ACTIVE VOICES II

Scientists of the Future: Jumping High Hurdles

If there's one message that has emerged from the past 20 years of trying to bring minorities into science, it is this: Efforts to stem the hemorrhage of students out of the pipeline must start early and continue through college.

To become a scientist, students must choose science and math as early as middle school and keep choosing them again and again. Unfortunately, at almost every critical transition, minorities opt out of science in greater proportions than their white classmates. Between freshman and junior years in college, 65% of the minorities initially interested in science and engineering abandon those plans, compared with only 37% of whites who exit the science pipeline at this point, according to longitudinal data gathered by the Department of Education and analyzed by the National Science Foundation (NSF).

To find out why, *Science* talked to dozens of minority science students from high school through graduate school, asking what kept them on track—and why their friends dropped out. Unlike their parents' generation, today's students report relatively little overt discrimination. But many see an insidious set of academic and social obstacles blocking their path: third-rate early educations, low expectations from teachers, anti-intellectual peer pressure, and a cultural gap between the world of research and that of their families.

Yet each of the young scientists has overcome those hurdles—so far—with help from scholarships, minority role models, and research programs. Their stories offer dramatic proof that even children from the harshest backgrounds can make the journey to the world of science.

From gangs to engineering. Five years ago, a 13-year-old boy named Robert White was stealing cars and fighting in a gang in a St. Louis ghetto. At night, he hung out on street corners; during the day, he slept instead of going to school. At the end of ninth grade at inner-city Beaumont High, his GPA was 0.8 out of 4.0.

Today, at 18, White is a freshman at Morgan State University with a NASA scholarship and big plans: major in electrical engineering, get a Ph.D. in chemical engineering, and, one day, start a business of his own. For White, the change began when he was taken in by a new family. Suddenly, all the expectations were different. In his new home, 7 a.m. meant it was time to catch the bus to school. Saturday mornings, he went back to school for extra math drills, taught by his chemistry teacher Edward Haynie. Sunday afternoons, White would work on chemistry experiments or go to a barbecue at Haynie's house.

"Suddenly I had people who cared about me," he says. "I wanted to go to school then. I had a family at home, and I had another family at school." His chemistry project on purifying thyroid hormones started to win awards. His GPA zoomed to 3.6—not counting that disastrous freshman year—and the NASA scholarship got him to college.

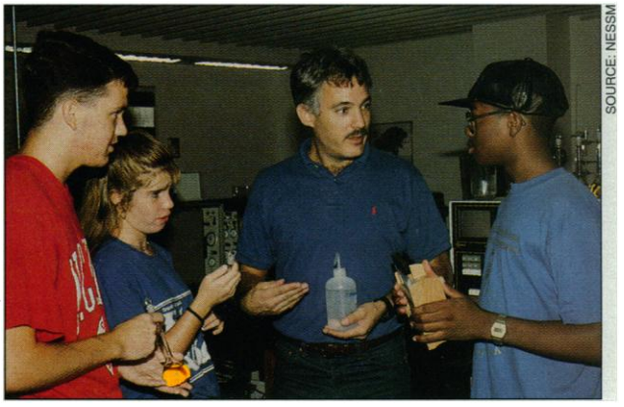
Peer pressure. To get out of the ghetto, White had to leave his gang, but even law-abiding high schoolers must confront the issue of peer pressure. Among many teen cliques, taking advanced classes and being an A student—in any subject but especially in science—is definitely not cool.

"People say you're acting white," says Anthony McCluney, 17, who attended a mostly black public high school in Shelby, North Carolina, for his first 2 years. He was in the precollege track, so he spent the day with white classmates and had white friends. As "the smart black kid," he learned social tricks to survive. "People ask you how many points you got on a test, you'd just say, 'I did well.' "

McCluney is now a senior at a public residential high school designed for talented science students, the North Carolina School of Science and Mathematics. He finds the social atmosphere a big relief: "Here it's considered good to be smart."

The few students who successfully run the peer pressure gauntlet in high school say their classmates are perfectly capable of doing the work. "We're the dumb ones," says Howard Manning, another Beaumont senior, who plans a major in microbiology. "I know so many guys who are so smart, who could run circles around me in every setting you could name. Lots of people could do science better than us." Manning describes what the statistics suggest: The pipeline leaks steadily during the teen years, so that by senior year in high school, many talented students are already lost. Just between sophomore and senior years in high school, the number of minorities interested in science and engineering drops by about one-quarter, according to longitudinal studies by the Department of Education and the NSF that followed the high school sophomore classes of 1972, 1980, and 1982. Among white students the pool shrank by 19%.

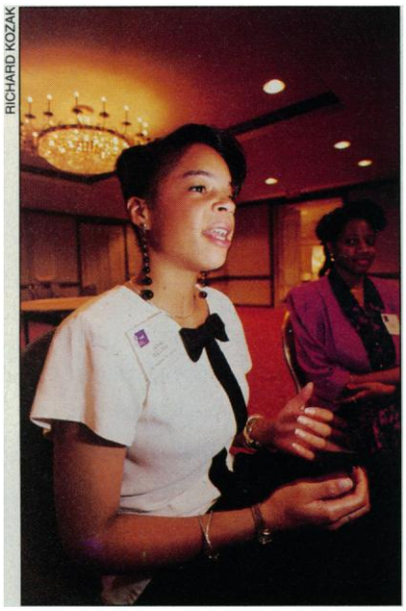
Overt discrimination is on the wane, but students report insidious obstacles on the pathway to science.



SOURCE: NESSM

Social science. "It's *good* to be smart" at the North Carolina School of Science and Mathematics, teens say.

Gender gap. Students agree the peer pressure is more vicious for boys than girls. Girls can get away with doing academics while for boys, sports is everything. Even within one family, girls seem to rise to academic heights more easily than boys. For example, Jamilla Martin has a string of academic awards and fellowships, including an extremely competitive 4-year merit scholarship to Duke University, where she's now a junior chemistry major. She also has a younger brother, age 15, back home in the San Francisco area. "We're the exact opposite. He's not into school at all. He's very good at sports. It's just more OK for the girls to be smart."



RICHARD KOZAK

Comeback kid. Jenae Williams switched to art, but she's back in science now.

The data back up Martin's impressions: In 1991, 4662 black men took the Graduate Record Examination (GRE)—the graduate version of the Scholastic Aptitude Test—compared to 10,085 black women, according to GRE. Even in science fields—where overall there are far more men than women—minority men, especially blacks, are relatively scarce. In 1991, about 550 black men took the GRE in physical science compared to 610 black women.

Poor preparation. Even if students do take science and math classes in high school, they may not learn what they need to know. Good science classes take money—for teachers trained in science, for labs, for up-to-date textbooks—and schools in poor neighborhoods often can't compete. At Beaumont, books are torn hand-me-downs from other schools, says senior Kamafi Byrd, 18. "Our physics books mention Jan and Dean. That's like, what, the 1960s?"

In his black inner-city high school in Buffalo, algebra class was "a joke" because the teacher couldn't control a few rowdy students, remembers Tommie Royster, 34, now a Ph.D. research chemist at Eastman Kodak Co. in Rochester, New York. Other young minorities tell similar tales of teachers who didn't know their subjects and homework so simple they finished it during lunch. Overall, schools with higher minority enrollments offer students fewer challenging courses in math and science, according to a 1990 study for the Rand Corp.

Such lackluster preparation can shadow students for years and helps create the next big kink in the minority pipeline, which comes in early years of college. "I was just blown away when I hit college," says Royster. Thanks to his shoddy algebra course, he did "miserably" on his first calculus test at the State University of New York, Buffalo. The professor told him he should have learned most of the material years ago. Royster got a textbook and taught himself algebra and later got the highest grade in the class in differential equations. But he remembers friends from high school who just faded out of science courses or out of school altogether. "It shouldn't be that way. It shouldn't take so many personal resources to overcome the system. We were not given equal opportunity."

Role models and mentors. Those minorities who have stayed in the pipeline often credit someone—a parent, teacher, or mentor—who wasn't satisfied unless they did well. High school senior Erin Locklear, 17, a Lumbee Indian from Fairmont, North Carolina, remembers teachers telling her American Indian friends to "just do what you can." She herself ignored this advice, because her parents expected her to excel. "I'd come home with a 97 on a test and my dad would say, 'Where are those other three points?' "

Many young minorities say it's important to see successful scientists of their own race and even gender. Robert White says he didn't trust white people when he was a young teen—"all the cops were white"—and didn't listen much to women either. "That's why I was so attracted to that guy, Mr. Haynie. That guy is wonderful as a male image. He knows a lot and you can go to him about anything."

Mentors are especially important when things go wrong. Jenae Williams is now a senior life sciences major at Pennsylvania State University, but a few years ago, "I dropped out. I was going into art." But the minority affairs counselor at Penn wouldn't let her get away without a lecture about what she was giving up in terms of job prospects. "He probably doesn't even know how much influence he had on me. He gave me a speech, and I stayed," Williams says.

Low expectations. From high school on up, minority students report that neither teachers nor classmates expect them to do well in science. And those

Culture Shock: Living in Two Worlds

Graduate student Sondra Mattox hit writer's block with a vengeance last summer while finishing the last chapter of her dissertation in experimental psychology. After 5 years, she was planning to quit the University of North Carolina, Chapel Hill, without her Ph.D.

Finally, she realized she was balking at leaving the world she grew up in. "I am an African-American, and a woman, and a pharmacologist, and a Christian. I had to come to realize that I am all these things, and it's OK. I had to reach a point where it's OK for me to be different."

Mattox pulled herself together, defended her thesis in October and is headed for a prestigious postdoc at the Addiction Research Center in Baltimore. But she'll have three or four separate parties instead of one big dissertation bash. Her circle of friends includes bus drivers, housekeepers, and activists in the black community, as well as scientists. "My groups don't mix," she says.

Minorities in science often live in two worlds: The world of their community and the world of science. Bridging the gap can be tough, but many say they're determined to hang on to the music, food, and religion they grew up with. "When I go home I'll still have my culture. I'll teach my kids the gospel songs," says Ericka Russell, senior biology major—and gospel singer—at Penn State.

Black students in particular say they appreciate knowing about the contributions of black scientists. Brian Gaffney, freshman at Morehouse College for black men, explains why he's so inspired to hear about the contributions of Africans to mathematics: "It's like, damn, *we* did all this! We're not *supposed* to be dumb in math and science!"

But if blacks are perhaps most forceful about the culture issue, some Hispanics also echo the feeling of living two separate lives. "At school I was Miriam the graduate student; in the neighborhood I was Miriam the dancer. You're a dual personality," says Miriam Rivas, 38, postdoc at Rockefeller University, who grew up on New York's Lower East Side and loves Puerto Rican folk dance.

Like many minority scientists, she clings to both worlds. "It's like I need science for my intellectual self and I need the Puerto Rican things for my soul."

–E.C.

expectations sink even lower when affirmative action enters the picture, at least according to some. "People assume you got where you are because of affirmative action," says Williams. "Instructors will not consider that you have the same ability [as white students]. And if it comes time to need a lab partner, nobody's going to choose you."

Many young minorities have mixed feelings about affirmative action: It may tarnish their accomplishments, yet many need a boost to get to a level playing field. "If you start off a race late, someone must be artificially sped up or someone else must be artificially slowed down," says physics graduate student Donnell Walton of the University of Michigan. But Walton and other students say the place for affirmative action programs is early in education. By hiring time or by graduate school, institutions should not lower standards, they say.

Ex-football player Walton is no stranger to low expectations, since he confronts the "dumb jock" image as well as racial prejudice. Because he has a muscular build, people assume he's an athlete instead of a physicist. "On top of being African-American, I'm also not a small guy. [I'm] just novel to people, totally different from the imagery in the media." As a result, when he studies with other students, "It's hard for people to believe that, no, it's not a coincidence that I've got the correct answer and, yes, I'm slightly ahead on this particular material."

Image problem. After graduation, only a fraction of students, white or minority, choose graduate school. But the minority pipeline shrinks more than that of whites, by 88% as compared to 71%, according to the Department of Education studies. And again, a host of factors are likely to be involved, including economics: Students from less affluent backgrounds need jobs, say officials like William McHenry, pipeline expert at NSF.

Another reason may be simply that minorities don't know much about research careers. "You can go home and watch TV and find out what a lawyer or doctor does. You can't do that with research," says Duke senior Torraine Williams, who once wanted to be a doctor but is now headed for a research career. Crystal Moffett, a junior biology major at Clark Atlanta University, agrees. When she goes home to rural south Georgia, a typical conversation with local adults about her future might run something like this: "I say 'biology.' And they say, 'Oh, you're going to be a doctor.'

'You're going to be a doctor but you're not practicing medicine? Well then, what are you studying biology for?'

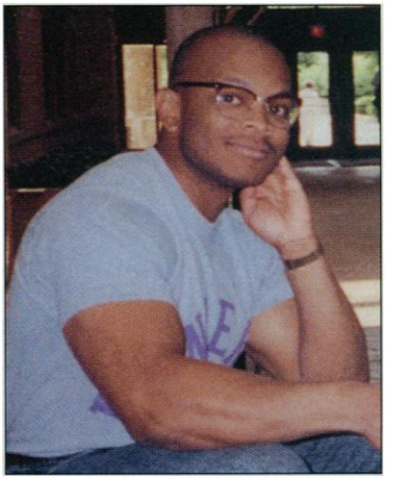
'You know what you should do? You should go into business.' "

One solution: get students to do research. A host of programs already do this—and students give them high marks. Cynthia Staton, senior in chemistry at North Carolina State University in Raleigh, credits a summer spent on an AT&T fellowship for keeping her in chemistry and helping her plan for a career in plastics or textiles: "Before, I'd thought about switching majors because I didn't know what I could do with a chemistry degree. Everybody kept saying, 'Oh, you could go into so many fields,'—but nobody ever said exactly what fields."

For those who do choose graduate school, there's a bright spot at the end of the pipeline: The proportions of minorities and whites who make it through grad school are similar. Of course, by grad school the numbers of minorities are vanishingly small. In physics and astronomy, 862 doctorates were given to U.S. citizens last year. Just 19 went to Hispanic students, nine went to blacks, and one went to an American Indian, according to National Research Council data.

But even if they aren't dropping out in large numbers, minority grad students say they continue to face difficulties as they move into scientific careers.

Conference blues. For example, to some minority students, a scientific meeting can be hell on earth. Everyone else seems to know each other, most attendees are more senior, and the student is usually the lone black or brown face wearing a badge. "I hate conferences," says one young black physicist. "It's a serious reason why I'm thinking of leaving research physics."



Smashing stereotypes. Athlete-scientist Donnell Walton is no dumb jock.

"I went to one for 3 days and no one spoke to me." he added. "Then I gave my talk and people noticed me. But what did they think for 3 days, that I was the help or something?"

Even older minority scientists mention meeting strategies as important to their success. Kenneth Olden, now director of the National Institute for Environmental Health Sciences, says minorities—or anyone who is different—need to be extra assertive to succeed. Even today, when he's usually the keynote speaker, "I have to walk over and introduce myself and people will discover that, yes, I can talk, and, yes, I know some science. Even now, every time, in a new group, I have to break the ice. No one else will do it first."

Safety in numbers. Another way minorities cope is by seeking out others like themselves. For example, Lewis Johnson and Walton are in physics graduate school on the buddy system—even though Johnson is at Duke and Walton at Michigan. They met as undergrads at North Carolina State University, the only two black physics majors there in recent memory. "Everybody was always comparing me to him, before I even met him," remembers Johnson. But it was Johnson who got Walton thinking about graduate school—"I think he's my role model, even though he's younger than me," says Walton.

Why should young black students need black friends? Johnson summed it up in a letter to the editor of the school paper last year, saying that to have a conversation about rap music and free electron lasers—and have the other person understand both topics—"gets me through a whole year."

So even the vicious cycles that push minorities out of science can run in reverse. At Robert White's old high school, the NSF-sponsored Incubator Scientist program that led him to engineering is turning peer pressure to advantage. This year, students like senior Bridgette Taylor urge younger classmates to enter the science program. "I used to say to everyone, 'You want to play basketball? You want to cheer lead?' Now I say, 'You want to be a scientist?' "

–Elizabeth Culotta