in zoology from the University of Tennessee at Knoxville in 1973, Parker went to Bowman-Gray School of Medicine at Wake Forest University in North Carolina. While there, he began research on limb development, differentiation, and regeneration. He then moved to Atlanta University and received an MRI grant to continue this research. Specifically, he developed a method to make chick embyro cells differentiate in culture the way they do when they form muscle and cartilage in a living animal.

"The MRI award enabled me to get started at a new university, to continue promising research, and to support graduate students," he comments. "I had the flexibility to spend the money as it was needed rather than in a certain fixed period of time. Three of my graduate students got Ph.D.s and one a master's as a direct or indirect result of the grant."

Dr. Parker is now professor of anatomy at the Morehouse School of Medicine in Atlanta. He sees "golden opportunities" for minorities if they can take advantage of them." According to some predictions," he notes, "minorities will comprise one-third of the work force by the year 2030. Contrast that with fact that enrollment of black males in graduate schools has slipped markedly, as has their rate of graduation from high school. We need to turn this around in order to keep up with other industrialized nations. To do that, we must identify those with an interest in science and engineering at the high school level or earlier. Then we should stimulate them as I was stimulated: let them see bright, dynamic young researchers at work."

Richard H. Pointer

Ph.D., Brown University

Department of Biochemistry
Howard University
Washington, DC 20059

Dr. Richard Pointer grew up in rural Georgia where his neighborhood elders cured their ailments with herbs and roots. "I always wanted to learn how this was possible," he recalls. "That is basically how I became interested in science." It was difficult to pursue that interest in high school. "The shop teacher could get all the equipment he wanted, but in science we had to provide household cleaners for reagents," Pointer remembers.

Pointer received a special scholarship to attend Morehouse College in Atlanta. After earning a B.S. degree in biochemistry in 1968, he worked as a research technician at Emory University in Atlanta. Wanting to advance himself, Pointer applied to local graduate schools but could not get accepted. He expanded his search to out-of-state schools and was offered a fellowship to Brown University in Providence, Rhode Island. There Pointer earned M.S. and Ph.D. degrees, the latter in biochemistry in 1975. Next came postdoctoral work at Vanderbilt University in Nashville, Tennessee, the Massachusetts General Hospital in Boston, and at Howard Hughes Medical Institute laboratory, also in Boston. In 1980, he accepted a position in the department of biochemistry at Howard University in Washington, D.C. where he now works.

Pointer did his thesis research on the regulation of glycogen metabolism. To continue that work, he applied for and received an MRI grant in 1981. With it, he investigated the regulation of glycogen metabolism in liver cells. "The grant enabled me to get started quickly in this research," he comments. "In fact, I could not have done it without NSF's generous support." Pointer has since received other grants and expanded his work to investigate how hormones regulate other aspects of intermediary metabolism.

Dr. Pointer notes that Howard University has a difficult time recruiting minorities into science and engineering. "I suspect that this is a problem all over the country," he says. "Good opportunities are available in these areas, but there are not enough minorities in the pipeline to take advantage of them."

To help fill the pipeline, he works with students and teachers who participate in science fairs. "We need much more of this kind of effort by many more minority Ph.D.'s," he asserts.

Hubert K. Rucker
Ph.D., Howard University
Department of Physiology
Meharry Medical College
Nashville, TN 37208

At the small school he attended in rural Texas, Dr. Hubert Rucker had one teacher for all science subjects for four years. "Usually, this puts kids interested in science at a disadvantage," he comments. "But Geneva Bailey was a rare combination of good science teacher, motivator, and source of information. I excelled in biology because I liked it, and she reinforced and guided my enthusiasm."

Rucker received a B.S. in biology from Texas Southern University in Houston, then spent the next 17 years working as a medical technologist at Children's Hospital in Washington, D.C. After 10 years there, he began to think about graduate school. "I had lots of ideas about how a clinical laboratory should be run," he recalls. "I wanted to be in a situation where I could test these ideas so I went to Howard University on a part-time basis."

Rucker earned a Ph.D. in physiology in 1984. He followed this with postdoctoral research on Alzheimer's disease at Texas Tech University in Lubbock. There he began studying the normal physiology of the central nervous system as a route to getting a better understanding of diseases of that system. In 1985, he moved to Meharry Medical College in Nashville, Tennessee. Two years later, he received an MRI grant to study the changes in neurotransmitters that occur when the brain learns to identify the source of sounds.

"To get funds as a new faculty member," Rucker notes, "I had to compete as an unknown against those who boasted distinguished track records. After choosing a career in science, it would have been devastating not to have been able to pursue it. The MRI grant enabled me to avoid that fate."

To bring more minorities into science and engineering, Dr. Rucker believes that they need the kind of motivation and guidance that he got from Geneva Bailey. "At Meharry, we run an NSF-funded program that introduces high school students to research in Saturday and summer sessions," he notes. "This lets them see that scientists are not the weird, absent-minded people portrayed by television actors. It provides the experience they need to compare careers in science and engineering with those in athletics, medicine, and other fields with which they are more familiar."

Michael A. Sesma
Ph.D., University of California at Riverside
School of Optometry
University of Missouri at St. Louis
St. Louis, MO 63101

Dr. Michael Sesma cannot remember when he was not interested in science. In kindergarten it was dinosaurs; in elementary school he read everything he could find on archeology. When his younger brother suffered from a brain tumor, the dynamic young physicians who performed the surgery became Sesma's role models. "From that time on, I intended to pursue a career in biomedical science," he recalls.

Sesma went to the University of California at San Diego, where the availability of excellent programs in psychology and neuroscience motivated him to take a double major in psychology and biology. He received a B.A. degree in 1976, then went on to graduate school at the University of California at Riverside. There, his interest centered on the anatomy and physiology of the visual system. "I felt that the research opportunities were greater and I could obtain the most help and attention from faculty members who were doing this kind of research," he says.

Sesma earned his Ph.D. degree in psychology in 1981, then spent four years as a postdoctoral research associate at Vanderbilt University in Nashville, Tennessee. Following that, he moved to a faculty position at the School of Optometry, University of Missouri at St. Louis. From there, he submitted a proposal to NSF to study the organization of neuronal connections in the visual cortex of the tree shrew. "This animal serves as a model for studying the development and organization of the visual and other sensory systems of mammals, particularly primates," Sesma explains.

NSF sent his proposal to the MRI program, and Michael received a grant in 1987. "The award was a validation that my research is scientifically valuable," he comments, "and it gave me funds and freedom to do that research."

Role models helped Dr. Sesma down the path to a career in research, and he sees a lack of role models as a primary factor in limiting the number of minorities who are attracted to science and engineering. Another crucial factor," he asserts, "involves the U.S. educational system that is generally deficient in preparing, directing, and training an adequate number of students for careers in science and technology. This is a problem for both minorities and majorities but it is disproportionately severe for the former. Even where quality education is available, minorities may not have equal access to it."

Mary E. Shepherd
Ph.D., Texas Women's University
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Galveston, TX 77550

Raised by her grandmother and grandfather in Beaumont, Texas, Dr. Mary Shepherd worked after high school classes to help support her family. When she was not busy, she was an avid reader of all types of literature. "I had a supportive, enthusiastic biology teacher who stimulated my interest in science," she recalls, "she prepared me so well that I had little difficulty with the courses at Texas Women's University (in Denton)."

Shepherd worked her way from cleaning petri dishes and animal cages to participating in research projects at Texas Women's. She stayed there until 1975 when she earned a Ph.D. degree in molecular biology. In 1980, Shepherd accepted a position at the Chicago campus of the University of Illinois.

At the University of Illinois, Shepherd received an MRI grant to study the development of the human immune system." Before I got the grant, I had to scrounge supplies, borrow equipment, and divide my time with other duties," she remembers. "I was trying to do good experiments in a chaotic environment with bad equipment. The MRI award changed all that. It gave me a sound base from which to work and to do research that I wanted to do."

"The grant also showed me what I lacked to be the scientist that I wanted to be," she continues. "I wanted to bridge the gap between basic and clinical research." To do this, Shepherd returned to school to earn an M.D. degree. Now a resident in dermatology at the University of Texas Medical Branch in Galveston, her goal is "to gain an academic position where I see patients and do research."

To those minorities who balk at the difficulties of pursuing careers in science and engineering, she says:" If Mary Shepherd from Beaumont can do it, you can do it. They should forget instant reward in favor of being focused on priorities and committed to them." The environment for doing this is kinder that it was when she was in graduate school in the early 1970s. "People are getting comfortable with the idea of black and Hispanic Ph.D.'s," Dr. Shepherd notes.

Dwayne D. Simmons
Ph.D., Harvard University
Department of Biology
Pepperdine University
Malibu, CA 90265

When he was six years old, Dr. Dwayne Simmons 'invented' a process for in-vitro fertilization. He was crushed when he saw the same process on public television. "I was always inventing things," he recalls, "and always discovering that they had already been invented."

Simmons avidly read the biographies of scientists and inventors such as Leonardo da Vinci, Albert Einstein, and Thomas Edison. He went to a private college-preparatory school in Toledo, which he often represented at science fairs. In 1976, he went to the national level of competition with a paper on the response of a unicellular organism to different wavelengths of light.

With advanced courses in science and mathematics behind him and a scholarship in hand, Simmons went off to Pepperdine University in Malibu, California. He studied biology and computers concurrently until biology won his primary interest. "I was fascinated by the human mind acting like a computer, and I wanted to learn how the brain works," he explained.

Simmons received a Ph.D. degree in biomedical sciences from Harvard University in 1986, then returned to an assistant professorship at Pepperdine. From here he applied for an MRI planning grant, followed by a regular research award, to work on the auditory nervous system. Specifically, he studied developmental changes in the neurons of the inner ear. Simmons uncovered the fact that interactions between sensory neurons and their receptors were much more complex than had been previously thought.

"The planning grant released me from teaching for a summer so I could concentrate on research," he comments. "The regular award provided fulltime assistance and allowed me to get to the point of publishing results and presenting them at meetings."

Dr. Simmons feels that "it is critical for minorities to be in science and technology because they provide a diversity that is one of our nation's strengths." He believes that role models are important for accomplishing this, and he tries to be a role model himself. "I give talks at elementary schools and participate in a program that brings high school students into my laboratory on Saturdays," he explains. "My parents, who had only grade school training, emphasized the importance of education. I want to provide young minorities with the same motivation my parents provided for me, and I want to be a role model that channels their interests into science and technology."

Sanya R. Springfield
Ph.D., Howard University
Department of Biology
City College - City University of New York
New York, NY 10031

Dr. Sanya Springfield began training as a dancer at five years of age. In grammar school, she played the violin, bassoon, and clarinet. By high school, she had added science to her interests. "I had two role models who were involved in science—a science teacher and an aunt who was a nurse," she recalls. "I decided that science would be more challenging because creative arts came so easily for me. I knew nothing about careers in basic research, so I assigned myself the life goal of teaching medicine."

Springfield started by earning a B.S. degree in zoology from Howard University in Washington, D.C. in 1974. She then taught at the high school level in Philadelphia for two years. "I knew that if I wanted to teach medicine, I needed a Ph.D., so I returned to Howard," she says. She rotated through the laboratories at Howard to sample different specialty areas. "I chose neurobiology," she relates, "because it was the most challenging." By this time, her life goal had changed from teaching medicine to doing basic research.

After receiving her Ph.D. degree in 1981, Springfield did four years of postdoctoral study at Rutgers University in New Brunswick, New Jersey; following this position, she took a faculty job in the department of biology at City College of the City University of New York in 1986. That same year, she submitted a proposal to the MRI program to study the interaction of neurotransmitters.

"The grant was a tremendous help," she comments. "It made it possible for me to do the research that I wanted to do. I probably would not have received tenure so soon without it. Just as importantly, it allowed me to expose students to research in my laboratory. My life goal now is to increase the number of minorities in basic research. A primary way to do this is to let them see people in successful and creative careers."

Dr. Springfield is optimistic about the future of minorities in science and engineering "as long as programs like the MRI continue to be funded," she says. I see that as assuring the training of new generations of basic researchers." Does she regret abandoning a career in the performing arts? "No," she answers. "When students tell me: 'If it were not for you, I would not know what basic research is about,' that is all the applause I need."

Myrtle Thierry-Palmer

Ph.D., University of Wisconsin

Department of Biochemistry
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In elementary and high school, Dr. Myrtle Thierry-Palmer was a bookworm. She loved reading and literature. She was, however, interested in how the human body works and was fascinated by biographies of Marie Curie and Louis Pasteur. As a result, she decided to study science.

She entered the University of Southwestern Louisiana in Lafayette with the idea of earning a medical degree and then going into research. But she liked chemistry enough to switch her major. In graduate school, she decided on a career in biochemical research. An "orientation toward nutrition" led her to do Ph.D. research on the metabolism of vitamin K.

Thierry-Palmer received her Ph.D. degree from the University of Wisconsin in 1970, but did not do a postdoctoral appointment until 10 years later. In the intervening years, she had three children, two of them twins, and taught biochemistry at an undergraduate, non-research school. "This interruption in my career became a major impediment to obtaining a faculty position" she says. "People expected the 10 years following my Ph.D. degree to be filled with research and published papers." Finally, Thierry-Palmer received a postdoctoral fellowship at the University of North Carolina, where she spent three years, from 1980 to 1983, doing research on vitamin D metabolism.

To continue her career, Thierry-Palmer had to find funds for research. She moved to Morehouse School of Medicine in Atlanta and while there, received her MRI grant to continue research on vitamin D. "The MRI program was the solution to my problem," she comments. "The people there took the interruption into consideration and gave me the opportunity that I needed."

Dr. Thierry-Palmer is an associate professor of biochemistry at Morehouse. She sees a problem in the low number of minorities who graduate in science. "Fortunately, the National Science Foundation is addressing the problem with programs aimed at getting young people interested and involved at the high school level."

Harvey F. Thomas
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Amoco Corporation
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Dr. Harvey Thomas was raised in the slums of East Baltimore in a house with only one book—a Bible. Nevertheless, he started to read at age four. He also became fascinated with science fiction, horror movies, puzzles, and anything mysterious and unknown to him. "I did not focus on science until college," he recalls. Thomas began his undergraduate work at Morgan State University in Baltimore as an art major. "I took a required course in biological science and realized that was what I wanted to do," he says.

Thomas did well enough to be offered several scholarships to medical and graduate schools. But he spent 18 months on active duty with the Navy in Vietnam before selecting Johns Hopkins University in Baltimore. There he took a double major in microbiology and biochemistry and did thesis research on the mutational effects on DNA of chemicals and ionizing radiation.

Following a postdoctoral fellowship at Johns Hopkins and another at the University of Wisconsin in Madison, Thomas went to the University of Kentucky in Lexington. While there, he received an MRI grant to study the genetic toxicology of several chemical substances. "The award came at a time when it was extremely difficult to obtain research support," he comments. "It did a great deal for my career and my self-esteem. In addition, I obtained valuable experience in hiring students and staff and managing a laboratory.

In 1987, Thomas left the University of Kentucky. He received a National Institutes of Health fellowship as a visiting scientist at Michigan State University. While there, he was offered and accepted a position as a toxicologist with Amoco Corporation in Chicago. "In the corporate world, I find that because I am judged primarily by my abilities, I have already begun to achieve success that I did not obtain when I faced the more subjective tenure criteria in academia," he comments.

Dr. Thomas believes that many young minorities are hampered by not being more directed, driven, and disciplined. "Many of them want instant gratification," he asserts, "you can be black and beautiful, yet focused and hardworking."

William E. Thomas
Ph.D., Meharry Medical College
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Growing up in Nashville, Tennessee, Dr. William E. Thomas, also known as Eric, was a "bug catcher." He vividly remembers catching a jar full of bees and rushing home to show them to his mother. "I dropped the jar," he recalls, "and things got very exciting for a few minutes."

The incident did not dampen his interest in biology, which persisted through high school and Tennessee State University. "At an age when many young people are confused about what they want to do, I just chose what I liked the most," he comments. "Before I graduated, I knew that I wanted a career in research and teaching. It seemed like a career that aligned itself with my personality and skills, and which offered intellectual stimulation and flexibility."

At Meharry Medical College in Nashville, where Thomas did his Ph.D. work, he acquired an interest in neurobiology. As a postdoctoral fellow at Harvard Medical School, he began studying the properties of cells in the cerebral cortex of mammals. He developed a tissue culture system to facilitate study of neurons and other cells in the cortex of rats. "I saw this work as a first step in understanding the higher functions of human memory, learning, and emotions," he explains.

When Thomas returned to Meharry as a faculty member, he applied for an MRI grant to continue this research. "The grant came at a crucial time in my career, when I was ready to start developing my independence as a research scientist," he comments. "Without this support, I would not have been able to equip a laboratory, or to pursue what to me is a very appealing way of life."

Dr. Thomas also sees it as a way of life that is lost to many minorities. "Young people are not influenced enough toward science and engineering at the elementary and secondary school levels," he asserts. "This may lock them out of a science or engineering major in college because they have not taken the requisite courses. The situation is reflected in the low number of minorities now in science and engineering, and the even lower number entering graduate programs in these areas. At the same time, the academic world is becoming more receptive to ethnic and cultural diversity. Institutions are looking for minorities to provide such diversity, but fewer minorities are available to provide it."

Vassie C. Ware
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Lehigh University
Bethlehem, PA 18015

Inspirational teachers played a major role in making Dr. Vassie Ware a research biologist. "In junior high school, a talented earth sciences teacher got a number of us interested in science," she recalls. "I was stimulated enough to take chemistry, physics, and biology in high school. I liked biology most, but it was not presented from a dynamic and experimental point of view." Ware decided that she wanted a more people-oriented career and chose psychology as a major when she entered Brown University in Providence, Rhode Island.

Walter Quevedo, the well-known teacher of introductory biology at Brown, changed her mind. "He made the subject so exciting that he even turned on students with little interest in biology," Ware remembers. She combined courses in the quantitative aspects of psychology with those in biology to get the most out of both disciplines. She graduated with a degree in human biology.

Ware attended graduate school at Yale University in New Haven, Connecticut, where she earned a Ph.D. degree in 1981. She then returned to Brown as a postdoctoral associate. Wishing to acquire research skills in molecular biology, she worked on the fine structure and function of ribosomal RNA. That interest stayed with her when she moved to Lehigh University in Bethlehem, Pennsylvania in 1985. She received an MRI grant there to research the role of ribosomal RNA in the synthesis of proteins.

"The award had an enormous impact on my ability to get research done as a new assistant professor," she comments. "Without the grant, it would have been exceedingly difficult to do any work with reasonable consistency. It also gave me confidence that I can compete for funds and progress further in my career."

Dr. Ware works with programs that Lehigh has developed to increase the number of minorities and women in science. She believes that "the best way to do this is to get more scientists 'into the trenches' to let students know what science is about. There seems to be plenty of interest among minorities and women, but they need more information. As scientists, we have the responsibility to provide this information and to encourage minorities and women to enter careers in science. We owe this to society."

Arthur L. Williams
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Clark Atlanta University
Atlanta, GA 30314

As a boy in Sawyerville, Alabama, Dr. Arthur Williams listened to science stories told by his great grandmother. "They were more like myths than real science," he recalls, "and were what could be called folksy science fiction. But she always insisted that the things she talked about were possible."

In junior high school, a teacher named Mary Fields taught Williams what was possible in biology, chemistry, and physics. "She was a strong influence on developing my natural fascination with science and living things," Williams says. "By the tenth grade, I knew that I wanted a career in biology."

He started that career at Alabama State University in Montgomery. The teachers there were impressed by this eager freshman who stayed after classes to work in the laboratory. He became a laboratory assistant, a job he held for four years. A National Institutes of Health predoctoral scholarship paid for graduate work that led to a master's degree from Atlanta University and a Ph.D. from Purdue. His graduate research focused on the behavior and adaption of animals and the genes that make both possible. Back at the University of Kentucky in a faculty position, Williams received an MRI grant to study genetic regulation of the process that releases energy in the cells of E. coli bacteria.

"The MRI grant got me started as an independent researcher," he explains. "Five years after the award, I

was still receiving benefits from it. It led to additional funding from the National Institutes of Health and the Department of Energy. And the equipment I purchased with the funds was still functioning."

When minority students ask him about the outlook for a career in science and engineering, Dr. Williams tells them that student interest does not appear as high as in the past. "However," he adds, "the future can be positive if funding is available to acquaint minorities with the possibilities in high school and to help them get started in research after the Ph.D. or even before then." Williams supports four minority graduate students in his laboratory, and he tells other would-be researchers about the MRI program. But he believes the U.S. should find a way to extend such efforts to lower levels—to all the Mary Fields of the nation.

Donella J. Wilson
Ph.D., Purdue University
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Growing up in Compton, California, Dr. Donella Wilson thought science was dull and scientists were absent-minded. Science fiction, on the other hand, excited her. "I saw every science fiction movie that was made at that time," she recalls. Then a chemistry teacher in high school showed her that science can be as exciting as science fiction. "He brought out a need that I had to know how and why things are the way they are," she says.

Medical school seemed like a natural place to satisfy her curiosity, so after graduation from the University of Redlands in San Bernardino, California, Wilson went to Baylor College of Medicine in Houston, Texas. Here, she discovered that "physicians were not the kind of people that I imagined I wanted to be. Their orientation was more toward business; mine was more toward answering the questions of life."

At Texas Southern University, Wilson met a biologist named John Sessions who convinced her that her burning need to know could be satisfied by doing scientific research. She earned a master's degree in biology with him, then went on to Purdue University and a Ph.D. degree. She followed this with postdoctoral research at Harvard University and then at the Whitehead Institute of the Massachsetts Institute of Technology (MIT).

At MIT, Wilson worked on the question of how genes influence development. When she obtained a faculty position at Meharry Medical College, she applied for an MRI grant to work on normal and abnormal development of red blood cells. "The award gave me the opportunity to start a laboratory and do the research that I wanted to do," she comments. "It also gained me the respect and acceptance of my colleagues, something that—as a black woman—I had not always enjoyed."

To gain respect, acceptance for science among minorities involves more exposure to successful role models and to research, she feels. "Opportunities exist for minorities in science if they are interested," Dr. Wilson asserts. "To find out who is interested, we need more programs that allow us to bring high school students and undergraduates into research laboratories.This lets them see that science is not dull and scientists are not absent-minded nerds."

Harold J. Wilson
Ph.D., University of Arizona at Tucson
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University of Alabama at Huntsville
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As the dean of the College of Science at the University of Alabama in Huntsville, Dr. Harold Wilson spends some of the college's resources on minorities at the middle, junior high and high school levels. "We have adopted a high school and I send doctoral students there and elsewhere to teach science and tell kids about careers in science," he says. Wilson knows how important good role models and teachers are. "Exciting and dedicated biology and chemistry teachers focused me on science in high school," he recalls.

Alabama A&M University in Huntsville encouraged only one major, so Wilson chose biology and minored in chemistry. He also worked five and six nights a week at the college telephone switchboard to support himself. Wilson decided to travel out of Alabama for the first time to attend graduate school. "Iowa seemed like a safe place for a black student in the early 1960s," he says. "George Washington Carver had been there 100 years earlier." Wilson received his master's degree in cell biology from Iowa State University in 1961. He then worked as assistant director of research at a brain tumor clinic in Cedar Falls, Iowa, but that "did not satisfy my intellectual curiousity," he remarks. Wilson went to the University of Arizona at Tuscon to get a Ph.D. in 1969.

Wilson came to the University of Alabama at Huntsville after doing one year of postdoctoral work in the Netherlands and two additional years at Cornell University. On a sabbatical leave in 1980, he wrote a proposal for an MRI grant to study the movement of molecules and particles, particularly viruses, within plant cells. He received the award which, he states, "gave me a chance to be independent. Until that time all the research I had done was on the grants of other people. The grant gave me the confidence and resources to do the things I wanted to do on my own."

"The future of minorities in science and education," Dr. Wilson maintains, "depends largely on what goes on between the fourth and twelfth grades. That is when you have to start getting kids interested. At the high school level you have to support that interest with information and funds. My dream is to use this formula to bring up a new generation of minorities who know about science and are not afraid to consider it as a career."

Maria Elena Zavala
Ph.D., University of California at Berkeley
Department of Biology
California State University at Northridge
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Dr. Maria Zavala's life has always been entwined with plants. She watched her great grandmother, a curandera, grow a variety of herbs which she used to heal people and to dispel spirits. Her parents were once migrant farm workers in California. "I realized early that without plants we could not live," she says. Now an associate professor of botany at California State University at Northridge, she has devoted her research life to studying the reproduction and development of plants.

Zavala's introduction to science came from stories about plants and animals that her older sister brought home from biology classes. At Pomona College, she was 'excited' by knowledge about the evolution of plants and their migrations in California. A Ford Foundation fellowship enabled her to earn a Ph.D. in botany at the University of California at Berkeley in 19[illegible].

After receiving her doctorate, Zavala worked for the Department of Agriculture and did research at Indiana, Yale, and Michigan State Universities. She became interested in the effects of cold stress on the growth of seedlings and the subsequent impact on plant size and yield. She applied for an MRI grant to work in this area while at Michigan State. She later moved to Northridge. "The award helped me to get an associate professorship, and it won me the support of my colleagues," she says.

Dr. Zavala also works with the Society for the Advancement of Chicanos and Native Americans in Science to get minority students interested in science and engineering. "We hold two and one-half day annual meetings to which we invite 250-350 undergraduate and graduate students," she explains. "They learn about careers available to them, and how to overcome real and perceived barriers to those careers. We pay their expenses."

"I also participate in a less formal mentoring program wherein undergraduates at Northridge can come into our laboratories just to talk. These programs, and those like the NSF-funded workshops on culturally relevant science for minority teachers, are helping to attract good students. We need more [illegible] efforts."

Daniel L. Akins
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Department of Chemistry
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Growing up in Miami, Florida, Dr. Daniel Akins had the kind of supportive teachers that made learning science challenging and enjoyable. "They provided students with positive reinforcement and pushed us to learn as much science as we wanted," he recalls. When mixed with his innate curiosity about how everything works, this made a potent combination. "I participated in science fairs, took physics and chemistry in the eleventh grade, and attended an advanced mathematics course that was sponsored by the University of Miami," he says. The combination was further strengthened by parents who put discipline and hard work over instant gratification.

It all paid off with a scholarship to Howard University where Akins majored in chemistry and minored in physics and mathematics. From there, he went to the University of California at Berkeley where he earned a Ph.D. degree in chemistry in 1968. He did postdoctoral work at the Institute for Molecular Biophysics at Florida State University in Tallahassee. Next came an assistant professorship at the University of South Florida in Tampa and from there a position as director of the Chemistry Dynamics Program at the National Science Foundation. After that, Akins worked for Polaroid Corporation in Massachusetts. "I enjoyed that job," he says, "but I decided the freedom to do research that is important to me outweighed the financial incentives of industry."

From Polaroid, Akins brought his interest in dyes that sensitize films to various colors of light to City College of the City University of New York (CUNY). In 1982, he received an MRI grant to probe the dynamics of such dyes on semiconductors. Since that time, Akins has become director of the NSF-funded Center of Excellence for Analysis of Structures and Interfaces at City College. "The MRI award enabled me to establish myself at a new university and it started my career as an independent researcher," he comments.

Dr. Akins sees "enormous opportunities" for minorities in filling the future human resource needs of science and engineering. However, he cautions, "we must teach youngsters, as my parents taught me, that success takes hard work and commitment. You cannot emphasize immediate gratification. If students invest their efforts early, they can receive long-term dividends in scholarships, research support, and an enormously rewarding lifestyle."

Maria A. Aponte
Ph.D., University of Florida
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University of Puerto Rico at Mayaguez
Mayaquez, PR 00709

As a young girl, the objectivity of science appealed to Dr. Maria Aponte. In high school, she liked the clear explanations of the world that she heard in physics, biology and, particularly, chemistry classes. She joined the chemistry club, which set a goal of competing in the annual chemistry examination in Puerto Rico. "It meant a year of study in addition to school," she recalls, "but it was not hard because I liked it. I took the test in my junior year and won an award for the highest marks. That made me very enthusiastic about chemistry."

However, when Aponte enrolled in the University of Puerto Rico at Mayaguez her parents wanted her to go into medicine. She started a major in medical technology but quickly switched to chemistry because "I liked it more than anything and I was good at it," she says. "I told my parents that chemists can find out what makes people sick, and I still could go into medicine later."

Aponte earned the highest grades in the chemistry department and that motivated her to go on to graduate school. She received her Ph.D. degree from the University of Florida in Gainesville in 1982. "Opportunities and salaries were better in the U.S. than in Puerto Rico," Aponte notes, "but I decided to go back home and do what I could to help develop the Island." She returned to Mayaguez to teach and continue her Ph.D. research on the synthesis and characterization of polymers with nucleic acid bases. She received an MRI grant for that purpose in 1985.

"I felt honored to receive the award, and it gave me an initial push into independent research," she comments. "It did everything for me that it was supposed to do." Aponte spends time each summer at the University of South Florida in Tampa. Here she collaborates with another MRI grantee, Luis Humberto Garcia-Rubio, on the characterization of polymers.

"The number of Hispanics receiving Ph.D.s has been increasing," Dr. Aponte notes, "and the outlook for those in science is improving. In Puerto Rico, one reason is NSF's Experimental Program to Stimulate Competitive Research (EPSCoR), which has the goal of getting more research into universities that are primarily teaching institutions. As this happens, there will be more incentives for Hispanics in Puerto Rico and other minorities to go into science and engineering careers."

Henry H. Ballard
Ph.D., Texas Christian University
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Prairie View A&M University
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Dr. Henry Ballard was always more interested in why things did not work than why they did. Instead of getting frustrated when something did not work, he got excited and labored on it until it was fixed. Ballard loved to do this with mathematical problems. "From the fifth grade on, I was always one of the best mathematics students," he recalls.

Ballard grew up in Waco, Texas and won a scholarship to Texas College in Tyler. There his preoccupation with mathematics was sidetracked when he did a research project in his sophomore year. "I worked on nucleic acid chemistry," he remembers. "And I became fascinated with the problems of organic synthesis and elucidation of chemical structures."

After earning a B.S. degree in chemistry in 1965, Ballard worked for 15 years as a researcher in industry and as a teacher at the high school and college levels. During this time, "I always wanted to go to graduate school," he admits. "There was a special problem in the back of my mind that I wanted to solve. He finally enrolled at Texas Christian University in Ft. Worth, and he earned his Ph.D. degree in 1980. He then went on to a faculty position, first at the University of Arkansas, then at Prairie View A&M University in Texas.

Once back in Texas, he applied for an MRI grant to work on that problem in the back of his mind. After receiving the grant, Ballard began investigating a specific reactive intermediate in aromatic diazonium salts. The intermediate that he finally isolated was not the one that chemists expected, and it has potential as a precursor to anti-tumor drugs. "The MRI award allowed me to solve a problem that I wanted to work on rather than problems that others wanted me to solve," he comments. "Just as importantly, it enabled me to give graduate and undergraduate students the opportunity to do research in my laboratory. Several of them have entered major Ph.D. programs."

Dr. Ballard feels that exposure to research, such as he had and gives, is vital to attracting more minorities into science and engineering. "Minority and majority students need a sound background in mathematics and science before they finish high school," he asserts. "Those who have the interest should be allowed to do some type of research by their sophomore year in college."

Nestor M. Carballeira
Ph.D., University of Wurzburg (West Germany)
Department of Chemistry
University of Puerto Rico at Rio Piedras
Rio Piedras, PR 00931

When he was growing up in Puerto Rico, Dr. Nestor Carballeira's mother kept hinting that he should be a physician. "It is pretty common for working-class parents, who want the best for their kids, to tell the youngsters to be doctors or lawyers," he comments. "My mother and father did not push me hard in this direction, but I had friends whose parents did. Neither the kids nor their parents knew anything about science or what scientists do."

So Carballeira went to the University of Puerto Rico at Rio Piedras to study medicine. "I had very stimulating teachers in my chemistry courses," he recalls. "I decided that I would enjoy it more than medicine, so I switched majors." Being a good student, he won scholarships and fellowships that took him through a master's degree at the University of Puerto Rico; a Ph.D. in physical organic chemistry at the University of Wurzburg in West Germany, and postdoctoral work at Stanford University.

At Stanford, Carballeira became interested in natural chemicals produced by marine organisms, which have potential as drugs, pesticides, and other useful products. "I decided to set up a laboratory at the University of Puerto Rico to look for promising compounds in Caribbean animals and plants," he says. No funds were available for this from the university, but he obtained an MRI grant.

"The grant gave us the start that we needed," he comments. "When we have preliminary results, we can apply for other grants from NSF and elsewhere."

Whenever he has an opportunity, Dr. Carballeira talks to high school students about careers in science. "There is a sore need for more of this type of orientation," he asserts. "Young people should have contact with scientists to learn what scientists do and what is available to them at local universities. Once in college, good students should have the financial aid they need to finish. Finally, and this is very important, they need good professors to stimulate and motivate them."

Harvest L. Collier
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Growing up in Starkville, Mississippi, Dr. Harvest Collier liked the challenge of understanding how things in nature function. Reading science literature and taking science courses, particularly chemistry, is basic to discovering how changes in nature occur and a natural thing for me to do."

Collier's parents could not afford to send him away to college so he attended Mississippi State University in Starkville. "I started there in 1968, during the time when civil rights and the Vietnam crisis were uppermost on everyone's mind," he remembers. "It was a confusing yet stimulating time: everyone wanted beneficial changes for themselves. Partly because of these attitudes, I made an early decision to pursue graduate studies."

He stayed at Mississippi State to earn a master's degree and then received a Ph.D. from there in 1977. Afterwards, he went to work for the Dow Chemical Company as a senior research chemist in Midland, Michigan. Part of his activities at Dow involved contacting universities to learn about ongoing research in academics that might be of interest to Dow. On one occasion of this activity, he was offered a position at the University of Missouri at Rolla. "I considered the offer for about two years," Collier recalls. "I realized that the academic environment would offer greater opportunities to pursue chemical research and allow me to continue to develop my talents. I decided that, if there was a time to begin making significant contributions in an area of chemical research, now was the time."

At the University of Missouri, Collier received an MRI grant to work on the synthesis and characterization of macrocyclic transition metal complexes. This study involves compounds that can potentially serve as models for specific metal ion chelation, catalysts and biological metal-center active site species. "The award provided the opportunity I needed to organize a laboratory and to begin my academic research," he says. "It represented a real beginning for me after being limited to what was possible on the small budget that was allowed by the university."

Such support is critical for assisting minorities to participate in academic careers in science and engineering, Dr. Collier believes. "But to take full advantage of such programs we must change deeply rooted attitudes among minorities and majorities that science and engineering are viable careers for minorities to pursue. I constantly remind people that because of the current emphasis on science and engineering education in this country, opportunities may now exist to make strides in these areas that have never been made before. I hope that the realization of this fact will challenge more minorities to participate in these career areas and contribute to helping this country maintain its strong technological competence."

Fernando A. Diaz
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Universidad Metropolitana
Rio Piedras, PR 00928

Dr. Fernando Diaz retired as a professor of physics when, with the help of an MRI grant, he began a new career-doing research in chemistry. "Universidad Metropolitana (Metropolitan University in Puerto Rico) never had a research program until Lawrence Berkeley Laboratory (LBL) in California proposed a collaboration to study atmospheric pollutants that reach the island," he explains. "I was interested in the research, so I decided to try a second career. I think of this as a natural extension of my life as a teacher."

In high school and college, however, Diaz thought that he would become a physician. "I probably would be rich by now if I had followed my original plan," he muses. "But when Diaz took physics at the University of Puerto Rico at Rio Piedras, I thought it was so wonderful that I had to switch my career plan." Diaz graduated from the university and stayed there to teach. During his sabbaticals, he earned master's and Ph.D. degrees in

physics and solid state science from Pennsylvania State University. Fernando had entered college at an early age, and became eligible to retire in 1983 when he was 49 years old.

Diaz now collects and analyzes contaminants that reach the east coast of Puerto Rico in clouds and in the trade winds that blow from Africa. "We are interested in how pollutants are trapped in clouds and in the chemical transformations that they undergo during transport and return to earth," he says. "The MRI grant provided the support needed for us to set up a laboratory so the university could work with LBL. It was the first serious research done at Universidad Metropolitana. For me personally, the award recognized that I could meet the challenge. I am very proud of that."

Dr. Diaz sees many bright students in Puerto Rico making the same choice that he once made—to go into medicine. "They want a prestigious career that pays well," he comments. "Scientists need to advise these and other students about the challenge, fun, and beauty of doing science. We need to provide role models that they can compare to physicians. We want them to think: 'if he can do it, I can do it; if he can be happy doing science, I can be happy doing science.' This is our challenge."

Harold S. Freeman
Ph.D., North Carolina State University
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Dr. Harold Freeman's mother bought him a chemistry set when he was in the sixth grade. "I was fascinated by the disappearing ink experiment," he remembers. That fascination was prophetic. Freeman now does research on photochemical and thermal reactions that contribute to the fading of dyes. He is a professor at the College of Textiles at North Carolina State University at Raleigh, where he was raised.

The chemistry set motivated him to take chemistry courses in high school. "I had an excellent teacher who stimulated me and many others to go on to careers in chemistry," he recalls.

His career started with a bachelor's degree from North Carolina A&T University in Greensboro. After graduation, he took a job as a medicinal chemist at a pharmaceutical company. For the next seven years, Freeman spent his non-working hours, weekends, and holidays on part-time graduate work, earning both master's and Ph.D. degrees from North Carolina State.

He took a minor in textile chemistry because it offered courses in polymer chemistry, one of his interests. After receiving his Ph.D. degree, the head of the textile chemistry department, nearing retirement, hired Freeman to replace him. The associate dean for research at the university brought the MRI program to his attention, and he received a grant in 1986.

"The MRI support allowed me to do the research of most interest to me, and it led to promotion and tenure," he comments. "I came to appreciate my own ability to be competitive in a highly competitive system. I feel confident that the work I have done and the papers I have published will lead to mainstream support."

"In theory, opportunities are there for minorities to do what I did," Freeman notes. "But I am unsure of the level of interest now since there seems to be much less commitment on the part of the Federal government and industry to attract, encourage, and promote minorities." Dr. Freeman is doing what he can as an individual. As part of an NSF-funded program, he brings about 40 minority junior high and high school students into his laboratory for five weeks each summer. "Giving them hands-on experience doing research will, hopefully, encourage and motivate them to enter careers in science and engineering."

Andrew Goudy
Ph.D., University of Pittsburgh
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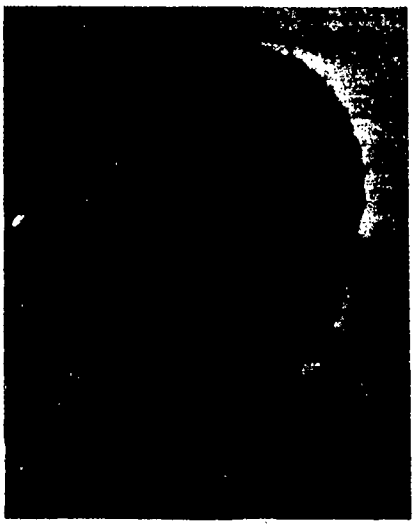
Dr. Andrew Goudy, the son of a coal miner, grew up with seven brothers and sisters near Pittsburgh. "We were poor, but we did not know it at the time," he remarks. "We were no worse off than anyone else in the neighborhood." Goudy had not thought about science until his sophomore year in high school when he took chemistry and biology. "I li[illegible]he logic of science," he recalls, "and I had a dynamic chemistry teacher." In his senior year, Goudy decided that he would become a chemistry teacher.

He graduated from Indiana University of Pennsylvania (IUP) in 1967, then spent the next four years as a high school chemistry teacher. "It was a good experience," he remembers, "But I also wanted to do research so I returned to IUP to get a master's degree. Goudy followed this up by earning a Ph.D. degree in chemistry from the University of Pittsburgh in 1976. The following year, he obtained a faculty post at West Chester University, a small school near Philadelphia.

At the University of Pittsburgh, Goudy had become interested in metal hydrides. He saw them as a practical way to store hydrogen when it is used as a fuel for vehicles or electric power generation. A small grant from the Petroleum Research Fund enabled him to begin research in this area at West Chester. Convinced of the potential of metal hydrides for future energy needs, Goudy applied for an MRI grant to study how effectively hydrogen can be stored and retrieved from metal alloys. "The



award enabled me to install computer-run equipment in my laboratory and to hire graduate students to help me collect data," he explains. "I did research that I could not have done without that support."

With cutbacks in Federal funding, Dr. Goudy does not see a large increase in minorities going into science and engineering. "Many students that I meet feel that they can do just as well in business, criminal justice, or other fields," he comments. "However, I do not see a big decrease either. Things will stay pretty much as they are until we can provide more information and generate more excitement about science and engineering at the high school level. Once we get them interested, minorities, like majorities, will do what they like to do. When you reach that stage, money is important, but it is secondary to doing what you want to do."

Jose A. Prieto
Ph.D., University of Puerto Rico
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University of Puerto Rico at Rio Piedras
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A small table in the back of a third grade classroom turned Dr. Jose Prieto onto science. "The teacher had prisms, magnets, and all sorts of interesting things on that table," he recalls. "We did experiments such as using a globe and flashlight to study the motions of Earth and the moon." In the seventh grade, another teacher who did wonderful tricks with chemistry enthralled Prieto so much that he decided to become a chemist."

Prieto earned a B.S. degree in chemistry from the University of Puerto Rico at Rio Piedras in 1973, then began work on the island for a chemical company. "I enjoyed the job," he remembers. "But I thought an academic life would be more appealing, so I decided to attend graduate school." He won a National Institutes of Health Minority Access to Research Careers (MARC) fellowship that enabled him to earn a Ph.D. from the University of Puerto Rico in 1981. He did a postdoctoral appointment at the University of California at Berkeley, then returned to a faculty position at the Rio Piedras campus—location of the only Ph.D. program in chemsitry in Puerto Rico.

Prieto's doctoral and postdoctoral research dealt with synthetic organic chemistry. He applied for an MRI grant to develop methodology for synthesizing complex molecules and biologically active compounds from simple organic materials. "The grant, which I received in 1985, allowed me

to establish a laboratory and begin my research," Prieto comments. "It made the difference for my career. I do not know how things would have been without the grant. As it is, I have published papers and have received another non-MRI grant."

Dr. Prieto has trained a number of students at the bachelor's level who have gone on to graduate schools in the U.S. "It is my experience that, if you are a competent minority student in science, it is easy to get help and money to pursue graduate work," he says. "The problem is to get students to a competent stage. This, I believe, is not just a matter of education but of providing guidance and information about options that are available. We need to begin equipping students in high school, not only with intellectual tools, but with the attitudes necessary for success in college and graduate school. One key to doing this is to provide inspiring role models."

Gregory H. Robinson
Ph.D., University of Alabama
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Clemson University
Clemson, SC 29634-1905

Football helped Dr. Gregory Robinson reach his goal of becoming a chemist. "In the 1970's, it was more unusual than it is today to be a good athlete and a good student," he recalls. "In addition to being all-state in football and basketball in high school, I was also an honor student. Science fascinated me; I took every science course available, but fighting the stereotype of a dumb jock provided extra impetus for me to major in chemistry."

Robinson won a four-year scholarship to Jacksonville State University in Alabama. In his senior year, he heard a lecture by Professor Jerry Atwood of the University of Alabama at Tuscaloosa that changed his life. "He talked about coal liquefaction," Robinson remembers. "But it was not the subject that caught my imagination as much as getting, for the first time, a glimpse of science beyond undergraduate textbooks—a glimpse of its broad effects on the world." Robinson talked with Atwood and was invited to visit him at Tuscaloosa. "I never would have gone to graduate school, if it were not for him," he admits.

In Atwood's laboratory, Robinson worked on the chemistry of aluminum. The research gave him the idea for using some of the aluminum compounds developed in Atwood's laboratory for easily separating biologically active and inactive isomers. When Robinson moved to the faculty of Clemson University, he received an MRI grant to do research in this area. Now an assistant professor, he has extended this work to using organoaluminum compounds for making commercially important ceramics.

"The effort to get research funding is like a lot of bright people trying to eat on a small pie," Robinson comments. "It is particularly difficult for new black Ph.D. researchers. The MRI award leveled the playing field, and it put success or failure entirely within my own hands."

NSF's recognition of this problem is, in Dr. Robinson's words, "lighting a few candles instead of cursing the darkness. As the pool of college-age people gets smaller, we must look to sections of the population that are not adequately represented in science and engineering. Bringing minorities into the mainstream is not only the just thing to do, it is necessary to maintain the U.S. standard of living which is directly tied to research and development in science and engineering."

Simon Simms
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Department of Chemistry
City College - City University of New York
New York, NY 10031

Dr. Simon Simms developed a familiarity with mathematics while working at his father's small grocery store in rural Jamaica. "I was always good at mathematics," he recalls. "That gave me self-confidence. I disciplined myself never to quit in mathematics, or in life, until I found a solution to a problem. Mathematics also made science less formidable for me."

In high school, Simms became attracted to chemistry. "Mathematics was familiar, but chemistry dealt with unknowns and mysteries," he says. "I was especially fascinated by the ideas of organic molecules interacting with each other."

Simms supported himself by being a tutor while an undergraduate student in chemistry at City College of the City University of New York. He received a B.S. degree in 1977, then went on to earn a Ph.D. degree in biochemistry from Princeton University in 1983. His thesis research involved purifying a bacterial enzyme and testing compounds to inhibit its activity.

Simms stayed at Princeton to do postdoctoral work on another bacterial enzyme which is involved in chemotaxis. He wanted to continue this research when he moved to a faculty position at City College, where he applied for an MRI grant for that purpose. "I was very gratified to get the award in 1988," he comments. "It made it possible for me to start my own laboratory. "It also gave me confidence that I can do research of high enough quality to be supported by mainstream grants."

As a teacher, Dr. Simms would like to see minority students come to college better prepared. "It is in their best interest to take as many science courses involved with mathematics, especially those that are offered in high school," he maintains. "That is where a career in science and engineering starts. Once minorities reach college, he would like to see more programs that expose them to research. "We administer a program at City College wherein students work in laboratories and receive tuition credit," he notes. "More of this would, I am sure, attract more minorities and majorities into science. In college, students should also be made aware of scholarships and fellowships that can support them in graduate school.

Finally, they should come to appreciate the freedom that Ph.D. researchers have that allows them to pursue research that they believe will have a positive impact on the world."

John S. Trent
Ph.D., Rutgers University
General Electric Plastics
Mount Vernon, IN 47620

Dr. John Trent traces his interest in science to watching television. "In elementary grades, science fiction programs really stimulated my natural curiosity about how things work," he recalls. He was stimulated enough to take physics, chemistry, biology, and mathematics in high school. "I liked mathematics so much that I took extra courses in the summer to be eligible for calculus courses in my senior year," he says.

Trent intended to major in mathematics at Pennsylvania State University, but on registration day he impulsively switched to astronomy. "But astronomy was not what I expected," he remembers, "and it was very difficult to get a job in this field." He then became intrigued with plastics. He enrolled in a new program that was commencing and he became the first student and first graduate in polymer science at Pennsylvania State University.

After receiving a B.S. degree in 1974, Trent worked for two and one-half years for Dow Chemical Company. He decided that he needed more knowledge to do more creative work, so he earned an M.S. degree from Case Western Reserve University in Ohio, followed by his Ph.D. in polymer science from Rutgers University in New Jersey in 1983. While doing thesis research, he discovered a novel staining agent that made it possible to look at polymer blends that could not be seen previously with a transmission electron microscope (TEM). "It was so successful that I decided to make this my niche in life," he says.

Trent then took a faculty post at Pennsylvania State. He immediately applied for an MRI grant to study the structure of polymer blends with a TEM and to correlate these structure with the properties of the blends. "No equipment was available at Pennsylvania State because this was a totally new area," he says. "Also, as a new professor I had to find students. The MRI award made it possible for me to solve both problems."

Dr. Trent now works for General Electric, but he remembers "how amazed I was at Penn State by the lack of preparation of students. It is a problem that can only be solved with knowledgeable and stimulating science teachers at the elementary and high school levels," he maintains. "However, the low salaries are driving many of the best potential teachers to jobs in industry. That is the main reason why I am no longer in academia."

Clifton Woods, III
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Mathematics always came easy to Dr. Clifton Woods. "I was the top student in every mathematics class I took," he recalls. As a sophomore at North Carolina Central University in Durham, he won an award as the outstanding student in mathematics and science. But about that time, Woods decided that: "I did not want to do mathematics for mathematic's sake. I wanted to apply it to something practical. My friends were always talking about how much fun chemistry was, so I started taking chemistry courses." He graduated as a mathematics major but with enough credits in chemistry to follow that subject in graduate school.

Woods earned a master's degree then a Ph.D. degree in chemistry from North Carolina State University in Raleigh. There he meshed his two interests by applying mathematics to analyze the vibrational spectra of inorganic systems. After finishing his Ph.D. degree in 1971, Woods held two temporary faculty positions, before he moved to the University of Tennessee at Knoxville. As an assistant professor at the University of Tennessee, he became fascinated with metal complexes that show anti-tumor activity. During the early 1980s, Woods focused on the interaction of rhodium compounds with biological molecules. In 1983, he received an MRI grant to expand this work into an investigation of rhodium complexes that might be used as catalysts.

"The award was a personal achievement for me," he comments. "Professionally, it allowed me to enter the mainstream of research. Without the grant, I doubt if I still would be in academe, at least at a research-oriented university." He is now an associate professor with tenure at the University of Tennessee.

Dr. Woods thinks that the future looks "bleak" for increasing the participation of minorities in science and engineering. "Minority students are not advised to pursue these careers," he asserts. "From personal experience with young relatives in high school, I know that kids are not being encouraged in this direction by counselors. Instead, they are advised to go into careers such as elementary education. To bring more minorities into science and engineering, high school students must be challenged to reach for the highest goals attainable."

Vaneica Young
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Department of Chemistry
University of Florida
Gainesville, FL 32611

In junior high school, Dr. Vaneica Young begged her parents for a chemistry set. Her father bought the largest one he could find then regretted it when she filled the house with hydrogen sulfide gas. Afterwards, she concentrated more on mathematics. "In the ninth grade, I saved my allowance, bought a slide rule, and taught myself how to use it," she recalls.

In high school, Young decided to become a mathematician. But her chemistry teacher told her to become a pharmacist because she was good at chemistry. She compromised and took a double major at the University of Kansas in Lawrence. "In the process, I found out that I could not handle abstract mathematics to my satisfaction," she admits.

Young received a fellowship to the University of Missouri at Kansas City where she concentrated on analytical chemistry. After earning a Ph.D. degree there in 1976, she spent two years in a postdoctoral appointment at Purdue University in Indiana, then six years on the faculty of Texas A&M University. "I could not get tenure at A&M," she says, "so I moved to the University of Florida in Gainesville in 1984." At Gainesville, Young received an MRI grant to do research aimed at optimizing the responses of sensors used to measure ions in solution.

"The award allowed me to bring two graduate students with me from A&M, both of whom have received Ph.D. degrees," she comments. "I would have done the research without the grant but it would have been done a lot less efficiently. With it, I had more latitude in what I could do. Also, I probably would not have attained tenure without it."

Dr. Young does not believe that there are many minorities, like herself, who have a natural interest in science and can make it to the Ph.D. level without guidance or role models. "To bring significant numbers of minorities into academic science and engineering, we must find ways to get bright young kids excited," she asserts. "The excitement needs to be generated in grade school to build enough enthusiasm for taking science and mathematics courses in high school. I do not know how to do this, but getting more interested and nurturing teachers certainly is one way."

Arturo Bronson
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As a boy, Dr. Arturo Bronson read the biographies of scientists such as Louis Pasteur and Alfred Noble. In the eighth and ninth grades, he spent many nights in a chemistry laboratory in his basement. In high school, his interests centered on chemistry and mathematics. His chemistry teacher advised him that a career in metallurgy would involved both passions. Bronson looked into metallurgy and decided that the teacher was right.

He applied for a scholarship and acceptance into the department of metallurgical engineering at the University of Texas at El Paso (UTEP). He received the latter but lost the former to a classmate. He worked part-time while earning a bachelor's degree and as a research assistant to acquire a master's degree at UTEP. Bronson then went on to obtain his Ph.D. degree in metallurgical engineering from Ohio State University in 1977.

He intended to work in industry but decided to also send his resume to the University of Arizona in Tucson. The department of metallurgical engineering there had a special interest in his specialty—chemical thermodynamics. As a result, Bronson spent six years at Tucson teaching and performing research on high temperature chemical reactions. In 1983, he returned to UTEP because he saw an opportunity to both fill a research void there and to help minority students develop more interest in science and engineering.

Bronson received an MRI grant that allowed him to expand his research into low temperature corrosion of iron-nickel-chromium alloys, a field with application to the corrosion and wear of automobile parts, stainless steels, and tool steels. "The award helped me to develop a track record with NSF," he notes. "It also precipitated a successful proposal to establish a Minority Research Center of Excellence (MRCE) in material science at UTEP. At this Center, undergraduates are introduced to research and interact with the faculty more than they would do otherwise."

"Most students at UTEP work part-time to support themselves and their families," Dr. Bronson continues. "They want to finish school then get a good job. It is difficult to entice them into graduate school; the MRCE helps us to attract them. Enrollment at minority institutions is increasing, and these students will become a larger source of new scientists and engineers in the future. The MRCE and MRI programs are ways to prepare them better for such careers."

Daniel C. Davis
Ph.D., Rensselaer Polytechnic Institute
College of Engineering
Pennsylvania State University
University Park, PA 16802

A junior high school teacher steered Dr. Daniel Davis into engineering, and an MRI award gave him a start in academic research after a number of years as a design engineer and manager in industry.

In the ninth grade, he took a course in mechanical drawing from a teacher who took an interest in him. She was one of the first women to earn a master's degree in civil engineering from the University of Pennsylvania, and Davis was a straight A student. They both moved to the same Philadelphia high school in the same year. For the next three years that Davis was her student, she encouraged him to enter his drawings in various local competitions. That experience led him to a major in engineering at Pennsylvania State University.

After graduation, he lacked funds to go to graduate school full-time, so Davis worked full-time for General Electric (GE) and attended Rensselaer Polytechnic Institute at Troy, New York part-time. He held a number of positions at GE, including supervisor of the creep rupture laboratory. The division in which he worked closed down at about the same time he earned his Ph.D. degree in 1981.

Davis returned to Pennsylvania State as a faculty member. He remained interested in creep and fatigue in metals, but lacked support to do research until he received an MRI award in 1988. He used the funds to study the effects of high temperatures on creep fatigue in stainless steels. "The award set the direction of the rest of my working life," he comments. "I intend to stay in academia and to pursue research for as long as possible."

Dr. Davis feels that he has been fortunate in receiving scholarships for education and the benefits of affirmative action for employment. "Such opportunities are still there," he says. "Engineering is wide open for minorities. However, major improvements are needed at the precollege level to inform minorities early about careers in science and engineering and to prepare them for such careers."

Luis Humberto Garcia-Rubio
Ph.D., McMaster University (Canada)
Department of Chemical Engineering
University of South Florida
Tampa, FL 33620

"Having a role model at home who stimulated a thirst for knowledge was the main incentive for me to follow science," says Dr. Luis Garcia. In his case, it was a grandfather who was a chemist. "I enjoyed science and mathematics," Garcia recalls, "and my grandfather's example helped me to get the most out of these courses."

Born in the United States, Garcia majored in chemical engineering at the National University in Mexico City, where he was raised. Here, he became interested in polymers through a teacher, Cesar Garcia-Franco, who had worked in this field in the U.S. He then went to McMaster University in Hamilton, Ontario, for his master's and Ph.D. degrees. After completing this work, he accepted a position at Xerox Corporation. From there, he moved to a faculty position at the University of South Florida in Tampa. "Coming to the U.S., I was suddenly exposed to the needs and anxieties of minorities in this country," he remembers. "I was hit in a rush with the scientific and social problems that programs like the MRI are meant to alleviate."

When Garcia applied for a regular grant to set-up a polymer analysis laboratory, his application was sent to the MRI. "Receiving such an award made me feel that my ideas and work were competitive," he remarks. The funds enabled him to establish a program in the analysis of complex organic polymers. "For me, it did all the things the grant was designed to do," he says. "For the University of South Florida, it has helped them to continue moving from a teaching-oriented school to one that also has a research component."

Dr. Garcia, now an associate professor of chemical engineering, continues to develop methodology for determining the structure and function of synthetic and biological macromolecules such as plastics and proteins. He chafes at accusations that programs like the MRI give minorities an unfair advantage. "It is as competitive as any other grant process," he asserts. "Minorities are an untapped resource in this country, especially in science and engineering. Highly motivated and eager to succeed, they can reduce the deficit in scientists and engineers predicted for the 1990s. Programs such as the MRI are an investment in that resource. That investment is paying off, not in providing an unfair advantage for minorities, but in providing a fair advantage for the future of the nation."

Sigrid R. McAfee
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Dr. Sigrid McAfee says that she "stumbled" from the ghetto into science with the help of her parents and luck. "I went to a junior high school full of thugs in the South Bronx," she recalls. "None of the students thought much about science or college."

Her attitude began to change when, as a high school senior, she took a course in physics. "For me, physics was fun," she remembers. When I graduated, my parents told me to get out of the house or go to college. I was not ready to get a job, so I got a scholarship and went to Vassar College (Poughkeepsie, N.Y.)." The cultural change was difficult but taking physics and chemistry provided enough motivation to get her through college in 1971.

A simultaneous search for a job or a suitable graduate program yielded a fellowship at the Polytechnic Institute of New York in Brooklyn. She earned a Ph.D. degree in 1976, then took a job at AT&T Bell Laboratories in Murray Hill, N.J. She did work on semiconductors which intrigued her, "but I wanted more research freedom and I wanted to teach," McAfee says. In 1982, she took a position at Rutgers University in New Brunswich, N.J.

The following year, McAfee received an MRI grant to study how impurities effect the performance of aluminum-gallium-arsenide semiconductors. "Bell Labs generously let me take some equipment with me," she says, "but the university had no support to offer. Without the MRI award, I would not have been able to start my research. It was a true beginning that led to regular support of my research."

Dr. McAfee often thinks about her bright friends from the ghetto who never made it. "In those days, it was heroin that got many of them, today it is crack," she laments." Drugs take a toll at all levels, as does the financial burden that many students carry. Today, scholarships are not enough; many students must also work to support their parents. Minorities from the ghettos need more financial support. They also need encouragement at an early age; the first grade is not too early. I would never have made it without strict parents, but lots of bright kids do not have those kind of parents."

Carolyn W. Meyers
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Dr. Carolyn Meyers had no idea that engineering existed until she was a senior in high school. In 1963, she participated in a summer science institute sponsored by NSF and the National Aeronautics and Space Administration at, what was then, the manned spaceflight center in Langley, Virginia. "I had a chance to watch the original seven astronauts in training and received my first exposure to engineering," she remembers. "In school, I loved the problem-solving part of mathematics but not the theory part. I discovered that I could make a career out of the fun part by becoming an engineer."

Meyers received a scholarship to Howard Univer ty, at that time the only black university accredited in engineering. After graduation, she married then had three children. She considered this a break in her career not the end of it. However, when she tried to return to graduate school after a 10-year break, Meyers ran into a problem. It was exemplified by the advisor who suggested that she "go home, have more babies, and forget about graduate school." "I was discouraged, she admits, "but I kept going until I found someone who told me what I wanted to hear."

That someone was at the Georgia Institute of Technology. Through her Ph.D. work there, Meyers developed an interest in the relationship between microstructure and the properties of materials. After she joined the faculty at Georgia Tech, she received an MRI grant to study the effects on crack propagation of grain structure in metal castings.

"The award gave me confidence that my work is important and timely," she comments. "Professionally, it gave me credibility among my peers and started me on the track to promotion and tenure." Now an associate professor with tenure, Meyers also received a Presidential Young Investigator award.

"For me," Dr. Meyers notes, "every award has two sides. People say that you got the prize because you are black and a women and not because you have intelligence, drive and ability. On the other hand, because of such awards and the low numbers of minorities in engineering and science, the professional outlook is excellent. However, we need aggressive recruiting to take advantage of the opportunities. Such an effort should involve funding on a national level and should reach into junior high schools. It should be equivalent to the response of the Federal government after the Soviets launched Sputnik."

Gregory V. Selby
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Dr. Gregory Selby went to a segregated rural high school in eastern Virginia. His greatest satisfaction was to defeat kids from the larger city schools in district-wide mathematics competitions.

Selby's performance in these competitions and his high grades convinced him that he had the potential to achieve in mathematics and science. He listened closely when representatives from the National Aeronautics and Space Administration (NASA) came to his school to talk about careers in engineering. "It really hit home," he recalls, "when I found out that an engineer's starting salary exceeded what my mother made after 30 years of teaching public school."

In the summer of his senior year, Selby obtained a job as an engineering aide at NASA's Wallops Flight Center, near his home. "That experience cemented in my mind the choice of engineering as a career," he says.

In 1966, Selby began undergraduate studies at the University of Virginia. It was a struggle. "Coming from a rural area, I did not have an adequate background in science and mathematics," he admits. A congenital lung problem forced him to drop out during his freshman year. When he recovered from surgery, Selby spent a year working for NASA again. "That year gave me the experience I needed to keep up in school," he relates.

After graduation, he worked 11 years for NASA while earning his master's and Ph.D degrees at the University of Delaware. He obtained a faculty position at Old Dominion University in Norfolk, Virginia, in 1983. From there, he applied for and received an MRI award to study airflow and drag in conjunction with the design of new types of aircraft wings. "Receiving the grant was crucial because it was so difficult to compete for funds with professors who had been doing research for many years," he notes.

"The award also gave me funds to hire a few minority students, and the time to participate in NSF and Old Dominion programs that help such students." Dr. Selby believes that a demand exists for minorities in engineering and science, but he is concerned about how to fill that demand. "Parents, teachers, and counselors must cooperate to expose elementary and middle school students to role models and to convince them that they can be successful in these areas," Selby maintains. "There is a big challenge here, and we must meet that challenge to be successful in the 21st century."

Mark J.T. Smith
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At four years of age, Dr. Mark Smith announced that he wanted to be a scientist. At age eight, he decided to go to the Massachusetts Institute of Technology (MIT). "My parents instilled in me the idea of aiming for the best, and they told me that MIT was the best," he recalls.

Smith got off to an explosive start with an electronics and chemistry laboratory in the basement of his Jamaica, New York home. "I discovered the effects of igniting magnesium powder," he remembers.

He took every course in science and mathematics offered in high school and he was accepted by MIT. While there, demonstrations of research on speech processing got him interested in this field. At the Georgia Institute of Technology, his doctoral thesis involved work on speech compression and modification techniques.

Smith joined the Georgia Tech faculty after receiving his Ph.D. degree. "Life for the next few years was kind of miserable," he admits, "as I struggled with a heavy teaching load and tried to obtain research funding." He learned how to write a proposal with help from his colleagues and received an MRI grant in 1986. "The award gave me peace of mind," he comments. "I was able to work on projects that were extensions of my thesis research. In addition, I had the time to expand my knowledge into other fields such as image processing."

Now an associate professor of electrical engineering at Georgia Tech, Smith wants to develop a way to transmit video signals over telephone lines. He also works on "a structure

for helping large numbers of minority and majority students who want to go into engineering and science." He will start by coaching a small number of students in networking and study skills. "If this improves their performance, we will expand the structure," he explains. Eventually, Mark sees learning organized around groups of five students led by a graduate student "who will tune them into the network and help them obtain the resources for proper study."

Dr. Smith believes that any such system should be combined with an effort "to change general perceptions about engineering in minority communities. We need to make careers in science and engineering as fashionable as those in business and medicine," he asserts. "Minorities should start learning about science and technology in elementary school. That is one way to fill the increased demand for scientists and engineers forecast for the 1990s."

Michael Spencer
Ph.D., Cornell University
Department of Electrical Engineering
Howard University
Washington, DC 20059

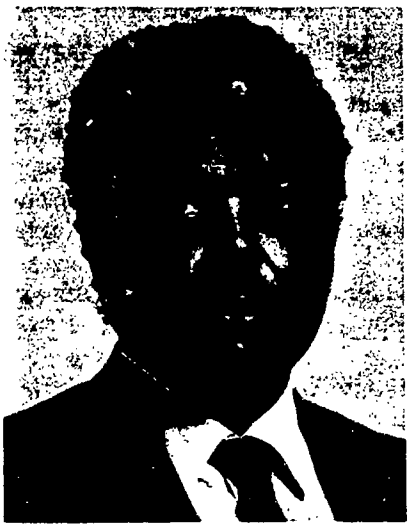
A chemistry teacher in high school "promoted a strong love of science in me," recalls Dr. Michael Spencer. The teacher helped him to focus a fascination with electronics on a science fair project. With the additional help of a graduate student from Howard University, he developed a project in ultrasonics. He did not win in the fair, but the experience motivated him to go eventually to Cornell University with the idea of becoming an electrical engineer.

"My parents are strong proponents of education," Spencer notes, "my mother earned a law degree at night. However, they were somewhat surprised when I chose engineering. Even at Cornell, the black community viewed it as an unusual profession for blacks." Not withstanding this, Spencer earned all three of his degrees at Cornell. In the process, his interest shifted to electronic materials, first solar cells then semiconductors.

Spencer went from Cornell to Howard University, where he now is an associate professor of electrical engineering. He continued his research on materials with an MRI award in 1981, which allowed him to build a chemical vapor deposition system and study the behavior of gallium arsenide semiconductors.

"The MRI grant came at a critical time," he says. "As a new Ph.D., I had to struggle to get research funds. This was especially true at a small school which lacked in-house expertise in my special research interest. The MRI grant enabled me to overcome these difficulties and to get a strong research program going."

Dr. Spencer also received a Presidential Young Investigator award in 1985, and is now the Director of an NSF-funded Materials Science Research Center of Excellence at Howard. He cites such support as the positive side of the future for minorities in science and engineering. The negative side," he believes, "involves a lack of mentors on the graduate level and enough financial support for minority undergraduates. Graduate education is more personal than undergraduate, so minorities at this level need more one-to-one interaction with successful mentors. Undergraduates at the top of their classes have little trouble getting money, but we also need to support minorities who are good but not necessarily exceptional."



William R. Brooks
Ph.D., Florida State University
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Growing up in Kansas, Dr. William Brooks was captivated by the television adventures of Jacques Cousteau. During his junior year at Southwestern College in Winfield, Brooks went on a biology field trip to Florida. "It was 45 degrees F. in Key West," he recalls, "but that did not deter me from snorkeling every chance I got. Before the trip was over, I knew that I wanted to be a marine biologist."

Brooks immediately began applying to schools with graduate programs in marine biology. He was accepted at Florida State University (FSU) in Tallahassee. A program for minorities known as the Graduate Professional Opportunities Program paid for his first three years of graduate school. He earned a master's degree, then became the first black to get a Ph.D. degree in marine biology at FSU. His Ph.D. research probed the relationshipbetween hermit crabs and sea anemones. The crabs live in discarded snail shells on which they place anemones, whose stinging tentacles protect them from predators.

From FSU, Brooks went to Auburn University in Alabama, then to Florida Atlantic University in Boca Raton. While there, he received an MRI grant to continue work on the hermit crab-anemone partnership. "The MRI award was a blessing," he remarks. "I could not have done the research on the budget of my department. I was able to publish and present papers, and I was invited to sit on an NSF grant-review panel. In short, it gave me the encouragement and know-how to keep going in research."

Dr. Brooks sees himself as a role model for both minorities and majorities. "I need to show them both that minorities should not be stereotyped into certain careers—that we can be scientists and excel as scientists," he asserts. "I am convinced that there are many minorities qualified for science and engineering. But many of the best students are pressured to go into medicine and other high-paying professions. Those who follow their hearts into science, as I did, must show other minorities that they can do the same and succeed at it."

Juan Homero Hinojosa
Ph.D., Johns Hopkins University
Department of Geological Sciences
University of Texas at El Paso
El Paso, TX 79968

During his high school years in Eagle Pass, Texas, Dr. Juan Hinojosa made a living playing in a Tex-Mex band. "I earned decent money and had no serious thought about going to college," he recalls. "Then a telephone call came from a recruiter of minorities at Brown University, and he offered me a scholarship. My parents never finished grade school but they urged me to take advantage of the offer."

When Hinojosa arrived in Providence, Rhode Island, his educational goals were unfocused. He liked and took courses in physics, geology, and astronomy. "Geophysics was the subject that fit most naturally with the curiosity about the world around me that I had since grade school," he remembers. Following his bachelor's degree, Hinojosa wanted to "keep learning." He went on to earn the master's and Ph.D. degrees from Johns Hopkins University. The Ph.D. degree was awarded in 1986, after which he became an assistant professor at the University of Texas at El Paso (UTEP).

Hinojosa's doctoral research involved the use of satellite data on gravity anomalies to study convection currents deep within the Earth. At UTEP, he applied for and received an MRI grant to "continue this unfinished business." Specifically, he constructed computer models of gravity anomalies thought to be caused by convection currents, then attempted to match these with satellite measurements of the actual anomalies. "The MRI was my first national grant," he notes. "It was crucial for initiating my research and setting a direction for it. If I did not have this support, I do not know how I could have gotten started."

Dr. Hinojosa thinks that the future for minorities in science and engineering "looks good." "NSF has helped make it this way by supporting minorities in their effort to get into the mainstream of research," he comments. "People who receive such grants can repay them by serving as role models for high school students. They can help to overcome the apathy in many schools. In my hometown, for example, nearly everyone is content to finish high school then go to work. School counselors do not push to get these kids into college. They have no brothers or sisters or relatives in college, so they have no one to show them the way. Those of us who have had MRI funds should go back to our local schools to tell and show students what is possible."

Carlos D. Robles
Ph.D., University of California at Berkeley
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California State University
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As a young boy, walking with his mother along the California shore, Dr. Carlos Robles thought tide pools were more exciting than television. "For me, television could not compete with the beauty of nature or the fascination of an anemone capturing its prey," he says.

The tidepool scenes returned to his mind when Robles was ready for college. "In high school, I did well in science, particularly biology," he recalls. "But I was more interested in music. I had won a music scholarship to the University of Southern California. However, I kept asking myself: 'what else do I enjoy?' Biology and the ocean felt as natural as breathing, so I decided to be a marine biologist."

His teachers warned Robles that jobs were few in this field and that the pay was low. They advised me: 'get out of marine biology unless you are really good at it and love it,'" he remembers. "I felt that way, so I decided to take the risk. I have never regretted that decision."

Robles spent many happy hours in graduate school at the University of California at Berkeley observing and doing experiments in California's rocky intertidal zone.

As his teachers had predicted, jobs were scarce after he finished his Ph.D. degree. Robles, however, managed to get an appointment at the California State University at Los Angeles (CSULA). He then applied for and received an MRI grant which, he says, "helped me and the biology department at CSULA. Once a teaching-oriented university, it was becoming more research-oriented in the early 1980s. The MRI award helped his process along by supporting me, and it opened the door for me to become nationally known in my field." Robles is now a full professor of biology with tenure at CSULA.

The job situation has now changed, according to Dr. Robles. "Many opportunities exist in environmental biology for well-trained people," he notes. To get the right training, he says, he advises minorities to start early. In addition, parents, teachers, and mentors need to encourage those with interests in nature to pursue those interests and not money. We should not hook kids as much on financial rewards as on the meaning and satisfaction of work that they can love."

Henry N. Williams

Ph.D., University of Maryland at Baltimore

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Dr. Henry Williams was not successful as a basketball player, but his coach, who also taught biology, motivated him to be a successful biologist. "A ninth-grade teacher brought science to my attention; the coach focused that attention on biology," Williams recalls. "My parents, both college graduates, expected me to finish college. There were many times when I did not think that was a good idea, but with the prodding of those teachers, I did enroll in North Carolina A&T State University."

Here again, teachers who impressed him steered Williams' interest into physiology and microbiology. After college, he was drafted into the army and assigned to a hospital unit. He volunteered to work in bacteriology. That experience motivated him to go to graduate school. Short of money, he needed to work while going to school. The chairman of the microbiology department of the University of Maryland gave him that opportunity. As part of his doctoral thesis, Williams became intrigued with the behavior of *Bdellovibrio*, a unique bacterium that preys on other bacteria.

Williams became involved with the questions of whether *Bdellovibrio* can be used for the control of harmful bacteria. Although he obtained a faculty position at the University of Maryland, he lacked the funds to pursue this research. "Those were lean years with few graduate students and no support," he remembers. Prior to his position at the University of Maryland, he was a Congressional Science Fellow on Capital Hill with Senator Charles Mathias. Finally, in 1984,

Williams received an MRI award which enabled him to establish a research program. I am now tenured and at the point of gaining national recognition," he says. "That would have been extremely difficult or impossible without the MRI program," he admits.

"The award also freed me to work with and encourage young people in the way that I was encouraged," Dr. Williams continues. He brings promising minority students into his laboratory each summer and works with them at North Carolina A&T, at his church, and in the Baltimore schools. "Every scientist," he asserts, "should take every opportunity—and create opportunities—to make minorities aware of the excitement and satisfaction of science and engineering. Also, the Federal government should provide enough support to prevent talented minority scientists from being abandoned before they have established themselves."

Gerald R. Chachere
Ph.D., University of California at Berkeley
Department of Mathematics
Howard University
Washington, DC 20059

Dr. Gerald Chachere was introduced to science by watching Mr. Wizard on television. "I looked for shops where I could buy electromagnets and other equipment to do experiments like he did," Chachere recalls. "When that turned out to be difficult, I began concentrating on mathematics because only paper and a pencil were needed."

In high school, he checked out every book on mathematics in a nearby library. "I did not understand much," he admits. "But I was fascinated with the symbols. In trying to discover their meaning, I learned a great deal of mathematics." No one told him anything about careers in mathematics until he was a freshman at the University of California at Los Angeles. "When I found out that I could make a living doing mathematics, it was a great feeling," Chachere remembers. "I could do what I liked best and get paid for it."

Chachere earned an M.A. degree from UCLA in 1969, and a Ph.D. degree from the University of California at Berkeley in 1977. He finished his dissertation at Howard University in Washington, D.C., after accepting a faculty position there. He then applied for an MRI grant to work on problems in differential geometry which involve generalizations of surfaces.

However, his research results were not well received by those who reviewed them. "I was very discouraged because I think it is good work," he says. Chachere stayed away from research in this field for a few years, but "now I am going over the same material again," he notes.

Meanwhile, Dr. Chachere earned tenure at Howard, and he does summer research on underwater acoustics at the Naval Research Laboratory in Washington, D.C. He believes that more minorities would choose careers in science and engineering if "counselors and teachers were more aggressive and parents more informed at the junior high and high school levels. All minority students should be encouraged to get into the college-bound lane. They should receive as much help as possible to get and stay there. This should be the case for every student who wants to reach his or her highest potential, not just for those going into science and engineering."

James H. Curry
Ph.D., University of California at Berkeley
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University of Colorado
Boulder, CO 80309-0426

At the age of 12 years, Dr. James Curry found a physics book in the library and thought it was "the most amazing thing I had ever seen." "Of course, I did not understand it," he admits, "but I was fascinated by the mathematical symbols and equations. In high school, I realized that mathematics was a special language that can be used to understand much of the universe. I set a goal for myself to learn calculus and to take the advanced college placement course." Curry received the support of Mary Perry-Smith, a mathematics teacher at Oakland Technical High School in California. "She coached me and convinced me that I could have a good future in mathematics," he says.

Curry went to the University of California at Berkeley for his undergraduate work and stayed there to earn his Ph.D. degree in 1976. In graduate school, he further developed an interest in computers which began when his high school received a donated machine. "It was old and slow, but I thought it was marvelous," he remembers. "And the teachers let me do whatever I wanted with it."

When Curry went to the National Center for Atmospheric Research in Boulder, Colorado on his first postdoctoral fellowship, he arrived a few weeks before a new Cray supercomputer. "It was a wonderful machine, and it steered my research into the computer-assisted study of dynamic systems. After he took a faculty post at the University of Colorado at Boulder, he applied for an MRI grant to use computers to help understand complex systems such as weather, flame propagation, and basic mathematics. "The MRI award gave me an opportunity to integrate myself into the mathematics department, and to develop my own research projects," Curry comments. "It freed me from the arduous task of searching for funds, a tough and time-consuming job for a new professor." Curry is now a professor of mathematics and the associate director of the Program in Applied Mathematics at the University of Colorado at Boulder.

To bring more minorities into science and engineering, Dr. Curry thinks that there must be more Mary Perry-Smiths and programs such as NSF's Research Experiences for Undergraduates. "We have to reach out to junior high and high school students and convince them that they can have an exciting and fulfilling future in science or engineering," he asserts. "They must realize that they can be the Magic Johnson or Walter Payton, not of basketball and football, but of mathematics, physics, biology, or electrical engineering."

Roosevelt Gentry
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Department of Mathematics
Jackson State University
Jackson, MS 39217-0355

Dr. Roosevelt Gentry faced a tough decision in high school —whether to be a mathematician or biologist. "I loved both subjects," he recalls, "but I was not sure that I had a future in mathematics. Then my mathematics teacher, who I admired, wrote in my high school yearbook: 'Roosevelt can do anything he wants to do in life.' That small message gave me the confidence to go into mathematics." Today, Gentry works in biomathematics. "I now have the best of both worlds," he says.

Gentry now teaches and does research at Jackson State University in Jackson, Mississippi, where he completed his undergraduate work. He returned to that school after earning a Ph.D. in mathematics from Rutgers University in New Brunswick, New Jersey. Gentry became chairman of the department soon afterwards and spent the next 10 years as an administrator and teacher. During and after this time he co-authored books on mathematics and psychology. In 1988, he received an MRI grant to work on the solution of a system of differential equations that describes events in the physical and biological worlds. "These equations can be used in computer simulations of experiments," he points out. "I am presently applying them to biology."

"I would not be able to do this without MRI support," Gentry continues. "It pays for computer hardware and software and frees me to do full-time research in the summer." Each summer, he travels to Rutgers to work with his former teacher. "I can travel and take minicourses, which I could not do on my department's budget,"

he adds. "And the grant gives me time to participate in a program whereby mathematicians travel to high schools in Mississippi and Louisiana to talk to students about careers in mathematics. I could not do this unless I had the freedom that the award gives me."

Dr. Gentry is convinced that such programs are one way to increase the participation of minorities in science and engineering. "MRI-type programs are another way," he says, "and the two can reinforce each other. Those of us who have received MRI support can serve as role models to encourage precollege and undergraduate students to go into research and graduate students to apply for the available grants. This is having a positive impact, but we need more of it and additional programs, too, to halt the decline in the numbers of Ph.D. degrees in science and engineering awarded to minorities."

Tepper L. Gill
Ph.D., Wayne State University
Department of Electrical Engineering
Howard University
Washington, D.C. 20059

In high school, Dr. Tepper Gill had his own quartet and he wanted to be a musician. He went to the Detroit Conservatory of Music and took regular courses at nearby Wayne State University. "My motivation for going to college was to pass the post office examination," he recalls. "In case I did not make it as a musician, I would have a stable job."

Gill took physics to satisfy a university requirement and found it to be exciting. He took calculus and considered it fun. "I received A's in those subjects, so I kept taking them," he says. Gill completed a five-year program that resulted in a B.S. degree in physics and mathematics in 1966.

"When I finished, I was not sure what I wanted to do with my life," he remembers. "I knew I did not want to get drafted, so I went to work for the Army. After three years of working for the Army Tank Command, Gill decided that he wanted to do research and teach. He returned to Wayne State and earned his Ph.D. degree in mathematics in 1974.

Gill then took a faculty position at Howard University in Washington, D.C., where he is now a professor and chairman of the department of electrical engineering. He received an MRI planning grant in 1986 and a regular grant in 1988. "The awards gave me the freedom and funds to explore the relationship between the way mathematicians represent physical realities and the way physicists view them," he notes. The grant also allowed me to train students. One of them has already earned a Ph.D. degree."

Dr. Gill notes that many minority students he sees are "a product of an educational system that has forgotten the distinction between training and education. By training, I mean learning personal discipline, and having parents and teachers make sure students do not make basic mistakes in things they must do for the rest of their lives. Education cannot come before that kind of training."

"In addition," he continues, "minority males must not fall victim to the idea that education is unmanly. Both sexes must avoid the message that minorities will always be behind whites and Asians in science and technology. That is what statistics may show, but statistics refer to groups and not to motivated individuals."

Carroll J. Guillory
Ph.D., University of California at Berkeley
Department of Mathematics
University of Southwesterm Louisiana
Lafayette, LA 70504

One reason Dr. Carroll Guillory enjoyed high school so much was that it provided relief from the hard work on his parents' small farm in southern Louisiana. Another reason was mathematics. "I was very interested in mathematics, and I had an excellent teacher who kept motivating me with challenging problems," he recalls.

Guillory went on to Southern University in Baton Rouge where his biggest problem involved writing English and mathematics. "My parents spoke Creole (a dialect of French)," he explains. "I did not have much trouble reading, but writing was difficult." Again, he received the help of a teacher, Dr. Rogers Newman, who also urged him to go to graduate school. Guillory's problem made writing a dissertation laborious, but he received a Ph.D. from the University of California at Berkeley. He then returned to live in Church Point, Louisiana, where he was raised, and to a faculty position at the University of Southwestern Louisiana.

An MRI award enabled him to take time off from teaching and return to a research setting at UC - Berkeley. "It was a personal dream come true," he comments. "Without the grant, I never would have come near my potential." Guillory works in function analysis, specifically Douglas algebra. "I learned a lot of mathematics, and put it in the perspective that I needed to continue in this field," he continues. "I still get help from my colleagues at Berkeley. Eventually, I hope to write a book about Douglas algebra."

Periodically, Dr. Guillory goes back to Southern University to encourage other minorities to become mathematicians and scientists. "Things are wide open for minorities," he states, "but not many of them are interested in these careers. We must get young people to realize that the opportunities can be limitless. This is especially true in mathematics where there are so few minorities. If we can get more to participate in mathematics and science, I believe that minorities have much to contribute."

William A. Hawkins, Jr.
Ph.D., University of Michigan
Department of Mathematics
University of the District of Columbia
Washington, DC 20008

In high school, Dr. William Hawkins was amazed to learn that Albert Einstein and other scientists had discovered truths about the universe with only paper and pen. "I wanted to learn as much as possible about how to predict things mathematically before they are discovered by observations," he recalls.

Hawkins took all the mathematics and physics courses that he could in high school. At Howard University in Washington, D.C., he graduated with a B.S. degree in mathematics in 1968 and had almost enough credits for another major in physics. Hawkins did earn master's degrees in both subjects simultaneously at different schools. In 1970, he received a master's in mathematics from the University of Michigan and a master's in physics from Howard.

Unsure of the best course to follow from there, Hawkins took a job teaching mathematics at the University of the District of Columbia (UDC). UDC was formerly called Federal City College. By 1974, his interests were exclusively mathematical, and he returned to the University of Michigan to work on a Ph.D. When he finished the course requirements in 1979, William returned to UDC.

"I had exerted considerable effort to get a Ph.D. degree and I wanted to do research," Hawkins notes. "But I did not know how to go about it until J. Arthur Jones of NSF told me about the MRI program." The grant Hawkins received in 1985 allowed him to take time from his teaching and administrative duties as chairman of the UDC

department of mathematics. "The award allowed me to travel to meetings and to interact with the mathematical community," Hawkins comments. "I also obtained the experience I needed to continue doing research."

Dr. Hawkins is concerned about the number of bright minorities who "fall by the wayside." "People are always falling out for various reasons," he remarks. "But the number of minorities far exceeds the national norm. A number for agencies and institutions are striving to correct this situation, but I fear that the mood of the country is pulling the other way. Recent legal decisions, for example, make me wonder if the nation will recognize the untapped resources of minorities before it loses its preeminent position in the world."

Herman D. Hughes
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In the sixth grade, Dr. Herman Hughes received the highest score on the Greene County, Alabama achievement test. "That was the first signal that I should go into education," he comments. "I did not think much about science because the high school courses were uneven in quality, but I did like mathematics and I did well at it." Herman scored high on the mathematics portion of the entrance examination for Stillman College in Tuscaloosa, Alabama leading to his being placed into that institution's major academic track.

After earning a B.S. degree in 1959, Hughes taught high school for three years. "I realized that I did not want to do this all my life," he recalls. "I also knew that a bachelor's degree limited what I could accomplish in education." He applied for graduate scholarships in mathematics and chemistry, another subject in which he excelled. He won a chemistry scholarship and attended Tuskegee University in Alabama. Hughes received an M.S. in chemistry, with a minor in mathematics, in 1963. He then took a teaching job at Grambling State University in Grambling, Louisiana.

In 1965, his interest turned to computers. "I became very excited about the possibilities of computers," he notes. "I also decided that being a college professor was a nice life, but a Ph.D. degree was required to get ahead." Herman earned his Ph.D. degree in computer science in 1972 at the University of Southwestern Louisiana. From there, he obtained a faculty position at Michigan State University in East Lansing, where he has worked since in the College of Engineering. Besides teaching, Hughes did research during summers for industry and the Air Force.

"I wanted to do research on my own," he says, "so I applied for an MRI grant. He received an award in 1980 to design, develop, and test protocols for computer local area networks. "The MRI grant permitted me to get started in academic research." Dr. Hughes states. "The work I did and papers I published gave me the credentials I needed to obtain other grants after the MRI award expired." Currently, he is a full professor and assistant Dean of the graduate school at Michigan State.

To attract more minorities into science and engineering, he believes that they must be exposed and stimulated starting in kindergarten. "Students need to experience success as they go along in order to build confidence in their abilities to take the courses required to prepare for these careers." he asserts. "If they become involved in and knowledgeable about science or engineering early enough, they will be motivated by the opportunities and exciting things they can do."

Joshua A. Leslie
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Department of Mathematics
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In high school, Dr. Joshua Leslie read Plato's assertion that mathematics is the perfect form of human reasoning. "I agreed with him," Leslie recalls. "And I still regard mathematics as the only certain form of reasoning."

Leslie's parents, who were in the real estate business, wanted him to go into law, but he resisted. Leslie did well in chemistry in high school, and for a while he thought of majoring in chemistry. However, he decided that he was not interested in experimental science. As an undergraduate at the University of Chicago, Leslie was impressed with Henri Cartan, a French professor of mathematics who visited the university. "I was much taken by the clarity of his thinking, and I went to the University of Paris at Sorbonne to do graduate work with him," Leslie says.

After receiving his Ph.D. degree in Paris in 1960, he went to Nigeria to teach. Leslie returned to the U.S. twice during the next seven years to work at the Institute for Advanced Studies at Princeton. On the second visit, he decided to stay in America to care for his aging mother. Leslie taught for one year at the University of California at Berkeley, then accepted an appointment at Northwestern University in Evanston, Illinois, where he is now a full professor.

At Northwestern, Leslie received an MRI grant to study the application of topology and group theory to solving differential equations. "The award enabled me to get back into research after being away from it for a while," he notes. "I had time to spend a year at the Institute for Advanced Studies and to think only about mathematical problems. Finally, it gave me a base from which to apply for other grants to further advance my research."

Dr. Leslie believes that the U.S. must mobilize the energies of minorities and women in order to remain a great nation. "The future of minorities and science is synonomous with the future of science and the U.S.," he asserts. "Minorities must come to see science and engineering as careers to gratify their material and intellectual needs and to provide socially upward mobility—careers that are just as attainable as those in athletics, law, and business. Programs like the MRI, coupled with the necessary educational opportunities, can make this view a reality."

Roberto A. Mena
Ph.D., University of Houston
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California State University at Long Beach
Long Beach, CA 90840

"My father, brothers, and uncles thought I was crazy to want to be a mathematician." Dr. Roberto Mena recalls. "I was always good at numbers, but my family expected me to work in a field like economics." At the University of Houston, however, Mena kept getting B's in economics and A's in mathematics, so he switched his major. "I was the seventh of seven children, raised in Mexico until I was 16, and my family did not see how it was possible for me to be successful in mathematics," Mena comments.

He became the first in his family to earn advanced degrees—a master's then a Ph.D. from the University of Houston. From Texas, he went to teach at the University of Wyoming. "There was a group at Wyoming working on combinatorial mathematics," Mena remembers. "I specialized in algebra but combinatorial problems fascinated me. I felt that it was closer to my nature than algebra, but it is very difficult to switch fields at that level."

After eight more years of working in algebra, Mena began to feel that he was "stagnating." He received a National Research Council fellowship that enabled him to go to the California Institute of Technology for a year. This was followed by an MRI award that permitted him to do research in combinatorics. "The grant substituted for the advisor that I did not have in this field, and it permitted me to publish and gain respectability in a new field," he notes.

Dr. Mena moved to California State University at Long Beach, where he now holds a full professorship and chairs the mathematics department. "One of the reasons I came to California," he relates, "is to become involved in helping minority students that are interested in mathematics. They need encouragement to overcome the cultural prejudice to this subject. They also need help at the elementary and high school levels from role models who can advise them how to plan for futures in mathematics, science, and engineering."

Pablo V. Negron-Marrero
Ph.D., University of Maryland at College Park
Department of Mathematics
University of Puerto Rico at Rio Piedras
Rio Piedras, PR 00931

While other kids were playing games, Dr. Pablo Negron was designing them. His classmates played baseball while he analyzed ways to measure the abilities of players. "I did a lot of this kind of thing independent of my schoolwork," Negron recalls. "My parents worried about how I was doing in classes. They saw education as the only way out of the poverty in which I was raised." They need not have worried; Negron and all his brothers and sisters have earned university degrees.

"There was never any doubt in my mind that I would be a mathematician," Negron asserts. "In my first year at the University of Puerto Rico, I told the chairman of the mathematics department that I would get a Ph.D. degree and return to Puerto Rico to teach and do research. He greeted a statement like that from someone so young with surprise and incredulity."

After earning bachelor's and master's degrees at the University of Puerto Rico, Negron went on to receive a Ph.D. degree from the University of Maryland. He became interested in bifurcation theory, specifically in nonlinear elasticity which has applications in engineering. His thesis advisor recommended that Negron do postdoctoral work at Heriot-Watt University in Edinburgh, Scotland, home of an excellent group that does research in this area.

After the postdoctoral work, Negron returned to the University of Puerto Rico and applied for an MRI grant. "Receiving the award meant that the scientific community was saying that my work was good," he comments. "That was very stimulating for me. It provided the opportunity to do work left open by my thesis and to publish it."

Dr. Negron believes that the same thing that happened to him will happen to an increasing number of minorities in the future. "There are many good people out there," he says. "We need to keep stimulating them with programs like the MRI. As long as we do this, their numbers will increase, as will the positive impact they will have on science and engineering."

Javier Rojo
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Dr. Javier Rojo was preparing for the 1971 Pan American Games in Mexico when he broke an ankle sliding into second base. His dream of becoming a professional baseball player was shattered with his ankle. Still on crutches, Rojo took a course in probability theory at the University of Texas at El Paso (UTEP), and that experience motivated him to become a mathematician. "I was always good at mathematics," he recalls. "I could beat everyone doing sums and multiplication in the second and third grades. So it was natural for me to replace a baseball career with one in statistics."

Rojo earned a master's degree from Stanford University then went on to a Ph.D. program at the University of California at Berkeley. Here, life was difficult for a kid from Mexico. "My parents did not finish grade school," he says, "but they pushed me to get a good education. In graduate school, however, I felt a need to talk to someone from my cultural background to get advice."

After earning his Ph.D. degree, Rojo returned to UTEP as an assistant professor. He then received an MRI grant that allowed him to do research dealing primarily with analysis of the tails, or ends, of distribution curves. "The funds freed me from teaching and permitted me to travel and interact with other mathematicians," he notes. "In the summer of 1988, I wrote a technical paper at UC-Berkeley that proved that my ideas can have an effect on the field of statistics. That would not have been possible without the grant.

"I have heard people say that minorities get support for work of lesser quality," Dr. Rojo continues. "That does not bother me because I have met many bright young minority doctorates who have benefited from MRI grants, and I know the value of such programs. However, I am concerned that some good people will be hesitant to apply because they may perceive these programs as providing support for work of lesser quality. There is a big need for role models who can tell minorities about the high quality and the need for such programs."

"Role models can also advise those from the same cultural background who have problems. Students from poor backgrounds need to know that they can make it under difficult circumstances. I tell high school students and those we recruit to graduate programs at UTEP that they can overcome these difficulties and have rewarding careers in science and mathematics."

Donald F. St. Mary
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Department of Mathematics and Statistics
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Dr. Donald St. Mary still remembers the shop teacher who brought word puzzles to his high school class in Lake Charles, Louisiana. "I loved to work on those thought puzzles," he recalls. "I also took geometry and discovered another form of reasoning that enthralled me. That was in my freshman year, and I just kept taking mathematics courses all through high school and college."

St. Mary went to McNeese State College in Lake Charles and received a B.S. in 1962. "I had no good sense of what I wanted to do," he remembers, "so I took the advice of one of my professors and applied to graduate schools. St. Mary earned an M.S. degree from the University of Kansas in Lawrence in 1964, followed by a Ph.D. degree from the University of Nebraska at Lincoln in 1968. That year, he took a faculty post at the University of Massachusetts at Amherst where he has worked since that time.

Interested in oscillation theory, St. Mary applied for grants to work in this area but he was unsuccessful. In 1980, he heard about the MRI program and immediately wrote a proposal. He received a grant in 1981 to work on oscillation theory of linear differential systems.

"The award was tremendously influential," he comments. "It permitted me to do research full-time in the summer and to travel to conferences. "On another level, it uplifted my spirits and gave me self-confi dence. That confidence influenced me

to apply for other grants and broadened my research." St. Mary now works on mathematical models that involve solutions of partial differential equations. "I concentrate on models that stretch the capacity of the largest computers, and thus need special mathematical skills for solution," he explains.

Dr. St. Mary sees a bright future for minorities who get into science and engineering. "The problem is getting there," he notes. "Youngsters who have the support of their family and school system, as I did, and are raised in stable neighborhoods, as I was, have good chances. But today such support is rarer than it once was. This is where role models and mentors can play an important part. They can help students obtain the preparation needed to be successful in college. They can make students aware that being a professor is a very rewarding life—that there can be no limit to what the student accomplishes."

Frances E. Sullivan
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Dr. Frances Sullivan always knew that she would be a mathematician. In elementary and high school, she could always do calculations faster and more accurately than anyone else in her class. "I thought of it as fun, and I won many contests and prizes." Sullivan also won a scholarship to South Carolina State College in Orangeburg, where she was raised.

During the summer of 1964, her senior year, she participated in a special program at Harvard University in Cambridge, Massachusetts. "I went to as many civil rights rallies as mathematics classes," she remembers. "I wanted black students to be as proficient in mathematics and science as white students. I decided I could contribute to achieving this by becoming a teacher."

After earning her undergraduate degree, Sullivan accepted a scholarship to attend the University of South Carolina in Columbia, where she was the only black in the mathematics department. "You can not learn mathematics in a vacuum, and there were no study groups open to me," Frances remembers. "Besides I was a civil rights activist. It all added up to a most unpleasant experience."

Sullivan earned her master's degree from the University of South Carolina in 1968. Then, from 1970 to 1980, she taught at City College-CUNY and earned a Ph.D. degree at the graduate school of CUNY. Afterwards, she returned to the South to teach at Jackson State University in Jackson Mississippi. Sullivan also planned to do research; so she applied for and received an MRI grant to study associative algebras. "The award released me from a heavy teaching load," Sullivan notes. "It was a great opportunity, but I misjudged the constraints on my time relative to program development at a predominantly teaching institution."

In 1988, Dr. Sullivan moved to Clemson University in South Carolina where she now teaches and does research on coding theory. She has continued to recruit minority students in mathematics and science to go on to graduate school. "It is very difficult," Sullivan admits. "Most black students who obtain undergraduate degrees in these areas immediately accept jobs in industry because of the high starting salaries. We need to convince minorities early that graduate school is more worthwhile in the long-term—that it can lead to greater achievements later in life."

Floyd L. Williams
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Dr. Floyd Williams was raised in extreme poverty in Kansas City, Missouri. His mother told him not to complain about their situation but to have faith in God and work hard. Her advice worked. Williams is now a professor of mathematics at the University of Massachusetts at Amherst.

However, it was music, not mathematics, that appealed to him through high school. "In fact," he admits, "mathematics was the only course in which I did not do well." Williams had not thought of going to college until his last week in high school when he was offered a music scholarship at Lincoln University in Jefferson City, Missouri.

"In my sophomore year, I became intrigued with the theory of relativity," he recalls. "I can not explain why, but I was drawn to trying to understand it. This was my main motivation for starting to study mathematics." Williams graduated from Lincoln with a major in mathematics, and semi-majors in physics and music. He went on to earn a Ph.D. degree at Washington University in St. Louis.

About 10 years ago, he began working on Lie theory, advanced mathematics that deals with symmetry. He received an MRI grant in 1983 to continue his research in this field. "Getting the award boosted my confidence and ushered me into the mainstream of mathematics," he comments. "I had participated in sponsored research before, but I had never been a principal investigator. The results of the work done with the MRI award enabled me to compete successfully for mainstream grants which I have had ever since."

Williams has felt the sting of discrimination during his career, but he also has been soothed by supportive teachers and colleagues. He believes that he has an obligation as a role model for helping young minorities enter science and engineering. "Many kids today see only athletes and entertainers as examples of success," he notes. Dr. Williams has helped to set up programs that allow precollege students and undergraduates to meet and talk with mathematicians, scientists, and engineers. "All that many of these youngsters see is different courses," he says, "but they want to know what mathematicians do from 8 a.m. to 5 p.m. Once minorities commit to graduate work in science or engineering," he continues, "they need extra help and support for what, for many, is the foreign environment of graduate school. Such programs exist at a few universities, but we need more of them."

Lawrence R. Williams
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In junior high and high school, Dr. Larry Williams had a problem. No matter how hard he tried, he could not defeat one kid from Jasper, Texas, in the annual mathematics contest. But that did not diminish his passion for mathematics, an interest shared by most of his 11 brothers and sisters as they grew up in Livingston, Texas.

"When it came time to go to college, majoring in mathematics was a natural thing to do," Williams says. "But at that point, I had never heard of graduate school or a Ph.D." One day at Texas Southern University in Houston, the head of the mathematics department asked him what he wanted to do after graduation. "Probably get a job in industry," Williams answered. "Why not think about graduate school?" the teacher suggested. "I started to do that," Williams remembers. "And the more I thought about it, the better I liked it."

He went on to earn a Ph.D. degree from the University of Michigan. He became interested in functional analysis, particularly operator theory. When Williams obtained a faculty position at the University of Texas at Austin, he applied for an MRI grant to do research in this area. "Receiving the award," he says, "helped me get over the first big hurdles of a university professor—promotion and tenure." He is now an associate professor and associate dean in the College of Science and Engineering at UTSA. "Beyond this," Williams continues, "it gave me time to sit and think about problems and to write good papers."

When asked how to get more minorities into science and engineering, Dr. Williams replies: "Be sure that they get an early start. Grade school is not too early to make minorities aware of opportunities and to guide them to the right courses. Unfortunately, some counselors steer minorities away from science and mathematics because they do not think the kids can handle difficult courses. Besides advice and support, kids with the interest and ability can profit greatly from summer programs that give them deeper experiences in mathematics, science, and engineering. We have run such a program at UTSA since 1978, and it goes a long way toward showing bright kids that they can have a good future in these areas."

Cesar D. Cordero - Montalvo
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University of Puerto Rico at Mayaquez
Mayaquez, PR 00709

In elementary school, Dr. Cesar Cordero was always asking questions like: What are clouds made of? or How do magnets work? In high school, he discovered, to his delight, that the physical world could be explained in term of atoms. "I decided that I could obtain a systematic, coherent explanation of much of the world by studying physics," he recalls. However, he was also interested in people and social problems. At the University of Puerto Rico at Rio Piedras, he had to decide between physics and psychology. "I felt a stronger need to explain the world of things," Cordero remembers, "so I chose physics. But I also had a strong commitment to the world of people."

From Rio Piedras, Cordero went to Pennsylvania State University to earn master's and Ph.D. degrees in physics. In 1978, he returned to the University of Puerto Rico to teach at the Cayey campus. He remained there until 1983 when he went to Harvard University as a visiting scholar. There he enjoyed working on nonlinear optics so much that he decided to continue the work at the University of Puerto Rico.

Cordero moved to the Mayaguez campus where he received an MRI grant to study nonlinear interactions between light and matter. "The award challenged me to formulate my own research program based on the work that I did at Harvard," he comments. "It freed me from teaching enough to try to answer questions I think are important. Additionally, it provided an opportunity for collegial interactions with other physicists in Puerto Rico."

Dr. Cordero did not forget his social commitment. He has divided his time with an effort to improve the training of science teachers at Cayey. He is convinced that improvements in teaching will increase the number of minorities in science and engineering. "Teachers should train students to deal with things, people, and ideas," he asserts. "From this, they will get a richer education and will be better equipped to decide on careers in physical, biological or social science or in engineering. We should also attend to the problems of not being able to attract the best people into teaching, of providing more role models, and of opening academic and industrial laboratories to students."

Carlos R. Handy
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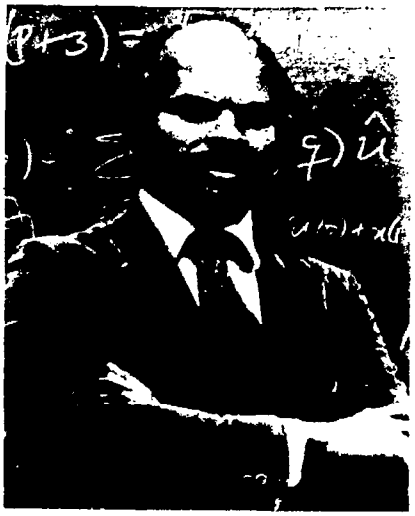
Like his grandfather, the famous blues composer W.C. Handy, Dr. Carlos Handy has a creative intellect in his chosen profession, mathematical physics. Since childhood, science had always fascinated him. Unfortunately, this predisposition did not receive the necessary academic guidance until he entered George Washington High School in New York City. While there, he taught himself calculus and learned advanced mathematics, computer programming, and physics. Prior to entering college, he abandoned his dream of becoming an astronomer in favor of pursuing a more challenging program in physics.

Handy earned both the B.A. (1972) and Ph.D. (1978) degrees in physics from Columbia University. The latter was awarded for work done in theoretical particle physics. Upon graduation, he pursued a postdoctoral appointment at Los Alamos National Laboratory. His MRI research was initiated there on the impact of the theory of moments in the analysis of singular—strongly coupled quantum systems. After joining the physics faculty at Clark Atlanta University in 1983, he received an MRI award which allowed him to develop his theory. The results of this ongoing research have yielded a fundamental advance in the mathematical/computational understanding of quantum operators. In particular, this work makes possible the calculation of very precise atomic energy levels for systems in high magnetic fields. Support from the MRI progra... mitted a very fruitful collaboration between Handy and some of the world's distinguished mathematical physicists, in particular, Dr. D. Bessis of the Centre d'Etudes Nuclaire in Saclay, France.



The development of new theories in physics is a creative enterprise. According to Handy: "subjective pressures at some majority institutions may make it difficult for some inquiring minds to flourish. One must have an environment where honest questions can be asked. be they right or wrong. without fear of any ethnic stigma attached to one's judgment." Historically Black Colleges and Universities (HBCUs). such as Clark Atlanta University, provide one such intellectual oasis. The existence of programs like the MRI guarantee the minority researcher access to 'state of the art' equipment and other necessary support by which to successfully sustain a vigorous and relevant research program. Dr. Handy believes that the combination of HBCUs and the MRI provide a 'safety net' by which many creative black researchers are prevented from disappearing from the alarmingly small population of minority research scientists in the United States.

Wendell T. Hill III
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At age five. Dr. Wendell Hill was solving puzzles and playing number games with his parents. His mother was a mathematics teachers and as soon as he could recognize numbers. he helped her grade papers. In high school. he helped develop work problems for an elementary-level text that his mother wrote.

Hill enrolled at the University of California at Irvine with the intention of majoring in mathematics. But in his sophomore year. he switched to physics. "I found that applying mathematics to solve physics problems was more enjoyable than proving things that seemed obvious to me." Hill recalls. "I decided that my nature was more in tune with physics than mathematics."

After receiving a B.S. degree in 1974. Hill went to Stanford University in California. There he worked with Nobelist Arthur Schawlow on developing high resolution and ultrasensitive techniques for probing atoms and molecules. Wendell earned a Ph.D. degree in 1980. then did postdoctoral work at the National Bureau of Standards. There he expanded his research to look at the unstable states and inner shell structure of many-electron atoms. He obtained his first faculty position in 1982 at the University of Maryland at College Park. He was just 29 years old.

Hill applied for an NSF grant to probe the structure of molecules such as hydrogen and oxygen with lasers. He received funds from the MRI program in 1984. "The award enabled me to quickly set up my own laboratory. purchase lasers. and hire graduate students," he comments. "I could not have done any of these things without it." Once he had found a research niche. he was able to obtain further support in the form of a Presidential Young Investigator award from NSF and a grant from the Air Force.

Dr. Hill views science as "very rewarding intellectually and socially. What it lacks in financial compensation is more than made up in personal satisfaction and the advantage of knowing and working with a variety of stimulating people." He conveys these feelings to young people along with a warning that "this is still not an open society: all people do not have equal choices." "However." he continues. "the additional challenge to minorities should not dissuade them from going into science and engineering. My personal goal is to serve as a role model for both minority and majority students, and to make them see the advantages of working with people from different backgrounds."

Keith H. Jackson

Ph.D., Stanford University

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At age 13, Dr. Keith Jackson's interest in science was stimulated by comic books in which scientists were heros. It was also fed by science fair projects in behavioral psychology. Jackson designed experiments using guinea pigs that he raised and sold to laboratories. By age 14, he decided to be a physicist. "Everyone tried to talk me into going to medical school instead," Jackson recalls. "These people had good hearts, but they were totally unaware of what a scientist does." There were no physics courses at the high school he attended in Columbus, Ohio. He had to ride a bus to the suburbs to take physics and calculus.

Jackson graduated from a special program at Morehouse College in Atlanta which led to his earning a B.S. degree in physics from Morehouse and a B.S. degree in electrical engineering from the Georgia Institute of Technology. He attended graduate school at Stanford University where he earned a Ph.D. degree in physics in 1982. Jackson was then hired by Hewlett Packard Corporation to work on the fabrication of semiconductor devices.

When his wife finished medical school and was assigned to Howard University for her internship, Jackson obtained a faculty position at the same university. Here he received an MRI grant to set up a laboratory for using spectroscopic techniques to characterize semiconductors and thin films. "That work could not have been done without MRI support," he notes. "The award also boosted my confidence and my visibility at Howard."

However, his low salary at Howard discouraged him and he returned to industry. Jackson sees low salaries at some universities as a factor that holds down the number of minorities in science and engineering. Other factors, he believes, are inadequate preparation at the high school level and large numbers of teachers at the undergraduate level who are foreign nationals. "Many minorities do not know what a career in science or engineering will be like; if they find out, they may not be able to take the courses they need," Dr. Jackson comments. "Foreign nationals may be technically qualified, but they can not serve as effective role models for U.S. minorities. Unless something is done about these problems, the outlook for minorities in science and engineering is bleak."

Henry Neal

Ph.D., Howard University

Department of Physics
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Atlanta, GA 30314

Dr. Henry Neal is legally blind; in the sixth grade he could not see the blackboard. "School officials recommended that I be sent to a special school," he recalls, "but my parents did not know about such things. I seemed to do okay, so they decided that I could get by in regular school."

Neal was helped by a science teacher that he rode to school with in Fort Lauderdale, Florida. "Any question that I could think of, he could provide a reasonable answer," Neal remembers. "That stimulated my interest in science."

He took all the science and mathematics courses offered in high school which, he says, "did not amount to much. I did not know physics existed until I arrived at college." Neal planned to major in engineering at Bethune-Cookman College in Daytona Beach, Florida. However, the curriculum there was not well suited for that major, so he chose physics.

Neal received a B.S. in 1972 then decided to pursue engineering in graduate school. He earned an M.S. degree in electrical engineering from the University of Florida in Gainesville in 1978. Afterwards, he worked in industry for a few years before deciding that life would be more interesting with a Ph.D. degree. Neal earned that degree in physics from Howard University in Washington, D.C. in 1984. He went on to a faculty post at Atlanta University, where he is still employed.

For his thesis research at Howard, Neal investigated how atoms interact with metal surfaces. At Atlanta, he applied for an MRI grant to find a mathematical solution that describes such interactions. "Receiving the award meant that I could be supported at a school which was, at the time, primarily a research institution. I do not know what I would have done without such support."

"The MRI grant," Dr. Neal continues, "gives doctorates opportunities that they could not get any other way. That helps to solve the serious problem of the declining number of black males at this level. But just as serious is the problem of getting blacks and other minorities into college in the first place. That calls for intervention at the high school level. Better teachers and more role models would certainly help, but I do not know if that is the complete answer."

Lynn E. Roberts
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Dr. Lynn Roberts' career in experimentation got off to a burning start. In the sixth grade, he built a rocket and tried to make an ignition system for it from the heating element of a toaster. "I burned up the kitchen table," he recalls. "From then on, my experiments were confined to the garage."

Roberts' mother was relieved when he decided to become a business major at the State University of New York (SUNY) at Stony Brook. "But after one semester," he remembers, "I got tired of it and switched to physics and mathematics. I had been interested in physics in high school but not so much in mathematics. When I took these subjects in college, I enjoyed them so much that I was hooked."

At SUNY, Roberts met Nobel physicists C. N. Yang and Paul Dirac. He became intrigued both with the men and with particle physics. That interest stayed with him at Adelphi University in New York where he earned the master's and Ph.D. degrees in 1976 and 1981, respectively. At Brookhaven National Laboratory in New York as a postdoctoral fellow, he switched his field to lattice gauge theory—mathematics that describes interactions between subatomic particles. From there, Roberts went to Lincoln University in Pennsylvania where he currently holds a faculty position.

"At a small school like Lincoln, it is difficult to get release time from teaching to do research," he notes. "The MRI grant that I received in 1988 gave me this time. I did research that

I wanted to do and was able to broaden my horizons and go in new directions." These directions included applying field theories to answer the question as to whether quarks are confined to the radius of the protons and neutrons of which they are part.

"The award also enabled me to train students in research," Dr. Roberts continues. "This is an important aspect of such support, and it fits in with programs we have at Lincoln to train students to go on to graduate school in science, mathematics, and engineering. We have been successful in placing our students in Ph.D. programs at universities such as Harvard, Penn State, Purdue, and Pennsylvania. Support of programs like this and the MRI is crucial for keeping this nation on the competitive edge. The U.S. must encourage minorities and women to help fill the growing need for scientists and engineers. Our survival as a great nation depends on it."

Barbara A. Williams
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University of Delaware
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As a child, Dr. Barbara Williams went to the library with her mother to do research on flowers that they wanted to grow in the family garden. "That started my interest in science," she recalls. "Then it crystallized in astronomy, because I did everything my older brother did and he was captivated by astronomy. My parents bought him a telescope and we looked at the stars and planets together from our backyard" in Charlotte, North Carolina."

Williams knew early on what kind of background she needed to be an astronomer. She took all the science courses available in high school and majored in physics at the University of North Carolina at Greensboro. She then did graduate work in astronomy at the University of Maryland at College Park, earning both M.S. and Ph.D. degrees there.

Her advisor at Maryland influenced her to specialize in the study of galaxies. She continued that research during postdoctoral appointments at the National Radio Astronomy Observatory at Charlottesville, Virginia, then at the University of North Carolina at Chapel Hill. During this work, Williams became intrigued with smaller compact groups of galaxies which she saw within galactic superclusters. In her first faculty position at the University of Delaware at Newark, she received a university grant to observe and model the interactions between members of compact groups.

Williams applied for an MRI grant to further her work and received it in 1988. "The award allowed me to do radio frequency observations at the Very Large Array in New Mexico and the Arecibo Observatory in Puerto Rico," she explains. "I also could hire graduate students to help me. It would have been much more difficult to do the research without an MRI grant."

To bring more minorities into science and engineering requires "more people to teach science who are excited about science," Dr. Williams asserts. "If they are not excited, the students and parents will not get excited. And we must generate this excitement at the elementary level when kids are naturally curious and before their values are set. In high school, many students are set on the idea of making lots of money. Before that occurs, we should sensitize students to the personal gratification and long-term rewards of a career in science and engineering."

John H. Ashe
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Department of Psychology
University of California at Riverside
Riverside, CA 92521

Dr. John Ashe admits that he was a poor student in high school and gave no serious thought to college. After graduation, Ashe worked at various odd jobs, and was employed by the California Department of Mental Hygiene. At the age of 24, he began taking courses at San Bernardino Valley Junior College. "Once I became involved with the subject matter," he states, "I liked it and decided to keep going."

Ashe enrolled at the University of California at Riverside. There he had an opportunity to participate in research on the central nervous system. He enjoyed it so much he decided to make a career of studying how the human brain works. Ashe received a B.A. in physiological psychology in 1973, then went on to graduate school at the University of California at Irvine. There, a National Institutes of Health doctoral fellowship supported him while he earned a Ph.D. degree in biological sciences in 1977.

Ashe did postdoctoral work at the University of California San Francisco Medical Center. He then obtained a faculty post at the University of California at Riverside, where he now is an associate professor with tenure. In 1982, he received an MRI grant that enabled him to begin research on how nerve cells communicate and how this communication is changed in a lasting way—a problem related to learning. "The MRI award gave me an opportunity to start my own laboratory and to work in my field of interest," Ashe comments. "I would not have been able to do much of the research I have done without it."

Dr. Ashe thinks that young minorities can learn a lesson from his experience. "Opportunities exist for those who want to go into science and engineering but who did not take the recommended courses or get high grades in high school," he asserts. The lesson is particularly appropriate for students who do not become aware of the range of careers in science and engineering while they are in high school. "That situation is all too common," he adds, "and it needs to be corrected. If it is corrected early, all is still not lost. Students should appreciate that their professional life is not over if they make early mistakes. You can always learn how to think."

Jaime Diaz
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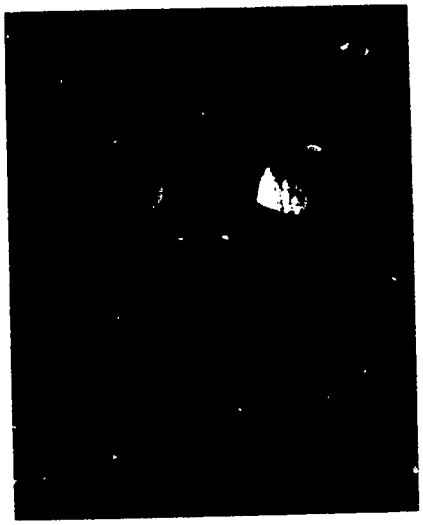
University of Washington
Seattle, WA 98195

Growing up in New York City, Dr. Jaime Diaz enjoyed going to Central Park with his older brother to examine and enjoy nature. "My brother would collect water samples from the lake then look at what was in the drops under a microscope," Diaz recalls. "He was incredibly curious and from him I learned to be comfortable with the natural sciences."

Diaz also was interested in the behavior of people and in religion. These interests drew him into a Catholic seminary for six years. But he decided that the priesthood was "not a good fit for my interests in people and natural science." He found a better fit studying physiological psychology at Hunter College of the City University of New York. From there, a scholarship took him to the master's and Ph.D. degrees at the University of California at Los Angeles (UCLA). Diaz then did a postdoctoral appointment at the UCLA School of Medicine in pediatric neurology. This work ignited an interest in brain development.

While at his first faculty position at the University of Washington, he applied for an MRI grant to do research on the spurt in brain growth that is part of the early development of all mammals. He developed a new procedure to study this growth phase in rats, which from age four to 21 days provide a model of the brain development that occurs in humans from mid-pregnancy to age four years.



"The MRI award allowed me to let my creativity run loose," Diaz comments. "It was incredible how I grew as a scientist from the beginning to the end of the grant. Professionally, the grant helped me to get early tenure at the University of Washington."

To attract more minorities into science and engineering, Dr. Diaz believes that "the fire of interest has to be kindled early. Elementary school students should be made aware of the rewards and difficulties of being a scientist or engineer," he insists. "Good students must be helped to resist pressures to be shifted into other tracts. We must explain that gratification in these fields comes, not from high pay, but from the satisfaction of solving natural puzzles and from doing what you like to do."

Eugene K. Emory
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Dr. Eugene Emory was a curious child who always was trying experiments. At age eight, he livened up dishwashing chores by dropping syrup, milk, and other things into the hot water to see what would happen. Growing up in Philadelphia, "I had no mentor or school experience to guide me," he recalls, "so I kept doing experiments and learning on my own. Even in college, I dissected frogs in my dormitory room."

Emory attended Edward Waters College, a small church school in Jacksonville, Florida, on a basketball scholarship. "I wanted to major in mathematics," he says. "But athletics did not leave enough study time for this, so I began taking biology courses. Eugene graduated with a biology/physical education degree then returned to Philadelphia to do human services work for three years. Following this, he went to the University of Florida in Gainesville where he earned a Ph.D. degree in biology in 1978.

In graduate school, Emory obtained his first formal research experience when he decided to work with a new professor who was starting a program on infant development. After a postdoctoral fellowship in clinical research at the University of California in Los Angeles, he continued work on infant development at the State University of New York at Binghamton.

In 1984, Emory received an MRI grant to investigate the response of human fetuses and infants to the stresses of labor. Two years later, he moved to Emory University in Atlanta, where he is now a tenured professor. "The MRI award helped me to get this position by funding me to start my own research," he comments. "It also gave me a tremendous psychological boost."

Dr. Emory feels that if role models or mentors had been available to him. "I would have gotten into research much earlier." He also believes that such guidance is more important for students who are not naturally curious or interested in science. "Those who receive MRI grants can serve as a pool of role models for all students," he suggests. "Those who are helped by them and rise to the same level can, in turn, assist the next generation. Such continual feedback is a powerful way to keep attracting minorities and women into science and engineering."

Roberto Rueda
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Department of Curriculum, Teaching, and Special Education
University of Southern California
Los Angeles, CA 90089-0031

While studying for a master's degree at the University of Southern California, Dr. Robert Rueda became interested in retarded children who are proficient in English and Spanish. To put his textbook knowledge of psychology to use, he volunteered to work with such kids and others needing help in the Spanish-speaking community. "Through this work, I developed an interest in the relationship between language and cognitive function," he explains. "I became particularly interested in bilingual kids with learning disabilities."

Rueda finished the master's program then earned a Ph.D. degree in educational psychology from the University of California at Los Angeles. From there, he went to a faculty position at Arizona State University at Tempe. Here, Rueda applied for an MRI grant to do research on the cognitive functioning of bilingual first graders in Phoenix. After receiving the award, he moved to the University of Southern California. Robert tested and found support for the hypothesis that, for kids to derive advantage from being bilingual, they need to be equally proficient in both languages.

"The MRI grant gave me my first major funding, and it allowed me to collaborate with colleagues that I otherwise would not have had the opportunity to work with," Rueda says. "The award provided a foundation upon which I have been able to broaden my research into how bilingual and learning-handicapped kids learn reading and writing." This work was subsequently funded by the California State Department of Education and a local school district.

In thinking about how to attract more minorities into science and engineering, Rueda draws on his own experiences. These included feelings of loneliness and confusion as a freshman at a large university, the motivation to continue school supplied by working as a volunteer counselor, and the support of a mentor relationship. To provide such experiences to other minorities, Dr. Rueda is working on a proposal to apprentice graduate and undergraduate students to faculty members actively engaged in research. "One of the best ways to learn is to see how knowledge is used," he asserts. "And research shows that students, especially minorities, who have strong ties to mentors tend to be more successful. The apprentice model would provide all of this, and I believe that it would be an innovative way to attract more minorities into science and engineering."

Melvin N. Wilson
Ph.D., University of Illinois
Department of Psychology
University of Virginia
Charlottesville, VA 22903

Dr. Melvin Wilson grew up in what he calls "a high-rise ghetto" in St. Louis, Missouri. Some of his friends came from single parent families. After he received his Ph.D. degree in psychology, Wilson thought about these friends. Because of the many multigenerational households involving adult relatives who were grandmothers, uncles, and aunts, the stereotype of a black mother rearing kids alone and without help did not fit with his experiences. So he applied for an MRI grant to try to understand the role that other adults play in the nurturing and support of single parent familes. He found that grandparents, aunts, and other adults play a significant role in raising the children.

Back in high school, however, Wilson was more interested in physical science. "I was always curious about how things work," he recalls. Two teachers—one in chemistry and the other in physics—stimulated this curiosity and sharpened his skills in science. He enrolled in Millikin University in Decatur, Illinois, with the intent of majoring in chemistry. But Wilson soon discovered he was more interested in people and how they work, so he switched to psychology.

Wilson earned master's and Ph.D. degrees from the University of Illinois at Champaign. His Ph.D. research involved a study of the role of self-disclosure in psychotherapy. When he obtained a faculty appointment at the University of Virginia, he wanted to work toward a deeper understanding of family interactions he had observed as a boy.

"The MRI grant allowed me to pursue this line of research which was new and somewhat controversial when I started it in 1983," Melvin comments. "The award allowed me to go beyond my original hunches and explore black family processes in a systematic way by videotaping their interactions during the evening meal. Since the MRI grant, Wilson has continued and expanded this research with support from the Rockefeller and Spencer Foundations.

Now an associate professor and assistant dean at the University of Virginia, Dr. Wilson is "dismayed that the number of minorities entering science and engineering has started to decline." To counter this trend, he recommends providing undergraduates with both financial support and opportunities to work directly with researchers. "Such support," he maintains, "should continue at the graduate and professional levels to compete with the financial attraction of careers in business, law, and medicine."

Robert D. Bullard
Ph.D., Iowa State University
Energy and Resources Group
University of California
Berkeley, CA 94720

Dr. Robert Bullard used his MRI grant to look at the relationship between minority communities in the South and the locations of hazardous and municipal waste landfills. In many cases, he found such facilities were located in economically underdeveloped areas having large populations of unskilled minorities. "It was the classic conflict of jobs versus the environment," he notes, "and economics won. The people in the affected communities are concerned about the environment, but they are more concerned about having jobs."

This was the kind of research that Bullard knew he wanted to do while still in high school in southern Alabama. "As far back as I can remember," he says, "I was interested in observing how people behave, and how to fit that behavior into a general scheme of understanding. I participated in a lot of individual and group social science projects in high school, and wrote the equivalent of college research papers. By the time I graduated, I knew that I wanted to be a Ph.D."

Bullard went to Alabama A&M University in Huntsville and finished with a bachelor's degree in history and government. He served two years in the Marines before going on to earn a master's in sociology from Atlanta University, then a Ph.D. from Iowa State University. From 1976 to 1987, he had a faculty position at Texas Southern University in Houston, where he did the MRI research. "The grant relieved me from a heavy teaching load, allowing me to do the research and write papers that put me on the cutting edge of environmental sociology." Since receiving the MRI grant in 1984, Bullard has authored or co-authored four books.

Bullard has expanded his research to other communities in the South with support from Resources for the Future, a Washington, D.C.-based foundation. He did the latter work as a visiting scholar in the Energy and Resources Group at the University of California at Berkeley. Again, he documented the same pattern from Atlanta to Dallas, and from Institute, West Virginia to Emelle, Alabama.

Now a tenured professor at the University of California at Riverside, Dr. Bullard sees a decline in the number of minority doctorates in sociology. "The same is probably true for the other social sciences," he believes. "To improve the situation, we must get to youngsters early– even in the fifth or sixth grades. We should identify those who are interested in science, then guide them in the right direction. I am optimistic that we will do this, I have to be."

Duane Champagne
Ph.D., Harvard University
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University of California
Los Angeles, CA 90024

Growing up on a reservation in North Dakota, Dr. Duane Champagne wondered about the poverty, political problems, and social changes that he saw around him. He also liked mathematics and did well in the subject at the reservation high school. Champagne straddled both interests by majoring in mathematics and minoring in sociology at North Dakota State University in Fargo.

After graduation in 1973, sociology won out. He worked as an Action volunteer for a year then earned a master's degree in sociology from North Dakota State. In 1975, Champagne was accepted at Harvard University and won a fellowship from the American Sociological Association at the same time. He studied political and economic changes among Native American tribes in eastern U.S. during the 19th century for his dissertation. He earned a Ph.D. degree in 1982.

A postdoctoral grant from the Rockefeller Foundation enabled him to study the recent political and corporate institutions established by the Tlingit Indians in Alaska. Champagne then taught at the University of Wisconsin at Milwaukee before taking a faculty position in 1984 at the University of California at Los Angeles, where he is now an assistant professor.

Champagne received an MRI grant in 1985 to expand his research to four tribes in the southeast—the Cherokees, Chickasaws, Choctaws, and Creeks in Tennessee, Alabama, Georgia, and Louisiana. "It would have been almost impossible to do the research I wanted to do without the grant," he comments. "It supported travel for field and archival work, purchase of microfilm records, and people to help me read and code documents. I could have done some of this without the award, but it would have taken much more time to do much less." He received an extension of the MRI grant which allowed him to finish several papers and a book.

Dr. Champagne's experiences guided him to the conclusion that, "if we are going to attract more minorities into the sciences, particularly the social sciences, there must be more openness to their points of view. People who make decisions about tenure and publication do not always recognize contributions with nontraditional viewpoints," he asserts. "Minorities that see things differently must compromise to survive. That can be disillusioning. It discourages students when their mentors and role models tell them about such subtle roadblocks to their careers."

Jose A. Cobas
Ph.D., University of Texas
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As an undergraduate visiting his Cuban parents in Puerto Rico, Dr. Jose Cobas became interested in the economic behavior of ethnic groups who migrate to other countries. His family had moved from Cuba to the United States then to Puerto Rico. Cobas stayed behind to attend Maryville College in Tennessee, where his natural curiosity about people focused on a major in sociology. He then went on to earn a master's degree from the University of Tennessee and a Ph.D. degree from the University of Texas.

The experiences of his family as part of an ethnic group within which many individuals worked for each other and for themselves dominated his thoughts. Cobas wondered if ethnic-economy theory applied to Koreans, Japanese, and Jews also held for Cuban exiles. He received an MRI grant to look into this question.

"The award allowed me to do research that I had always wanted to do, and which otherwise would have been very difficult," Cobas comments. "I was able to use data that I had collected on Cubans in Puerto

Rico and Miami to write papers and to start a book. As a result, I was asked to present papers, edit journal issues, and chair sessions of the American Sociological Association on the subject of ethnic economies. In short, the award made me known nationally among those who do research in this area."

Dr. Cobas believes that it is becoming more difficult for other minorities to follow in his footsteps. "A shortage of funds," he asserts, "has led to a relaxation in the national commitment to help minorities. The cutbacks are hurting both social programs and social science research." The solution, he suggests, is a "recommitment to the goal of helping minorities in particular and disadvantaged people in general." Otherwise, Cobas believes, things will get "tougher and tougher" for minorities to enter science and engineering, and the U.S. will waste a valuable resource.

Jeanette Covington
Ph.D., University of Chicago
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New Brunswick, NJ 08903

Dr. Jeanette Covington had no special interest in science in high school or college. After a scholarship offer to the University of Chicago, she decided to major in history. "However," she recalls, "in my senior year, I was pulled away from dealing with the past in favor of considering the present problems of society." Covington switched to sociology in graduate school, earning an M.A. degree then a Ph.D. degree in 1979 from the University of Chicago.

During her first year in graduate school, Covington became interested in crime and drugs. She did her M.A. thesis and Ph.D. dissertation on methadone maintenance. After teaching at the University of Michigan in Ann Arbor until 1981, she returned to Chicago to do postdoctoral work on drugs, which was supported by the National Institute on Drug Abuse. In 1984, she accepted an assistant professorship in the department of criminal justice at Temple University in Philadelphia. There she started research on the fear of crime.

Covington received an MRI grant in 1986 to investigate the impact of neighborhood changes on this fear, especially on factors besides crime itself which make people afraid of crime. "The award supported me to look into this topic in greater detail than I could have otherwise done," she comments. "The prestige it afforded identified me as someone doing basic research worthy of support from a highly respected funding agency."

In 1987, Covington moved to Rutgers University in New Brunswick, New Jersey where she is now an assistant professor. When she completes her MRI research, she intends to study the decriminalization of drugs.

Dr. Covington believes that more minorities would seek careers in science and engineering if high school students who did well in mathematics and science received more encouragement. "I got my best grades in mathematics in high school," she remembers. "But no one encouraged me to look into such careers. It would also help greatly if we could change a peer culture that labels good students as nerds or squares. If getting high grades became as important as dressing stylishly or playing sports, minorities, science, and the nation would be better off."

Jorge Duany
Ph.D., University of California at Berkeley
University of the Sacred Heart
Academic Research Center
Santurce, PR 00914

Dr. Jorge Duany's research work was partly autobiographical. Born in Cuba, he migrated with his family to Panama, then to Puerto Rico. For his Ph.D. dissertation at the University of California at Berkeley, Duany studied the migration of Cubans to Puerto Rico. He went from UC-Berkeley to the University of the Sacred Heart in Santurce, Puerto Rico, a city with a large population of migrants from the Dominican Republic. "This group had never been studied," Duany notes. "It seemed logical to extend my work to them and to compare the Dominicans with the Cubans."

The MRI award he received for the latter work marked the first time that the University of the Sacred Heart had received a research grant in the social sciences. This caused Duany some administrative headaches, but these were more than compensated for by the positive aspects of the support. "The award made it possible to do the research I wanted to do," he says. "However, the prestige and moral support were as important as the money. It recognized my work in a university that did not have a tradition in research." Duany is now director of the Academic Research Center at the University of the Sacred Heart and an assistant professor who teaches anthropology and psychology. He was a senior at Columbia University majoring in psychology when he took his first course in anthropology. Taught by Margaret Mead, it changed the direction of his life. "A very inspiring teacher," Duany recalls, "she channeled my interest in the social and cultural aspects of behavior into anthropology. Michel Laguere, a Haitian who taught Caribbean anthropology at UC-Berkeley, influenced me even more."

Dr. Duany's experience in the Caribbean and the United States leads him to conclude that some Hispanic groups, notably Cubans, are increasing their participation in science and engineering. Nevertheless, he believes that, overall, the number of minorities participating at the advanced levels is decreasing. He suggests that additional financial incentives, along the lines of the MRI awards,and more exposure to successful role models would counteract this situation.

Steven Gregory
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Asian American Center
Queens College - City University of New York
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Dr. Steven Gregory read avidly about Egypt and the pyramids in elementary school. But in high school, he recalls, "I switched my enthusiasm from archeology to photography and filmmaking because the latter seemed like a glamorous profession."

Gregory earned a Bachelor of Fine Arts then a master's degree in art education from Pratt Institute in Brooklyn, New York, where he grew up. He began working as a photographer while attending Pratt and continued on the job fulltime after graduation. However, Gregory found that "the world of commercial media was dull and boring for me. "I decided to go back to school to do what had interested me in elementary school," he says. The New School of Social Research in New York City, the school he selected, offered no archeology, so he chose anthropology. There he earned an M.A. degree in 1981 and a Ph.D. degree in 1986.

At the New School, Gregory became curious about the impact of the civil rights movement on urban black communities. After graduation, he received a one-year National Research Council minority fellowship to study working and middle class families in Queens, a borough of New York City. He based himself at Queens College where he applied for an MRI grant to continue this work. Specifically, Gregory focused on the changing relationships of class and the significance of race in this community.

"The grant enabled me to do research that otherwise I might not have been able to do," he comments. "It would have been extremely difficult to get support without a faculty position or a track record in research. Winning such a prestigious award, also enabled me to obtain a faculty position at Wesleyan University in Middletown, Connecticut."

Dr. Gregory is not optimistic about the future of minorities in science and engineering because of the low numbers of such people who finish undergraduate and graduate school. "To increase the numbers," he maintains, "we need to give minorities more exposure to science and technology in high school and even in elementary school. At the university level, particularly in graduate school, departments must be more sensitive to cultural bias and more careful about how not to alienate minority students."

James W. Harrington
Ph.D., University of Washington
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Buffalo, NY 14260

At age five, Dr. James Harrington decided to be an architect. He spent many hours looking at pictures of buildings, sketching, and constructing buildings with Lego blocks. By age 13, the Lego buildings became Lego cities, and Harrington decided to be a city planner.

Harrington won a scholarship to Harvard University, where he concentrated on urban studies, government, and economics. During the summers, James worked in the planning offices in Florence South Carolina, where he was raised, and for the State of Vermont. After graduation, he found a job with the Massachusetts Office of State Planning.

"Working there, I felt a need for more study to advance my interests, so I decided to go to graduate school," he remembers. Harrington found the type of studies that appealed to him most at the University of Washington in Seattle. There, he received an NSF doctoral fellowship, graduating with a Ph.D. degree in economic geography in 1983. "The University of Buffalo in New York had the best geography department with an opening at that time, so that is where I went," he says.

Harrington had studied the semiconductor industry for his dissertation, specifically how different companies within the industry maneuver to gain and maintain a monopolistic advantage. To extend this research, he received an MRI grant in 1987. "The award showed the University of Buffalo that its investment in me, through small internal grants, was worthwhile," he comments. "It certified my professional maturity."

Dr. Harrington sees two things that keep minorities out of science and engineering. "Many minorities do not attend high schools that prepare them adequately for these careers," he notes. "When I went to Harvard, for example, it would have taken a huge, perhaps impossible, effort for me to have majored in mathematics or a physical science. Mitigating this situation today are magnet and academic honors high schools in inner cities.

"I am even more pessimistic, however, about wasted youth—the significant number of minorities who, by age 12, believe that neither school nor work will improve the quality of their lives. Universities worry about the lack of minority Ph.D. candidates, but the real problem is at the junior high and high school levels."

Darnell F. Hawkins
J.D. University of North Carolina at Chapel Hill
Ph.D., University of Michigan

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His parents, along with a high school French teacher, inspired Dr. Darnell Hawkins to go to college. "In the early 1960s in Arkansas, blacks were not encouraged to take the standard college admission tests, even if they had good grades," he recalls. "Lois Faucette convinced many of us that we could do well on such tests and could go on to college. She instilled us with a desire to do this."

Hawkins went to Kansas State University in Manhattan with a $100 scholarship and majored in French. In addition, he took courses in anthropology, psychology, and sociology. "I had practically no exposure to social science in elementary and secondary school," Hawkins notes. "I did not learn about the possibility of a career as a sociologist until college."

After graduation, Hawkins joined the National Teachers Corps and taught elementary school in Detroit for four years. "I became disillusioned about my ability do great social good there, so I decided to go to graduate school at the University of Michigan," he relates. "I chose sociology, but it was not until I was immersed in the program that I was sure that I wanted to be a sociologist."

Hawkins received his Ph.D. degree in 1976, then went on to teach sociology at the University of North Carolina at Chapel Hill. He became interested in the prison system of North Carolina and received a Ford Foundation fellowship, then an MRI grant, to study the history of that system. He then moved to the Black Studies Program at the University of Chicago where he has continued this work. "After I left the University of Michigan, I realized that I had not made the connections necessary to obtain grants and start a research career," Hawkins comments. "This is also a problem for whites, but it affects minorities disproportionately. Without something like an MRI grant, minorities can be locked out of a research career for five or 10 years, or forever."

Dr. Hawkins sees plenty of opportunities in science for minorities. However, he notes, "many minorities are not aware that science and engineering are valid career options. Kids go through secondary school without a clear idea of what persons with academic doctorates do. They do not identify with scientists and engineers the way they do with physicians, lawyers, and businessmen. Until we change that, we are not going to get motivated and qualified people to take advantage of the opportunities at higher levels."

Jean K. Latting
Dr.P.H., University of North Carolina School of Public Health

Graduate School of Social Work
University of Houston
Houston, TX 77204-4492

"I have been interested in social work all my life," Dr. Jean Latting says. "I designed a slide for crippled children when I was eight years old, because sliding was my favorite pastime and I wanted to help kids who could not do it. Then I expanded my interest to designing a home for handicapped kids and orphans."

The attitude of her parents and other role models set Latting's course in life and research. Her father was the first black attorney in Memphis, Tennessee. "He and my mother believed that the worse thing a person could do was not realize her potential," Latting recalls. She applied this attitude to others as well as herself.

As a "child of the sixties," Latting was continually active as a community organizer for causes such as welfare, civil rights, and tenants rights. "I gradually became interested in why people who need services can not obtain those services," she continues. "As I worked at different jobs in the area of human services, my focus shifted to workers who wanted to give the services but were hampered by bureaucracy.

At the University of North Carolina School of Public Health, Latting studied the development of organizations and what they do to motivate or turn-off people. As an assistant professor at the University of Houston, she applied for an MRI grant to investigate motivation among human services workers at a large nonprofit agency in Houston, Texas. She is testing the effects of a training system and extrinsic incentives on the motivation and performance of those workers. Latting plans

to apply the results in government and nonprofit agencies. "I feel like a missionary about this," she remarks. "I want to find out ways to improve services in nonprofit and government agencies—ways that save both money and get the best out of workers."

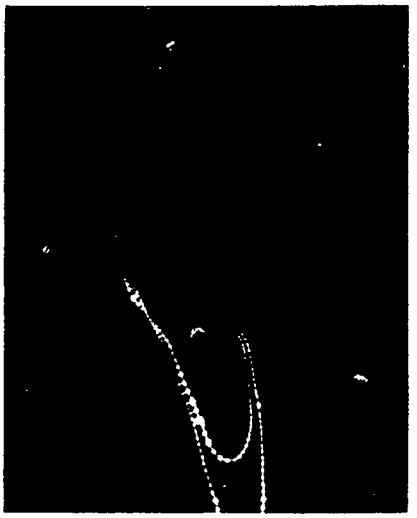
Dr. Latting says the MRI award "gave me the resources to do what I thought was possible." She believes that such awards are necessary to help minorities overcome obstacles that are unique to them. Despite the availability of such help, however, she does not think the outlook for minorities is promising. "We need a policy at the national level," she maintains, "which is dedicated to educational reform for both minorities and majorities.

Alley Mack
Ph.D., Texas A&M University
Department of Political Science
Jackson State University
Jackson, MS 39217

Dr. Alley Mack, now Chair of the political science department at Jackson State University, believes that you cannot teach political science without getting involved. Her involvement goes back to the civil rights movement of the early 1960's when she attended Grambling State University in Louisiana. Mack kept politically active in graduate school at Atlanta University, where she earned a master's degree in 1964, then as a teacher at Prairie View A&M University in Texas.

In 1967, Mack enrolled in the doctoral program at Texas A&M University. There she became interested in how the behavior and attitudes of politicians affect the legislative process. After receiving a Ph.D. in 1969, she taught at Langston University in Oklahoma, then at Jackson State in Jackson, Mississippi. She was in a good position to observe the result when districts in Mississippi switched from single to multiple member representation in the state legislature. The movement, which started in 1975, spread throughout the South.

Mack saw this change as a fertile area for research. At Jackson State, she applied for and received, in 1982, an MRI grant to make a comparative assessment of legislators in seven southern states. "We looked at how their race, backgrounds, and perceptions of race impacted legislative decisions," she explains. "Because of a full teaching load, I would not have been able to collect data first hand without the grant. Questionnaires would not have provided the same insight as seeing, listening to, and questioning the legislators in their own environments."



Dr. Mack sees the outlook for minorities in science and engineering as excellent because of small numbers and increasing demand. She thinks low salaries are a major problem in filling that demand as far as university doctorates are concerned. "The U.S. Office of Education, has initiated a program to entice minorities in college to pursue advanced degrees in science then go into teaching," she notes. Other programs are aimed at informing high schoolers about careers in science and engineering. However, the appeal of such careers is dimmed by low salaries. To attract more scientists and engineers into academia, there should be a concerted effort to raise salaries to levels comparable with those in industry."

Edwardo L. Rhodes
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School of Public and Environmental Affairs
Indiana University
Bloomington, IN 47405

Dr. Edwardo Rhodes studied biostatistics at age 14 because of the Soviet launching of Sputnik. "I grew up in a segregated neighborhood in Pittsburgh where the schools had poor science programs," he recalls. "When the Soviets orbited the first satellite, the Board of Education grabbed ninth and tenth graders with reasonable grades in science, and sent them to a summer science program at the University of Pittsburgh. I learned statistical techniques that usually are not taught until the junior year in college."

When he entered college, however, Rhodes wanted to be a career diplomat. "I was born in the Philippines, so I had an interest in East Asian affairs," he explains. "Between his junior and senior years, Rhodes served in Washington, D.C. as a U.S. Department of State intern in the East Asian bureau. "This experience caused a collision between college perceptions and reality," he says. "I found that the reality did not fit my personality."

After four years in the Navy, Rhodes decided to study public policy because "I realized that my interest in Asia was primarily economic." He received a Ph.D. degree from Carnegie-Mellon University in 1978. After various jobs and fellowships, he came to the School of Public and Environmental Affairs at Indiana University in Bloomington in 1986. Here he received an MRI grant to study efficiency difference in higher education. "I was back doing the kind of quantitative analysis I had done doing my Sputnik summer," he comments.

Using an analysis technique that he had developed earlier, Rhodes was able to manipulate as many as 10 criteria simultaneously, and to rate hundreds of public and private universities on these criteria. "I simply could not have done this without MRI support because of the time, money, and travel required," he states.

Dr. Rhodes expresses alarm at the "57% drop in black males receiving academic doctorates in a recent 12 year period." "This," he adds, "is primarily counter-balanced by the number of foreign nationals receiving doctorates and staying in this country. Universities are filling their needs from this labor pool, reducing the imperative to recruit U.S. minorities. Unless we address this situation, the outlook for minorities in science and engineering is bleak."

John H. Stanfield
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Williamsburg, VA 23185

In the fourth grade, Dr. John Stanfield started writing short stories that showed his interest in social science. However, his mother did not see it that way when he wrote about the eating rituals of cannibals. That interest was formalized in junior high school when he received the highest score in his class on a New York State test in social science.

The Stanfield family moved to California in 1967 to take advantage of lower educational costs and greater integration. Stanfield started out as a pre-law major at California State University at Fresno because he considered social sciences "too easy for me." But he continued writing about social problems as a hobby and could not resist social analysis of people in various financial and cultural situations. "I finally decided that I should do what came naturally," he recalls, "rather than pushing myself into a more lucrative career." Stanfield received a bachelor's degree in sociology, then went on to a doctoral program at Northwestern University in Evanston, Illinois.

In graduate school, his interests evolved to issues related to philanthropy and science, particularly how the values of financiers shape the development of race relations research. After leaving Northwestern, Stanfield held faculty posts at several

universities, including Yale. In 1984, while at Yale, he received an MRI grant to study the role of philanthropy in the development of social science research in black and white institutions prior to World War II. "The award made my career," Stanfield states. "Without it, I would not have had the funds or time to do careful work that produced well-received books and papers."

Dr. Stanfield now holds an endowed chair at the College of William and Mary in Williamsburg, Virginia, where he is building a doctoral program in American studies in sociology. He acknowledges the need for more minorities in science and engineering but does not think an increase in numbers goes far enough. "To obtain significant influence on knowledge production," he asserts, "minorities must hold high positions in the best universities and colleges, the most elite research laboratories, major foundations, and government funding agencies. Until that happens, increases in numbers will not mean much. It is not a matter of numbers, in my opinion, but of power and influence."

Gail E. Thomas

Ph.D., University of North Carolina at Chapel Hill

Department of Sociology
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Dr. Gail Thomas is trying to understand how blacks commit to college majors in science. To do this, she probes the attitudes and motivation of students as well as the impact of schools, parents, and significant others. Her research shows that kids begin to develop the interests that influence career choices earlier than generally believed. "Any effort to guide or reinforce that choice must start early—even in kindergarten," Thomas says. "Before getting on 'bandwagons', such as the movement to bring more women and minorities into science and engineering, we need to understand more about how these individuals perceive the costs and benefits of investing in these careers."

Thomas herself was turned onto science at an early age by a cousin who majored in chemistry in college. She also was influenced by teachers who motivated her with special events such as science days, or letting students play the role of teacher. At North Carolina A&T State University in Greensboro, she decided to major in social science rather than biology because she perceived the female biologists that she knew as cold and unhappy. Thomas was favorably impressed by a male sociology professor who made obvious efforts to motivate students to learn. She had the opportunity to go to a top law school, but the success of this sociology professor as a teacher and mentor pointed her toward sociology. Thomas received her master's and Ph.D. degrees in sociology from the University of North Carolina at Chapel Hill.

Dr. Thomas' Ph.D. research involved a study of how racial and sex differences relate to educational attainment. "This work fits into the same intellectual theme as my work on the choice of a science major," she notes. However, before applying for the MRI grant, she did research at Johns Hopkins University for 12 years and spent a year as a visiting scholar at the National Academy of Sciences. She applied for MRI funds while at Hopkins, then moved her research to Texas A&M University, where she is now a professor.

"The MRI award came at a critical time for me, in terms of getting into the grant network," she remarks. "Receiving it was the vote of confidence I needed to continue a study on which I was already collecting data. And it paved the way for further funding." She believes the results of her work will help policymakers "to more effectively capitalize on the talents of minorities who are interested in science and technology."

Norma Williams
Ph.D., University of Texas at Austin
Department of Sociology and Social Work
University of North Texas
Denton, TX 76203-3408

Dr. Norma Williams disagreed with the literature on the sociology of Mexican Americans. In 1975, she told her class at Texas A&I University in Kingville: "One day I am going to write a book that disproves stereotypical notions about Mexican Americans." Fourteen years later, with the help of an MRI grant, she has done it.

Growing up, her parents put great value on education. Her mother wanted Williams to become a teacher. With that goal in mind, she began taking classes part-time at Texas A&I in 1964 while working full-time. However, the family was short of money, and Williams felt exhausted after three years. She left Texas and went to work as an administrative secretary in California.

Every Sunday, her mother urged Williams by telephone to come home and finish her education. After six years, she relented and went back to A&I. "A course in social problems introduced me to sociology," Williams recalls. "I began reading the literature on Mexican Americans and to reflect on my own cultural background and experience. That is when I decided to set the record straight."

She finished a bachelor's degree in education in 1975, then she earned a master's in sociology the following year. After working as an instructor at A&I and as a supervisor at a telephone company, Williams enrolled at the University of Texas at Austin in 1978. For her thesis, she interviewed and observed Mexican American families in and around Austin.

Williams received her Ph.D. degree in 1984, then took an assistant professorship at Texas A&M University in College Station. There she applied for an MRI grant to continue her thesis research. "The award freed me to replicate my Austin study in Corpus Christi," Williams explains. "It also provided the incentive to write that book, which is titled *The Mexican American Family: Tradition and Change*."

Dr. Williams, now at the University of North Texas, provides young minorities with information about college, financial aid, and careers in science that she had to learn the hard way. "I counsel my young relatives and students, their friends, and the families that I interview," she says. "This should be done on a national level. We should contact students in the sixth grade and make sure that they and their parents receive the continuing guidance that they need to go to college."

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Dr. Ernest Wilson got the idea for his MRI research while hitchhiking through Africa. When he finished his work as a Michael Clarke Rockefeller Fellow in Zaire, Wilson spent six-months wandering though West Africa. "I was struck by the dominance of government intervention in Zaire as opposed to the lack of it in Ghana and Nigeria," he recalls. That was in 1970-71, following his graduation from Harvard University. Fourteen years later, Wilson won the funds he needed to try to explain the differences.

Africa was a natural subject for him to study. His father, director of foreign student services at Howard University, traveled extensively there. Wilson also came to know many African students at Howard. After completing undergraduate work in government at Harvard, he decided to see the continent for himself.

After his return, Wilson worked at the New York Times and on Capitol Hill, but the lure of research on Africa pulled him to graduate school at the University of California at Berkeley. He returned to Zaire and Nigeria to do Ph.D. research on state-owned enterprises in the energy sector.

After graduate school, Wilson moved on to a faculty position at the University of Pennsylvania where he published articles and a book on the international oil market. In his mind, the energy issues were inseparable from government intervention in the economy. Accepting a faculty position at the University of Michigan, he applied for the MRI grant that enabled him to travel through Tanzania and

Zambia, where government influence dominates; and Nigeria and the Ivory Coast, where it is not as strong. "The MRI award made it possible for me to do unique research," Wilson states. It also contributed to his obtaining tenure at the University of Michigan where he now directs the Center for Research on Economic Development.

Dr. Wilson also participates in a summer research opportunities program that encourages minorities to pursue careers in science. He feels that such programs are vital to combat a drop in the number of minorities who earn doctorates. "A study I did for the Ford Foundation found evidence of a decrease in the number of minorities who received academic doctorates in social sciences from 1974 to 1989," he comments. "I suspect that the same is true in science and engineering. To counter this situation, universities need to take more active roles in exposing minority undergraduates to the opportunities and satisfaction of working in basic research."

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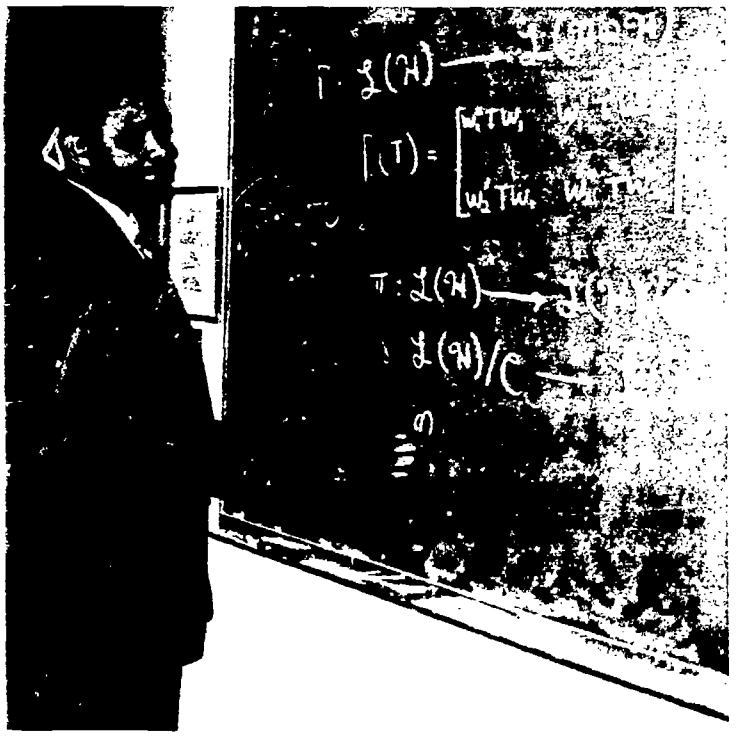

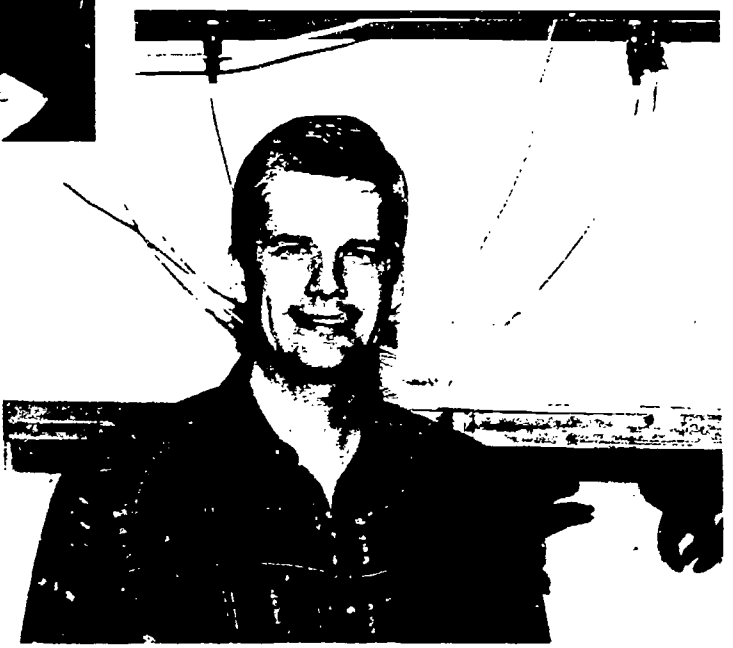

IN THE WORK PLACE . . . .