COMMITTEE ON THE STATUS OF MINORITIES IN ASTRONOMY

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SPECTRUM

A report on underrepresented minorities in astronomy

Diversity Through Outreach: Center for Adaptive Optics at UC Santa Cruz Partners with Hartnell Community College

by Laura Lopez, University of California at Santa Cruz

According to a recent National Science Foundation survey[1], more than half (51%) of the Latino students who earn bachelors degrees in science and engineering (S&E) fields attend community college first. Other races/ethnicities are not far behind: 45% of Native Americans, 44% of African Americans, 43% of Whites, and 40% of Asian Americans go to community college before obtaining S&E bachelors. In conjunction with the fact that record levels of minorities are attending community colleges, these statistics highlight the important role of community colleges in the pipeline toward S&E careers. Consequently, outreach efforts directed toward community college students can be especially effective at encouraging minorities to pursue S&E professions.

With this goal in mind, Dr. Anne Metevier (NSF Astronomy & Astrophysics Postdoctoral Fellow at the NSF Center for Adaptive Optics, University of California, Santa Cruz) began an intensive astronomy short course in 2004 at Hartnell Community College, a minority-serving institution in Salinas, California. The summer class is six full days long, and it features astronomy lectures to learn scientific content, career talks to discuss job paths in astronomy, and hands-on astronomy activities to demonstrate the inquiry process. In this article, we highlight the approaches and the successes of this program, with emphasis on how one can organize a similar course at his/her local community college.

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Goal #1: Good Science. Goal #1: Diversity

by Claudia Dreifus, New York Times

There's something striking about the laboratory of Michael F. Summers at the University of Maryland, Baltimore County. It's not the giant nuclear magnetic resonance machine that he uses to visualize molecules; it's the faces of the people who work there.

Fifteen of the 32 researchers in Dr. Summers's biochemistry lab, including a postdoctoral student and 3 Ph.D. candidates, are black. In the halls of American science, such representation is rare.

Dr. Summers, 49, works on two tracks: trying to cure AIDS and trying to create more diversity at the research bench. When he is not in the lab, he takes to the road with the university president, Freeman A. Hrabowski III, pushing universities to set up programs for minority students who are inclined toward science. At U.M.B.C., the Meyerhoff Scholarship Program has provided an intense scientific education to about 800 undergraduates so far.

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- *Learn about diversity-related outreach efforts at UC Santa Cruz.*
- *Read about how to apply "scientific thinking" to diversity efforts.*
- *Find out how meritocratic principles square off against the realities of admissions practices at the nation's elite schools.*
- *See the continuing importance of minority-serving institutions in the preparation of future generations of faculty of color.*

Diversity Through Outreach at CfAO (cont'd)

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Students and Instructors

Short course students are recruited from astronomy, physics, engineering, and math courses at Hartnell as well as from classes of graduating seniors of area high schools (such as Salinas High and North Salinas High). In the three years since the course began, 47 students total have enrolled. The demographics of the students reflect those of Hartnell Community College and the Salinas area generally: more than half are Hispanic, one-quarter are White, one-tenth are Asian, and a small percentage are African-American or Native American. The majority of students are 18-24 years old, although a handful are older, returning students. Approximately one-quarter of the short-course students are female.

The short course instruction team is comprised of roughly five people, including astronomy graduate students from UC Santa Cruz and UC Berkeley as well as physics faculty from Hartnell, including Dr. Pimol Moth. From 2004-2006, Dr. Metevier was the lead instructor of the course; in 2007, the lead instructor will be Candace Church, UCSC astronomy & astrophysics graduate student.

Course Format

The central activity of the Hartnell astronomy short course is an inquiry-based research project in which students pursue one of three content areas: galaxy morphologies, active galaxies, or galaxy clusters. If the course is emulated elsewhere, the projects could be switched easily to match the resources and the instructors' knowledge at the host institution. No prior knowledge of astronomy is assumed, but by the end of the course, students have learned many advanced concepts in modern astronomy. To complement the research activities of this program, students participate in galaxy and cosmology-related lectures, guided labs and demonstrations, and trips to planetarium shows and to nearby Lick Observatory. Throughout the course, instructors and guest speakers also give career talks in which they detail their own professional paths and personal decisions (such as financial and family choices) that guided their way. Figure 1 shows a typical schedule of these activities for the six full days of the course at Hartnell. The research, lecture, and career components of the class combine to engage students in the scientific process and to convey science as an attainable and exciting profession.

Throughout the course, students are encouraged to synthesize their knowledge and to develop their communication skills via writing abstracts, poster/oral presentations, and discussion of inquiry results in groups. These activities are designed to reflect the ways scientists convey results to their peers, and the students gain confidence and ownership of their work through these tasks. As many of the students' first language is not English, these communication activities also strengthen students' speaking and writing abilities.

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Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
• Icebreakers to meet students • Intro lecture on astronomy • Assessment activities on students' questioning and graphing skills • Guided lab on light and spectra • Career talk: Higher education pathways	• Inquiry starters: students ask questions about astro images • Students choose research questions to investigate, divide into research groups, & meet advisors • Lecture on telescopes and observing • Trip to Lick Observatory	• Lecture on cosmology • Students begin inquiry investigations • Practice writing abstracts • Career talk on observational astronomy	• Galaxies lecture • Continue inquiry investigations • Planetarium show at Hartnell • Worksheet on cosmic distance ladder • More work on abstracts • Career talk on teaching jobs	• Continue investigation • Students prepare posters for presentations • Assessment activity: students repeat task from Day 1 for evaluation of skills gained • Career talk on theory & simulations	• Lecture on universe's fate • Students give presentations; share results from inquiries • Instructors give talks on science content and research skills learned from inquiries • Quiz over class material & student survey

Figure 1. *Typical daily schedule of activities in the Hartnell astronomy short-course.*

Goal #1: Good Science. Goal #1: Diversity (cont'd)

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Q. *Define the problem, please.*

A. The big thing is that the way beginning chemistry, calculus and physics are taught at most colleges is discouraging. They are taught as gateway courses, and they are structured to weed out students. The Chem 101 professor gets up at the first session and says, "Look around you; only one person here is going to end up a chemistry major."

SPECTRUM

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That's discouraging to everyone, but for the African-Americans, it's really negative. These are young people who — because of history — may already feel that society has low expectations of them. The crunch comes after the first exam when the black youngster might pull a C and when some of the whites and international students get A's. When he or she goes up to the professor, he says, "Listen, you passed, what's your complaint?" And the student thinks, "Maybe the professor is right, I don't belong here."

Q. *What should the professor have said instead?*

A. "How many hours a night are you studying?" "Can I help you find a study group so that you can do better?"

Q. *What do you do differently in the Meyerhoff program?*

A. We take minority students — those with very high SATs and high school grades — and we offer them full scholarships. We compete for them with the Ivy Leagues and we focus on retaining them as science majors. We provide the same kind of nurturance they might get at the traditionally black colleges, but we do some extra things, too. In the summer between high school and college, we have a "bridge program" showing the students what it will take to excel in science. We say, "we expect you to get A's," and we show them how to study so they'll get them.

Then, at the end of the first year, they develop research projects and find a professor to accept them into their laboratory. There, they'll get hands-on experience with experimentation and discovery — plus they'll find mentors.

Q. *Why move them into the lab so quickly?*

A. Because the president of this university, Freeman Hrabowski — who is himself a mathematician and statistician — believes it takes a scientist to make a scientist. He knows that mentoring is a key element of any scientist's training. In the past, black students sometimes had trouble finding a

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The Color of Our Classroom, the Color of Our Future

by Dolan Hubbard, reprinted with permission from Academe Online

Historically black colleges are key to producing African-American faculty.

Historically black colleges and universities (HBCUs) constitute only 3 percent of U.S. colleges and universities, yet they enroll 28 percent of all African American students in higher education and educate 40 percent of the black Americans who earn doctorates or first professional degrees. Just fifteen HBCUs accounted for half of the institutions that ranked highest in graduating African Americans who obtained a PhD in 2003–04 (http://www.webcaspar.nsf.gov/). These statistics show just how important the black colleges are for producing African American PhDs and training black leaders. But these colleges are struggling to survive, and the loss of HBCUs could mean the disappearance of African American professors from U.S. classrooms.

My own institution, Morgan State University, consistently ranks in the top 10 percent of the nation's HBCUs, of which there are slightly more than one hundred. Designated by the state of Maryland as a public urban university, Morgan was established in Baltimore in 1867, attained university status in 1975, and today has 7,000 students. Its mission is to address the needs associated with the urban community and to educate a relatively broad segment of Baltimore's increasingly diverse population. Part of that mission includes offering programs that increase the number of minority students with graduate degrees in areas of demonstrated need. Morgan State leads all other Maryland campuses in the number of bachelor's degrees awarded to African Americans and accounts for a relatively high percentage of the degrees received by African American graduates in English and other key fields. Historically, Morgan has been a national leader in educating African Americans who subsequently receive doctoral degrees from U.S. universities.

> *"HBCUs constitute only 3% of US colleges and universities, yet they educate 40% of the black Americans who earn doctorates."*

Imagine Freedom

Morgan State has been blessed over the years to have had a strong coterie of faculty who have instilled a legacy of excellence in students from diverse backgrounds. For their students, these teachers have made Morgan a safe harbor and a site where students can imagine freedom. Under the tutelage of their instructors, the sons and daughters of domestic workers, doctors, stevedores, steelworkers, teachers, and small business owners have become pillars of the community. Members of this largely black faculty—most with doctorates from the nation's elite universities—have helped to put their students' experiences into historical context, thereby enabling those who have been two, three, or four generations removed from slavery to understand the forces shaping their lives.

Generations of Morgan students learned that there are no limits to the imagination and no reason they should not pursue any line of intellectual inquiry. Of course, much of this intellectual inquiry is refracted through the lens of the African experience in the New World, a lens that sees America's failure to live up to the promise of august national documents such as the Declaration of Independence and the Constitution. To teach American history within the context of the Atlantic formation without discussing racism would be a failure of nerve.

Minority students, particularly African Americans, have been subject historically to persistent prejudice and discrimination. Their credentials, and even their humanity, have been called into question. The nurturing environment at Morgan, however, encourages students to indulge in flights of critical fancy or, as former Morgan student Zora Neale Hurston wrote in her 1937 novel, *Their Eyes Were Watching God*, to "go to de horizon."

In the exchanges that take place in an HBCU classroom, students are free of the almost incessant pressure to interpret, understand, or represent the true nature of "the souls of black folk." This freedom is evident when students discuss works that some deem racially charged, such as The *Tempest, Huckleberry Finn, Heart of Darkness*, or *Go Down Moses*. It is this space that HBCUs open, a space available almost nowhere else, that allows for the

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wings of the imagination to unfurl to their full breadth. It permits the exercise of freedom, where students learn that they have the capacity to legislate by means of the imagination.

Too many black students' ability to master subject matter and imitate models of success has been affected by limits placed on their imagination. I was one of about a dozen black students to attend Catawba College, a small, church-affiliated college in Salisbury, North Carolina, during the initial phase of integration in the late 1960s. I was the only black student in the MA program in English at the University of Denver in the mid-1970s, and I was one of three black students in the PhD program at the University of Illinois at Urbana-Champaign in the early 1980s. The unifying thread, as I look back, is my loneliness in what, at times, was an inhospitable environment.

This loneliness and attendant isolation that I and others like me have felt speaks to the importance of mentoring and affirmation. (I hasten to add that I tell my students that mentors come in all hefts and hues). Without mentors who can jump barriers, and without African American faculty in the system, young African American students are much more likely to fail. Unfortunately, those who survive this rigorous terrain sometimes fall into the trap of believing the hype: they say to themselves and others who come after them that, against the odds, I made it, and so can you—without coming to grips with a system that does not promote their success.

"The debate about who should have access to higher education presumes that merit and access are mutually exclusive principles."

As I listened to the papers of African American students at a recent conference organized by the Phi Upsilon Chapter of the Sigma Tau Delta International English Honor Society, I could not help but wonder: regardless of where they earned their bachelor's degrees, are African American students who enter graduate schools, especially the most competitive ones, encouraged to pursue their first academic love? Or are they gently steered in the direction of post-1970s area studies such as African American literature, women's studies, African diaspora literature, or postcolonial literature and away from foundational areas in English studies such as medieval literature, Shakespeare, or the Romantics? Against the odds, some, nevertheless, emerge from a PhD program and confidently say, "Reader, I married British literature."

Of course, academic specializations in ethnic area studies were not available to graduate students before the civil rights movement. Students are now free to pursue these options. Although it is right to applaud the opening up of these areas and the important work that has helped to redraw the boundaries of the academic universe, it is worth remembering that students should be allowed the freedom to choose their own paths. Too often, assumptions about race curb the development of students of color and leave them without the guidance of mentors who are sensitive to these issues.

Social Equality

The current debate about who should have access to higher education is framed in such way as to presume that merit and access are mutually exclusive principles, thereby shutting down a meaningful discussion of access and equity. This reasoning stands in opposition to W.E.B. Du Bois's vision of smashing "the color line" in a world where the black subject is excluded from history. The weight given to merit reflects the anxiety white Americans may feel at the prospect of integration and the failure of America to come to grips with the emergence of a truly multicultural society. Exclusion is antithetical to democracy, if by democracy we mean practicing social equality.

Democracy demands that the academy address the obvious underproduction of African American PhDs. African American graduate students should be encouraged to walk freely in all sections of the academic garden. Freer access might just make the difference in whether a student emerges from graduate school with a sense of self-fulfillment instead of a feeling of mere survivorship. More African American graduate students should have the opportunity to experience the joy that comes from the development of the scholarly imagination.

But who will speak in defense of African American students once they enter graduate school? Will they be encouraged to pursue areas of intellectual inquiry that match their passions? Will they continue the weary tradition of being "firsts" in

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Shared Challenges, Shared Solutions

by Wendy E. Raymond and Robert A. Lue, reprinted by permission from The Scientist

At most colleges or universities, a snapshot of graduates who recently entered PhD programs in the sciences won't reflect the diversity seen in the undergraduate population. Even undergraduate science majors, bound for graduate school or not, likely do not reflect the student distribution within each discipline's introductory courses.

Recognizing how common this situation is presents an opportunity to explore whether our shared challenges might be met with strategies based on best practices that have been effective at minority-serving institutions as well as at a handful of traditionally white institutions.

The idea of addressing shared challenges with shared successful strategies coalesced during an October 2004 conference on undergraduate science education at the Howard Hughes Medical Institute (HHMI), where a group of scientists resolved to disseminate information about current strategies that have successfully educated a diverse array of undergraduates who later pursued PhDs. Representing 18 institutions—from large research universities to small liberal arts colleges—the consortium of scientists, or the "Diversity in the Sciences Collaborative," organized three national symposia on "Diversity in the Sciences" for 2005-06, held at Harvard University, the University of Louisiana at Monroe, and the University of Washington. Support from HHMI, the National Institutes of Health, and the host schools enabled more than 60 institutions to participate.

A first step toward our consortium's goal of national engagement is to provide symposium participants with a framework for building an educational community that welcomes students of all backgrounds into the ranks of potential future scientists.

The consortium aims to build on the successes of existing programs with proven track records. Xavier University in Louisiana, for example, served as one model for the symposia. Current national data reveal that decades of well-funded, well-intended diversity programs at majority institutions have generally not contributed significantly to educating scientists from underrepresented groups. Some exceptions stand out.

The successes of the Meyerhoff Scholars Program at the University of Maryland-Baltimore County (UMBC) and the Biology Scholars Program at the University of California-Berkeley provided a source of rich dialog among symposia participants. The programs differ significantly (the Meyerhoff Scholars Program admits only the most qualified entering undergraduates, while all students are eligible for the Biology Scholars Program), but they also employ strategies in common-immediate and continued mentoring, study group participation, and opportunities for research. Both can claim an increased retention rate of underrepresented students with science majors and increased GPAs for these students. Additionally, Meyerhoff Scholars enter graduate study at five times the rate of students who were accepted into the program but decided to attend college elsewhere. To develop new approaches that may be better suited to other institutional settings, rigorous assessment and publication of data on effectiveness from additional successful programs must ensue.

Components of a Successful Program

Symposia discussions revealed important components that contribute to broad-based inclusion of underrepresented students in undergraduate science programs. Though visionary soloists can make a difference, a combination of administrative and faculty commitment is clearly the ideal starting point. Presidential or high-level administrative commitment-in both visionary and financial terms-eases the road to program assessment and change, and faculty commitment leads to inclusive curricular and research initiatives.

> *"Though visionary soloists can make a difference, a combination of administrative and faculty commitment is clearly the ideal starting point."*

This starting point requires an informed, institution-specific context based on the data analysis of recent enrollments, withdrawals, grades, progression through the major, and measures of excellence such as an undergraduate thesis, honors, and peer teach-

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Old Problem, Old Solutions

by Kirsten Weir, reprinted by permission from The Scientist

Failure to question conventional wisdom contributes to persistent leaks in scientific pipeline.

Monique Ferguson nearly slipped through the cracks. Though she was a top student in high school and college, she faced a bumpy road as an African-American woman pursuing a science career in what she felt was "a good-old-boys system." At the University of Texas Medical Branch (UTMB), where she attended graduate school, she was the first African-American to graduate from the department of microbiology and immunology. "It's hard when you don't have someone who looks like you in an administrative leadership position," she says.

Fortunately, the university's committee for diversity in graduate education reached out to her. The committee served graduate students in all fields, but luckily for Ferguson, the founder and chair happened to be a microbiologist. He was the only African-American scientist in the department, but one was enough. "He was the right person at the right place at the right time," she says. She believes his encouragement made all the difference. "I know for a fact that if he had not been my mentor, I would have pursued other options."

"It's hard when you don't have someone who looks like you in a leadership position."

Today Ferguson is an assistant professor in the division of infectious diseases at UTMB. But for every Monique Ferguson who perseveres through the science "pipeline" and emerges successful at the other end, plenty of others are lost.

Women in the United States now earn half of science and engineering bachelor's degrees, according to the National Science Foundation, and 38% of science and engineering PhDs go to females, according to the Commission on Professionals in Science and Technology (CPST). But women represent just one quarter of the science and engineering workforce and, similarly, a quarter of all employed science and engineering PhD holders.

Underrepresented ethnic minorities fare worse. Together African-Americans, Hispanics, and Native Americans make up nearly 26% of the US population but, according to CPST, earn just nine percent of science and engineering doctorates. Kids from underrepresented groups often give up before they've even entered the pipeline, says Lino Gonzalez, a chemist at Genentech in South San Francisco. "They don't believe they can do it. It's not something that they've ever seen, or that anyone in their families has ever done."

Family Support and Family Pressure

Johanna Carmel Egan, an Indianapolis-based chemist and vice president of project management for Eli Lilly and Company, notes that women often feel isolated in graduate school without a robust support group of other women. Then "when you come into industry, you experience the same phenomenon to some extent," she says.

Minority groups also face family pressure, but in different ways. "There's a correlation between race and lower socioeconomic status," notes John Matsui, head of the University of California at Berkeley's Biology Scholars Program, which mentors minority students. Undergrads from cash-strapped families may need to turn down valuable lab experience for part-time jobs, while family members may pressure college graduates to take a job rather than take on debt for graduate school. "A lot is riding on what kind of job you get," Matsui says.

Even supportive families may not understand science or science careers. "My parents were laborers. They supported me, but couldn't sit down with me and teach me calculus," Gonzales says. Avery August, associate professor of immunology at Penn State University, also had trouble explaining his career choices to family. "Our families often don't recognize what it takes to get a PhD, and they don't understand the process," he says. "You have to explain why you're still in college after five years."

Lots of Noise, But No Real Change

It's clear that many factors conspire to push underrepresented groups out of the pipeline, but the challenges aren't new. "There's been a lot of noise [about increasing diversity] for years, but there has

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The Scientific Approach

by Clifton A. Poodry, reprinted by permission from The Scientist

It's time to apply our scientific thinking to designing diversity programs. Here's how.

Despite our scientific training, when we think about ways to build a more diverse biomedical research workforce, we may base our ideas on sentiments and preconceptions rather than the best evidence. One way to avoid this is to approach the challenge of increasing diversity as a scientific problem.

The first step is to understand the scope of underrepresentation, which is discussed elsewhere in this supplement and in National Science Foundation reports. What's clear in that data is that achieving proportional representation among new PhDs in the sciences would require us to produce about 1,700 additional minority PhDs per year, and even at that rate it would take many years to achieve parity in the workforce.

National Institutes of Health undergraduate training programs at minority-serving institutions provide a total of 800 slots for juniors and seniors and should lead to 400 baccalaureate degrees per year. If every one of these students were to progress on to a science PhD, these programs would contribute significantly to diversity. But not all students given a supported research opportunity go on to a research career, and we can't assume that the NIH trainees who do go on to a PhD represent an increase above a historical baseline. Moreover, tracking individual participants, while valuable in many ways, will not tell us whether the effort increased absolute numbers.

"Just as we publish our scientific results for others to scrutinize, evaluation and sharing of outcomes must be critical elements of our diversity strategies."

The second step is to build upon the work of others. There is a growing literature on the barriers that minorities and women face on their career paths, and also on how and why specific interventions succeed. But much of the literature is for specialists in various fields of psychology and sociology and needs to be critically reviewed and made more accessible to scientists in other fields who are interested in contributing to change.

Next, we must identify what each program is intended to achieve. All big problems such as cancer, heart disease, and AIDS must be attacked on multiple fronts by discrete but coordinated efforts. Underrepresentation is a similarly huge, complex problem, and it makes no more sense to expect that a single intervention - improving the research infrastructure at minority-serving institutions, for example - will solve it than it would for a single intervention to solve any of these other complex problems.

Then we need to identify multiple strategies with specific aims and milestones to use in measuring progress. Our planning must include estimating the extent to which we can improve outcomes by expanding the pool of potential minority researchers, as well as identifying and being more successful in retaining those already engaged.

In designing programs, it's important to recognize any assumptions we are making. For example, we assume that a problem is solvable, that talent is not limited to any group, and the skills needed to be a productive researcher are teachable. Also, we assume that exposing students to laboratory research will inspire them to consider research careers and motivate them to improve their overall academic preparation. And we might presuppose that students are ready for this exposure at a specific stage in their education as well as that most labs are willing and able to provide students with mentored experiences. Assumptions could also be made about the level of institutional involvement or the availability of resources.

Ideally, we would determine at the outset whether our assumptions are valid. If we can't be sure, we would need to take these uncertainties into account in designing programs and acknowledge them in discussing outcomes.

Just as we publish our scientific results for others to scrutinize, evaluation and sharing of outcomes must be critical elements of our diversity strategies. Thinking of evaluation in terms of ac-

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Shared Challenges, Shared Solutions (cont'd)

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ing. A year-by-year analysis will reveal imbalances, allow for a plan of action to be developed and implemented, and measure changes.

Successfully designed programs include significant components of early faculty and peer mentoring, which can profoundly affect student retention and success. This early attention may begin on campus in the summer preceding the start of college, where students learn about the high expectations of university academics through science course work, exposure to scientific research, time-management training, and even professional "manners." Faculty and peer mentoring are perhaps most critical in the first six weeks of the first science course (through the first exam), when students may decide whether they "belong" in the sciences. Inclusion is further fostered by expectations of excellence, not the traditional sink-or-swim approach, combined with the assurance of students' ability to meet these high expectations. Mentoring can happen within the context of a course being taught; it does not necessarily require extensive one-on-one time.

> *"The idea that college students of color taking introductory biology or chemistry courses are interested in medicine, not basic science, does not stand up to scrutiny."*

Institutions with proven track records of sending higher percentages of underrepresented students into PhD programs fund and encourage early student research experiences, where mentoring becomes more focused. Students' immersion in science with scientists can impact everything that follows. Thus research opportunities ideally begin the summer after a student's first year.

Successful programs also encourage or mandate student participation in peer study groups for science and math courses. Study groups foster identification with the sciences and take advantage of the known benefits of mixed-group learning.

While analyzing data from a range of institutions, our consortium encountered obstructive stereotypes that must be dispelled for progress to be made. The idea that college students of color taking introductory biology or chemistry courses are interested in medicine, not basic science, is often used to justify their underrepresentation in science. This does not stand up to scrutiny since approximately 90% of all college students in introductory biology or chemistry courses for majors look toward medical rather than scientific careers.[1]

Another stereotype claims that inadequate K-12 education in the United States is to blame for students' lack of interest in pursuing college-level science study. Data from our own and other institutions indicate that students of color and from all educational and income levels enroll in introductory courses in biology and chemistry (the disciplines on which we have focused) at representative levels. Yet they disengage during their earliest experiences at the university level. The most successful programs have found ways to stem this early exodus from the sciences.

Louisiana State University's relatively new La-STEM and La-Scholars "mentoring ladder" Programs have graduate students mentor undergraduate science majors and undergraduate science majors mentor entering undergraduates. Programs such as these, along with the Meyerhoff Scholars Program and Biology Scholars Program, keep underrepresented minority students thriving in the sciences, and they can serve as models for the effective engagement of underrepresented science students nationwide.

Faculty and administrators need to confront stereotypes and analyze their own recent institutional records of undergraduate science education if the tide is going to turn away from science's long-standing track record of non-inclusion. By joining a national effort to learn about successful practices and to avoid reinventing the wheel, we are among many who hope our own institutions will soon be included in this list of proven change-makers.

Wendy Raymond *is Associate Professor of Biology at Williams College and Robert A. Lue is Director of Life Sciences Education at Harvard University.*

References

1 R.A. Elliott et al., "Non-Asian minority students in the science pipeline at highly selective institutions," (unpub. grant report to the NSF), July 1, 1995.

Color of our Classroom… (cont'd)

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their departments and have to overcome obstacles just to earn their degrees, or will they be primed to direct all their energies into becoming authorities in their fields? We want our students to be the best they can be, so it's no wonder that those of us mentoring HBCU students routinely direct them into programs that have established track records of supporting and graduating African American students. We steer them toward departments that promote the success of African American students, not those that simply send anxiety-ridden new graduate students in the direction of the two or three black faculty members and consider their responsibility fulfilled.

Democratizing the academy means opening what Du Bois called the "doors of opportunity" and making it a receptive place for African American students. A competitive environment and a nurturing one need not be mutually exclusive. We must work to remove the perception that the academy is a private preserve in which African Americans are all too often spoken *of* but rarely spoken *to* or *with*. African Americans are frequently out of the loop in regard to meaningful academic discourse; many of them discover upon their arrival in the academy that they are tolerated in an atmosphere of benign neglect. This neglect may serve to create feelings of inadequacy and ambivalence on their part and may prevent their departments from benefiting from their presence. These black students can help us to see our field anew, no matter what specialty they choose. Their success is the success of all members of the department as well as the university.

> *"We must remove the perception that the academy is a private preserve in which African Americans are all too often spoken* of *but rarely spoken* to *or* with*."*

Black Scholars

Are we scholars who are black or blacks who are scholars? As African American students wrestle with this question, those outside the academy see them as having made it, while those on the inside sometimes perceive them as necessary but unwelcome interlopers. The fortification that occurs in HBCUs often helps to nourish the young scholars who take this journey and prepares them for the times ahead when the legitimacy of their own imaginations may be challenged.

According to the 2004 *Fall Staff Survey* of the National Center for Education Statistics, 57.9% of the full-time faculty at HBCUs in fall 2003 were African American; only 4 percent of the full-time faculty at all other U.S. institutions were African American. Although some people view the nation's HBCUs as a pale simulacrum of their traditionally white counterparts, they in fact contribute to a culture of excellence and fulfill an important function.

Despite the nearly forty-year push to integrate the academy following the death of Dr. Martin Luther King, Jr., HBCUs remain the colleges of choice for many of the nation's black students. They see them as sites where they can imagine freedom, places where they are affirmed. Black students need to see someone who looks like them and who can speak with authority, and without restrictions, on the great issues that confront the human community. White students need to know that academic citizenship is not a property right and that the world in which they will reach their majority will be a mostly black and brown one.

HBCUs practice a pedagogy of success, instilling in their students an intellectual toughness that, in the words of a well-known spiritual, invests them with the determination not to "let nobody turn me 'round." The number of future PhDs HBCUs produce is testimony to their success. Graduate departments looking for more minority PhD recipients need look no further than the nation's HBCUs for the scholars who will make it in their programs. And we can all take lessons from HBCUs when it comes to inspiring undergraduates of color to become the faculty members of the next decade.

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Old Problem, Old Solutions (cont'd)

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been no systemic change," says Elizabeth Ivey, a physicist and past president of the Association for Women in Science. "That's the nut to crack."

Industry appears to be making some progress in this direction. Egan says diversity at Eli Lily has improved a lot in the 16 years since she joined the company. Similarly, Lino Gonzalez has positive feelings about the culture at Genentech, where 49% of employees are women and 43% are minorities. A big factor in that diversity success is the company's commitment to mentoring and networking. Genentech offers a variety of internal networking groups; Gonzalez belongs to one specifically for Latinos. That formal support structure helps to recruit and retain new hires. "It's a working group, we're working to achieve things, but it's also a support group," he says. "You have a lot of friends there."

Such structured programs are often the missing factor from initiatives at colleges and universities, Ferguson says. She notes that the medical school at UTMB has a great diversity record.

According to the most recent figures available from UTMB, underrepresented minorities accounted for nearly 26% of graduates from the school of medicine between 2002 and 2005, the same percentage as that of the underrepresented groups in the general population. Yet during the same period, minorities made up just 9% of graduates from the school of biomedical sciences.

Ferguson attributes the difference to a program that pairs first-year med students with mentors who will guide them throughout their career. "It really seems to work, and the institution supports it," she says, "But those types of mentoring programs aren't built into the system at the graduate school."

Ferguson became a member of the committee for diversity in graduate education that once helped her through grad school, but the committee broke up due to lack of financial support, she says. "We have to have the support of the university to carry out our objectives." Unfortunately, Ferguson feels that support is often lacking - and not just at UTMB. Unless institutions are held accountable for increasing diversity, she says, nothing will change.

> *"There's been a reluctance to incorporate qualitative data into the design of diversity programs."*

Venturing Beyond Blame

John Matsui, at Berkeley, couldn't agree more. He argues that many institutional diversity programs are working from the same untested checklist - without questioning the conventional wisdom, let alone challenging it. According to Matsui, "the big question is: What works, what doesn't, and for whom?"

Answering that question, he says, is where institutions and science faculty have failed miserably. Professors are good at telling students what to do, but terrible at listening. "We say 'we have this to offer' and if our students don't succeed, we place the blame on the students," he says. He argues it's time to turn the blame inward.

The irony, Matsui points out, is that scientists and science faculty have been taught to be skeptical and to hone their questioning skills. Yet "when it comes to diversity work, we take it at face value," says Matsui. He insists qualitative research must be done to really understand what works and why. Unfortunately, he says, many scientists don't respect social science enough to consider it. "There's been a reluctance to incorporate qualitative data into the design of diversity programs."

How to get past the reluctance? Carrots and sticks. Matsui argues that institutions could do more to reward faculty for efforts to improve diversity in their labs. The number of papers a professor publishes has a direct impact on tenure. But his or her efforts to improve education and increase diversity have little or no bearing on career advancement. "We respond to reward structures," says Matsui. "If our funders place outcomes front and center as requisites for funding, then we're going to hop to it."

After all, it's not just about doing the right thing; it's about doing better science. Scientists ask questions based on their experiences, Matsui says, and broader backgrounds will only mean broader discovery. "What does diversity have to do with research?" he asks. "It has everything to do with it."

Does Meritocracy Work?

by Ross Douthat, reprinted by permission from the Atlantic Monthly

Not if society and colleges keep failing to distinguish between wealth and merit.

For a parent drowning in glossy college mailings, a college admissions officer deluged with applications, or a student padding a résumé with extracurricular activities, it's easy to see applying to college as a universal American rite of passage—a brutal and ecumenical process that ushers each generation of stressed—out applicants into the anteroom of adulthood. But for many American teenagers the admissions process is something else entirely—a game that is dramatically rigged against them, if they even play it. In a country where a college degree is a prerequisite for economic and social advancement, rich and upper-middle-class students can feel secure about their chances. They may not have the grades or the good fortune to attend their first-choice schools, but they're still likely to be admitted to a college that matches their interests and ambitions reasonably well. For those further down the socioeconomic ladder, though, getting in is hard, and getting through can be even harder.

Native intelligence and academic achievement do lift many poor students into college. But especially where elite colleges are concerned, students from well-off families have a big advantage. The figures are stark. If you hope to obtain a bachelor's degree by age twenty-four, your chances are roughly one in two if you come from a family with an annual income over $90,000; roughly one in four if your family's income falls between $61,000 and $90,000; and slightly better than one in ten if it is between $35,000 and $61,000. For high schoolers whose families make less than $35,000 a year the chances are around one in seventeen.

This is not how the modern meritocracy was supposed to work. American higher education was overhauled in the middle years of the twentieth century to be a force for near universal opportunity—or so the overhaulers intended. The widespread use of the SAT would identify working-class kids with high "scholastic aptitude," as the initialism then had it (since 1994 the SAT has been for "scholastic assessment"), and give them the academic chances they deserved. Need-based financial aid and government grants would ensure that everyone who wanted a college education could afford one. Affirmative action would diversify campuses and buoy disadvantaged minorities.

Part of this vision has come to pass. Minority participation in higher education has risen since the 1960s, and college campuses are far more racially and ethnically diverse today than they were half a century ago. But the socioeconomic diversity that administrators assumed would follow has failed to materialize. It's true that more low-income students enroll in college now than in the 1970s—but they are less likely to graduate than their wealthier peers. Through boom and recession, war and peace, the proportion of the poorest Americans obtaining college degrees by age twenty-four has remained around six percent. This is not something that most colleges like to discuss—particularly elite schools, which have long taken pride in their supposed diversity. But the idea that the meritocracy isn't working is gaining currency among observers of higher education. It's visible in recent high-profile changes in the financial-aid policies of such schools as Harvard, Princeton, and the University of Virginia; as a thread of disquiet running through the interviews this magazine has conducted with admissions officers over the past two years; and as the unpleasant but undeniable conclusion of a number of new studies.

> *"The obvious culprits are the universities, which have trumpeted their commitment to diversity and equal access while pursuing policies that favor better-off students."*

The most prominent of these studies was headed by William Bowen, a former president of Princeton, who since leaving that office, in 1988, has produced a series of weighty analyses of college admissions—on the consequences of racial preferences, the role of athletics, and, most recently, the question of socioeconomic diversity. In

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the recently published book Equity and Excellence in American Higher Education, Bowen and his co-authors use detailed data from the 1995 entering class at nineteen selective schools—five Ivies, ten small liberal arts colleges, and four flagship state universities—to argue that elite universities today are as much "bastions of privilege" as they are "engines of opportunity." Only six percent of the students at these schools are first-generation collegians; only 11 percent of the graduates come from families in the country's bottom economic quartile. The picture is even worse in another recent study. The education expert Anthony Carnevale and the economist Stephen Rose surveyed 146 top colleges and found that only three percent of their students came from the bottom economic quartile of the U.S. population—whereas 74 percent came from the top one.

At the very least, the persistence of this higher-education gap suggests that the causes of the decades-old growth in economic inequality are deeper than, say, tax cuts or the ebb and flow of the stock market. Inequality of income breeds inequality of education, and the reverse is also true: as long as the financial returns on a college degree continue to rise, the upper and upper-middle classes are likely to pull further away from the working and lower classes.

The United States still leads most countries by a considerable margin in proportion of the population with a college degree (27 percent). But when the sample is narrowed to those between the ages of twenty-five and thirty-four, we slip into the pack of industrialized nations, behind Canada, Japan, and five others. Further, the U.S. college-age population is swelling (it will increase by about 3.9 million during this decade, according to one estimate), with much of the growth occurring among low-income Hispanics, one of the groups least likely to attend college. Educating this population is an enormous challenge—one that we are unprepared to meet.

The obvious culprits are the universities, which have trumpeted their commitment to diversity and equal access while pursuing policies that favor better-off students. Not only is admitting too many low-income students expensive, but it can be bad for a school's rankings and prestige—and in the long run prestige builds endowments.

The current arms race for higher rankings

(Continued on page 16)

THE COLLEGE PIPELINE

Some of the most basic information can also be the hardest to come by—and data about who moves on to what level of education, and when, is a classic case in point. Official education statistics often omit students when they switch schools, or when they drop out and then re-enroll. As a result, there is disagreement over precise numbers. The chart below, derived from a study that followed 12,000 eighth-graders from 1988 through 2000, represents the Department of Education's best available snapshot of what percentage of young people make it through college within twelve years of leaving the eighth grade.

OUT OF EVERY 100 EIGHTH-GRADE STUDENTS ...

78 graduate from high school on time with a standard diploma

Of these, 60 start college (35 in a four-year college, 25 in a two-year college or trade school) by age 26 or 27

Of these, 47 remain in the post-secondary system after their first year

Twelve years after the eighth grade 29 have earned at least a bachelor's degree, five an associate's degree, and three a certificate

Sources: National Center for Education Statistics; National Education Longitudinal Study of 1988/2000 Postsecondary Transcript Files

Diversity Through Outreach at CfAO (cont'd)

(Continued from page 2)

Inquiry-Based Research Projects

At the beginning of the Hartnell course, students are shown three posters with astronomical images and are asked to generate questions about the pictures and how they might investigate their inquiries. Some examples of questions that students asked include: "Why is the large galaxy asymmetric?"; "Are the bright points stars?"; "Is it a galaxy at all?" After viewing all the questions asked by their classmates, students divide into groups and choose an issue to investigate. Each group is assigned an "advisor" (i.e., one of the course instructors) to assist them in the research process.

With little astronomy background, the students are uncertain how to investigate their questions. For example, one response regarding how to investigate object properties was, "zoom into the bright points and vertical objects." Thus, the advisors play an essential role in providing the background tools necessary to progress with the project. Students build close working relationships with their advisors that facilitate a positive learning environment and active mentorship (see Figure 2). The course has roughly five hours allotted for these inquiry activities (plus two hours for writing abstracts and two hours for presentation preparation), sufficient for students to explore their topics in detail.

Figure 3 shows the outline of each inquiry-based project in the Hartnell short course. Since students choose the direction of their research, they are actively engaged throughout the process. Ultimately, the inquiries aim to teach students research process skills: generating questions, transforming observations into plots and interpreting data, and developing explanations from evidence. Additionally, the research projects are a fun way to utilize the tools of astronomers and to apply their knowledge from lectures. Much like professional astronomers, the students present their results to their peers upon completion of their research

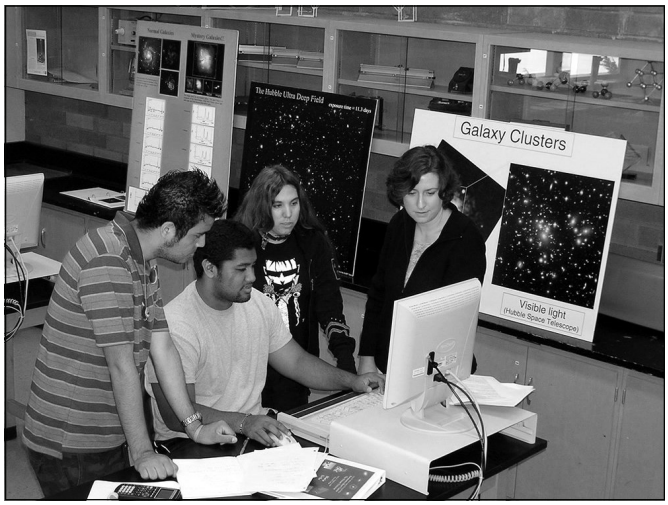

Figure 2. *Dr. Anne Metevier (far right) works with three Hartnell students on a galaxy cluster inquiry-based research project during the short course.*

Galaxy Morphologies

Starter: Show students image of Hubble Ultra Deep Field.

Content Areas for Investigation: *galaxy classification; galaxy subcomponents* (disks, bulges, spiral arms, bars; exponential vs. de Vaucouleurs surface brightness profiles); *galaxy morphology vs. redshift or color; apparent size vs. redshift.*

Possible Tools: provide color images, surface-brightness profiles, contour maps, spectra, redshifts; show students merger simulations; help with graphical analysis.

Active Galaxies

Starter: Show students multiwavelength images of normal and active galaxies (called 'mystery galaxies'); show students spectra and light curves from each.

Content Areas for Investigation: *galaxy classification; effects of viewing angle; measurement of size and mass of central region; constraints on light production* (considering shape and processes); *jets and disks.*

Possible Tools: explain photometry/light curves (to get light crossing time) and spectra/SEDs (shape of SED, emission lines, velocity dispersion vs central object mass).

Galaxy Clusters

Starter: Show students X-ray and optical images (with lensing) of galaxy clusters.

Content Areas for Investigation: *large-scale structure of Universe; gravitationally bound systems; benefits of multiwavelength observations; mass measurements* (stars are small fraction of total galaxy mass; dark matter); *gravitational lensing.*

Possible Tools: provide multiwavelength images, redshifts of objects in images; teach techniques to measure velocity dispersion and total mass to compare to order-of-magnitude estimate of stellar mass

Figure 3. *Outlines of the three inquiries from the Hartnell astronomy short course, including the starter, possible content areas for investigation, and potential tools provided by the groups' advisors.*

Diversity Through Outreach at CfAO (cont'd)

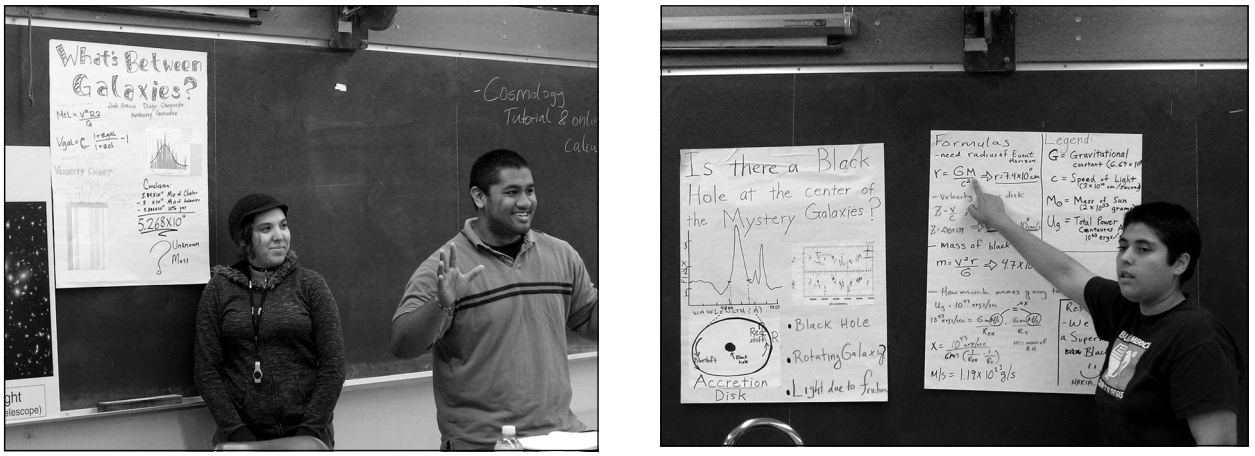

Figure 4. *Students give presentations at the end of the Hartnell short course to summarize their results.*

project (see Figure 4).

Success of the Course

Toward the end of the short course, students generate questions again about astronomical images. Students now asked, "are the galaxies close enough to be interacting with each other?" and, "is the ring of dust outside the apparent radius of the galaxy the rest of a merger?". When instructed to state how they might investigate these questions, their responses were "measure the redshift of both galaxies to determine their relative distance," and "the amount of blue stars in the ring of dust might indicate increased star formation which is one of the consequences of a merger." As is evident from these answers, the students gained an exceptional amount of scientific knowledge and a great familiarity with astronomical research techniques.

In written assessments of the course and their experiences, Hartnell students praised the class:

- "I love science a couple degrees in magnitude more. If anything [the course has] inspired me to passionately pursue my interests."
- "I want to go to graduate school now, whereas I only wanted a BS."
- "It was a really good experience [to] work as a scientist. I personally felt like one. Also it was a very good experience working with professional people. I hope I can be one of you one day."

The Hartnell short course has been largely successful at motivating and preparing students for science and engineering careers as well. 16 of the 47 students (34%) from the last three years have since transferred to four-year institutions to pursue S&E degrees (many of the others are still completing their associate's degrees at Hartnell). Additionally, four students were subsequently accepted into a Center for Adaptive Optics (CfAO) summer internship program. The CfAO internship program is highly competitive, offering positions to only 1 in 8 college applicants from all over the country. Recently, Hartnell president Edward Valeau also recognized the CfAO for this successful program by presenting the Center with the President's Partnership of Excellence Award.

For such a widely successful initiative, the Hartnell astronomy short-course is relatively simple to model at other community colleges. With a few motivated instructors and some inquiry ideas (or maybe even just the projects outlined here), one can have a profound influence on tomorrow's scientists. Community colleges represent an important resource to increase representation of minorities in S&E, and astronomers can utilize their teaching and research skills to inspire community college students near them.

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Does Meritocracy Work? (cont'd)

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began in earnest in the early 1980s, when the post-Baby Boom dearth of applicants sent colleges, both public and private, scrambling to keep tuition revenue coming in. It has been sustained by anxious Boomer parents, by the increasing financial advantages of a college degree, by cutbacks in government aid, and by magazines eager to make money from ranking America's top schools. The rankings rely on statistics such as average SAT scores, alumni giving, financial resources, and graduation rates. Attracting students with high scores and high family incomes offers the biggest gains of all. (See Matthew Quirk's "The Best Class Money Can Buy," page 128.)

Meanwhile, the admissions process is strewn with practical obstacles for low-income students. Early-admissions programs, for instance, which James Fallows has discussed in these pages (see "The Early-Decision Racket," September 2001 Atlantic), offer many benefits to applicants, but they almost exclusively help wealthy students, whose parents and guidance counselors are more likely to have the resources to take advantage of them. Poorer students are also less likely to know about the availability of financial aid, and thus more likely to let "sticker shock" keep them from applying in the first place. And a poor student put on a waiting list at a selective school is less likely than a well-to-do student to be accepted, because often a school has exhausted its financial-aid budget before it turns to the list.

In this scramble selectivity is "the coin of the realm," as one admissions officer put it to The Atlantic last year. More and more schools define themselves as "selective" in an effort to boost their position and prestige, and fewer and fewer offer the kind of admissions process that provides real opportunities for poorer students. As a result, those disadvantaged students who do attend college are less and less likely to find themselves at four-year schools. Among students who receive Pell Grants—the chief need-based form of federal assistance—the share attending four-year colleges fell from 62 percent in 1974 to 45 percent in 2002; the share attending two-year schools rose from 38 percent to 55 percent.

The advantage to well-off students is particularly pronounced at private colleges and universities. Over the course of the 1990s, for instance, the average private-school grant to students from the top income quartile grew from $1,920 to $3,510, whereas the average grant to students from the lowest income quartile grew from $2,890 to $3,460. And for all the worry of the middle class over rising tuition, increases in grant dollars often outstrip increases in tuition costs for middle- and upper-income students—but not for their poorer peers. In the second half of the 1990s, a study by the Lumina Foundation (a higher-education nonprofit) found, families with incomes below $40,000 received less than seventy cents in grants for every dollar increase in private-college tuition. All other families, including the richest, received more than a dollar in aid for every dollar increase in tuition.

It isn't just schools that have moved their aid dollars up the income ladder. State and federal governments have done the same. Since the 1980s public funds have covered a shrinking share of college costs, and with entitlements claiming an ever growing chunk of state and federal budgets, the chance of a return to the free-spending 1970s seems remote. But even when higher-education outlays have increased—they did during the 1990s boom years, for instance—government dollars have been funneled to programs that disproportionately benefit middle- and upper-income college students.

Both colleges and states have increasingly

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Does Meritocracy Work? (cont'd)

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invested in "merit-based" scholarships, which offer extra cash to high-performing students regardless of need; these programs are often modeled on Georgia's HOPE scholarship, established in 1993 and funded by a state lottery, and thus amount to a form of regressive taxation. The federal government, meanwhile, has used tax credits to help parents defray the cost of college—a benefit that offers little to low-income families. Pell Grants have been expanded, but the purchasing power of individual grants hasn't kept pace with rising tuition.

Overall, American financial aid has gradually moved from a grant-based to a loan-based system. In 1980, 41 percent of all financial-aid dollars were in the form of loans; today 59 percent are. In the early 1990s Congress created a now enormous "no-need" loan program; it has been a boon for upper-income students, who can more easily afford to repay debts accrued during college. At the same time, the federal government allowed families to discount home equity when assessing their financial circumstances, making many more students eligible for loans that had previously been reserved for the poorest applicants. The burdens associated with loans may be part of the reason why only 41 percent of low-income students who enter four-year colleges graduate within five years, compared with 66 percent of high-income students.

"Even the admissions advantage that many schools give to recruited athletes actually tends to disproportionately benefit the children of upper-income families."

All these policy changes have been politically popular, supported by Democratic and Republican politicians alike. After all, the current financial-aid system is good for those voters—middle-class and above—who already expect to send their kids to college, and who are more likely to take the cost of college into consideration when they vote. And though Americans support the ideal of universal educational opportunity, they also support the somewhat nebulous notion of merit and the idea that a high SAT score or good grades should be rewarded with tuition discounts—especially when it's their children's grades and SAT scores that are being rewarded.

But it's not enough to blame the self-interest of many universities or the pandering of politicians for the lack of socioeconomic diversity in higher education. There's also the uncomfortable fact that a society in which education is so unevenly distributed may represent less a failure of meritocracy than its logical endpoint.

That the meritocracy would become hereditary was the fear of Michael Young, the British civil servant who coined the term. His novel The Rise of the Meritocracy (1958)—written in the form of a dry Ph.D. thesis that analyzed society from the vantage point of 2034—envisions a future of ever more perfect intelligence tests and educational segregation, in which a cognitive elite holds sway until the less intelligent masses rise to overthrow their brainy masters. A scenario of stratification by intelligence was raised again in 1971, in these pages, by the Harvard psychologist Richard Herrnstein, and in 1994 by Herrnstein and Charles Murray, in their controversial best seller The Bell Curve. That book is now remembered for suggesting the existence of ineradicable racial differences in IQ, but its larger argument was that America is segregated according to cognitive ability—and there's nothing we can do about it.

Today Young's dystopian fears and The Bell Curve's self-consciously hardheaded realism seem simplistic; both reduce the complex questions of merit and success to a matter of IQ, easily tested and easily graphed. The role that inherited intelligence plays in personal success remains muddy and controversial, but most scholars reject the "Herrnstein Nightmare" (as the journalist Mickey Kaus dubbed it) of class division by IQ.

It doesn't really matter, though, whether our meritocracy passes on success genetically, given how completely it is passed on through wealth and culture. The higher one goes up the income ladder, the greater the emphasis on education and the pressure from parents and peers to excel at extracurricu-

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Does Meritocracy Work? (cont'd)

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lar achievement—and the greater the likelihood of success. (Even the admissions advantage that many schools give to recruited athletes—often presumed to help low-income students—actually tends to disproportionately benefit the children of upper-income families, perhaps because they are sent to high schools that encourage students to participate in a variety of sports.) In this inherited meritocracy the high-achieving kid will not only attend school with other high achievers but will also marry a high achiever and settle in a high-achieving area—the better to ensure that his children will have all the cultural advantages he enjoyed growing up.

Powerful though these cultural factors are, change is possible. The same studies that reveal just how class-defined American higher education remains also offer comfort for would-be reformers. Certainly, policies that strengthen families or improve elementary education undercut social stratification more effectively than anything colleges do. For now, however, numerous reasonably prepared students—300,000 a year, by one estimate—who aren't going to college could be. And many students who are less likely than their higher income peers to attend the most selective schools would thrive if admitted.

> *"In America access ultimately rests on what happens in the vast middle rank of colleges and universities, where most undergraduates are educated."*

The obvious way to reach these students is to institute some sort of class-based affirmative action—a "thumb on the scale" for low-income students that is championed by Bowen and by Carnevale and Rose in their analyses of educational inequality. Many elite universities claim to pursue such policies already, but Bowen's study finds no admissions advantage for poor applicants to the selective schools in the sample simply for being poor. In contrast, a recruited athlete is 30 percent more likely to be admitted than an otherwise identical applicant; a member of an under-represented minority is 28 percent more likely; and a "legacy" (alumni child) or a student who applies early is 20 percent more likely.

As an alternative Bowen and his co-authors propose that selective schools begin offering a 20 percent advantage to low-income students—a policy with "a nice kind of symbolic symmetry" to the advantage for legacies, they point out. By their calculations, this would raise the proportion of low-income students at the nineteen elite schools in their sample from 11 to 17 percent, without much impact on the schools' academic profiles.

Class-based affirmative action has an obvious political advantage: it's more popular with the public than race-based affirmative action. (Bowen envisions socioeconomic diversity as a supplement to racial diversity, not a replacement.) Increasing socioeconomic diversity might offer something to both sides of the red-blue divide—to a Democratic Party rhetorically committed to equalizing opportunity, and to a Republican Party that increasingly represents the white working class, one of the groups most likely to benefit from having the scales weighted at elite universities. But however happy this may sound in theory, one wonders how likely schools are to adopt class-based preferences. As Carnevale and Rose put it, doing so "would alienate politically powerful groups and help less powerful constituencies"; Bowen notes that it would reduce income from tuition and alumni giving. A selective school might court backlash every time it admitted a poor kid with, say, a middle-range SAT over an upper-middle-class kid with a perfect score. It's doubtful that many colleges would be willing to accept the losses—and, for the more selective among them, the possible drop in U.S. News rankings.

Even the elite of the elite—schools like the nineteen examined in Bowen's book, which are best able to afford the costs associated with class-based affirmative action—seem more inclined to increase financial aid than to revamp their admissions policies with an eye toward economic diversity. In the past several years schools like Harvard, Princeton, and Brown have shifted financial-aid dollars from loans to grants, helping to ensure a free ride for the neediest students once they get in. Such gestures make for good public relations, and

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they do help a few students—but they don't make it easier for low-income students to gain admission.

The benefits and the limitations of moving from loans to grants can be observed in the "AccessUVa" program at the University of Virginia, one of the schools in Bowen's sample. In 2003 it had a typical entering class for an elite school—58 percent of the students came from families with annual incomes above $100,000—and in 2004 fewer than six percent of students came from families with incomes below $40,000. In 2004 Virginia announced that for students with family incomes below 150 percent of the poverty line it would eliminate need-based loans and would instead offer grants exclusively (the school has since raised the threshold to include families of four making less than 200 percent of the poverty line, or about $40,000). It would also cap the amount of debt any student could accrue, funding the rest of his or her tuition through grants. The school publicized its increased affordability, with large-scale outreach to poorer parts of the state. It's too early to judge the program's success, but the first year's results are instructive: the number of low-income freshmen increased by nearly half, or sixty-six out of a class of about 3,100. This is a praiseworthy if small step: those sixty-six brought the low-income total to 199, or about six percent of the class. But it does not solve the problem of unequal access to higher education.

Significant improvements in access, if and when they come, will probably have little to do with the policies at the most elite schools. In America access ultimately rests on what happens in the vast middle rank of colleges and universities, where most undergraduates are educated—in particular, in state schools.

One thing that's unlikely to happen is a sudden increase in funding for higher education, along the lines of the post-World War II surge that made college possible for so many young people. The budgetary demands of swelling entitlements and military spending, the wariness of voters who perceive schools (sometimes rightly, usually wrongly) to be growing fat off their high tuition, and the cultural chasm between a Republican-controlled government and a lefter-than-thou academy—all this and more ensures that spending on higher education will not leap to the top of the nation's political agenda. Instead, schools and legislators must be willing to experiment. The good news is that there's no shortage of ideas. Bowen, for instance, points out that state schools might consider rethinking their relatively low tuition, which amounts to a subsidy for wealthy in-state parents. (Indeed, upper-income parents are increasingly choosing to send their children to state schools, presumably with just this advantage in mind.) These schools could keep their official tuition low while charging premiums for better-off applicants. Or they could follow the lead of Miami University, in Ohio, which recently raised in-state tuition to the same level as out-of-state tuition (from $9,150 to $19,730).

What should be done with the extra money? State governments might consider tying funding for schools more tightly to access—either directly, by rewarding those colleges that graduate larger numbers of low-income students, or indirectly, as Bowen and his co-authors suggest, by shifting funding from flagship universities to regional schools, which are more likely to enroll disadvantaged students.

More radically, states might ask how well they are serving their populations by funding public universities directly and allowing the universities to

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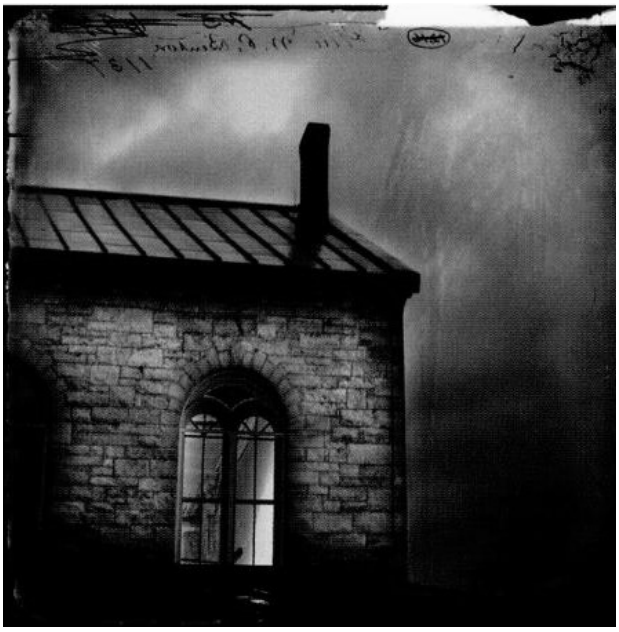
disburse the funds as they see fit. If the point of a public university is to hire superstar faculty members, build world-class research facilities, and compete with Harvard and Yale, then perhaps this way of funding makes sense. (It's worth noting that since the 1970s public schools have spent an increasing share of their funds on research and administration rather than on instruction.) But if the point is to make higher education more accessible, it doesn't.



The Ohio University economist Richard Vedder has suggested that states might consider offering less money to schools and more money to students, in the form of tuition vouchers redeemable at any public institution in their home state. These could be distributed according to financial need: if the average tuition in a state university system were $15,000, a poor student might receive a voucher for $15,000 and a wealthy student one for $3,000. Schools would have less of a financial incentive to admit mostly rich students. Vouchers might also simplify filing for financial aid; the economist Thomas Kane has argued that the sheer complexity of this process deters many low-income students.

Like class-based affirmative action, a voucher program might be able to command support from both sides of the political aisle. The system's market-based efficiency would delight free marketeers (Vedder is affiliated with the conservative American Enterprise Institute), and its potential for increasing access might win the support of egalitarian liberals. And a voucher approach to funding state schools would mean less direct state involvement in higher education, which would please academics and administrators tired of having cost-conscious legislators looking over their shoulders.

Governments and public universities may also have lessons to learn from for-profit schools, which increasingly attract the students shut out of American higher education. Driven by bottom-line concerns, some of these schools enroll students who can't do the work, or promise job opportunities that never materialize. But many are oriented toward the needs of low-income populations. In New York State, for instance, some commercial schools set tuition at around $9,000—exactly the amount that a needy student can expect to receive from a Pell Grant combined with the state's tuition-assistance program. And they tend to serve the kind of students that traditional universities are failing—working adults, for instance, looking for the economic advantages that come with a college degree.

What gives the for-profit schools a leg up is their ability to "unbundle" a college education from its traditional (and costly) campus environment—something made possible in large part by the spread of the Internet. Some forprofit schools are entirely Web-based. Many others have put their reading lists, class registration, and even advising online. This is obviously not a model that a flagship state university is likely to emulate. But it may no longer make sense to spend a vast amount to sustain a traditional campus experience for the few when the same amount can provide an education for the many.

All these experiments—and that's what they are—have drawbacks. Public universities that spend more to improve access and graduation rates could make up for the expense by cutting, say, faculty salaries. Public schools already have a hard time keeping sought-after teachers from jumping to private colleges; if more money were spent enrolling and graduating poorer students, the problem would only worsen.

And the more that market efficiency was

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Does Meritocracy Work? (cont'd)

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brought to bear on higher education, and the more that degree-granting and graduation rates were emphasized over the traditional academic experience, the more the liberal arts would be likely to suffer. Computer classes would crowd out Shakespeare, management courses would replace musical instruction, everyone would learn Spanish and no one Greek. Who would speak up to save liberal education?

The most obvious drawback is that a more egalitarian system, in which a college degree is nearly universal and therefore a less exclusive pathway to later success, would run counter to the interests of upper-middle-class parents—the people who wield the most influence in the politics of higher education. It's elite Americans who would lose out in class-based affirmative action. It's elite Americans who would pay more if state schools raised their tuition and state governments handed out income-adjusted vouchers. And it's elite Americans who would lose some of their standing if educational opportunity were more widely distributed. Why should they give it up? It's not as if our child doesn't deserve his advantages, parents might say, after helping that child rack up not only high grades and SAT scores but also a sterling record of community service.

What, really, does an eighteen-year-old high achiever "deserve"? A good college education, certainly—but surely not the kind of advantage that college graduates now enjoy. As Nicholas Lemann put it in The Big Test, his history of the American meritocracy, "Let us say you wanted to design a system that would distribute opportunity in the most unfair possible way. A first choice would be one in which all roles were inherited ... A second unfair system might be one that allowed for competition but insisted that it take place as early in life as possible and with school as the arena." Students should be rewarded for academic achievement. But twelve years of parentally subsidized achievement should not hand them an advantage for the next fifty years of their lives.

Ross Douthat is a reporter-researcher for The Atlantic and the author of Privilege: Harvard and the Education of the Ruling Class.

The Scientific Approach (cont'd)

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countability purposes can undermine it as an endeavor for understanding and self-improvement. Evaluation is made more challenging by the difficulty in understanding how the context of a particular program influences its success or failure. And how do we judge the "added value" of an intervention or the relationship between cause and effect? Selection bias and other variables must always be considered.

We also need to understand the efficacy of program components. This kind of assessment goes beyond the bounds of what is commonly considered evaluation, and its complexity presents us with additional challenges. While evaluation focuses on overall results, such as whether students involved in a particular program went on to receive PhD degrees, efficacy studies might attempt to tease apart the causal relationships between specific program elements and desired behavioral changes or skill acquisition.

We already have the tools we need to devise a productive approach to achieving diversity in the biomedical research workforce. The process should look much like our research approach to other big problems. We have ideas, we experiment, we collect and analyze data, and we share the results. We seek a diversity of ideas and we encourage thoughtful engagement. Fresh perspectives and skepticism are of as much value as longstanding involvement with the issue. We expect that our work will generate new insights and lead to significant progress.

The NIH has begun to work along these lines. However, efforts to develop the breadth of talent in this country are too important to be isolated in select offices or targeted programs. Inclusiveness and diversity matter, greatly, and every scientific program administrator, investigator, and grantee institution should be concerned with them.

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Goal #1: Good Science. Goal #1: Diversity (cont'd)

(Continued from page 3)

mentor.

This works. We've tracked students who'd been invited to join the program, but who chose to go to elsewhere. The Meyerhoff Scholars were five times more likely to enter graduate school and twice as likely to eventually have science careers.

Q. *I've heard it said that there is something inherent in scientific culture that's uninviting to African-Americans. Is that true?*

A. We have a once-a-year retreat where we talk, and the students tell of some astonishing experiences. For instance, one spoke about how she and her white male classmate went to a scientific conference together. They put posters up on their research, side by side. The white guy had a whole bunch of people come up to him and ask about his research. The young black woman had two people ask about her project.

I invited a former Meyerhoff, a Harvard postdoc, who had solved the structure of a very important protein, to speak at a professional meeting. She arrived early, and people asked her how the projector worked. Because she was black, they assumed she was from maintenance.

Q. *What is your area of research?*

A. In a nutshell, we take pictures of parts of viruses, mainly H.I.V. We want to understand how the virus works. The virus is like a little engine, with lots of different parts. If you can figure out how all the parts fit together, then maybe you can come up with a drug that keeps the parts from doing what they should. From work we've done, we now know that one of the H.I.V. parts has to undergo a change in shape for the virus to become infectious. And we've discovered a new class of drugs that actually binds to that part and keeps it from changing shape. Those drugs don't work in humans yet, but they do work on cells in test tubes.

Q. *You talk a great deal about mentors. Who were yours?*

A. My father, who grew up really poor in a mining town in West Virginia and put himself through school on the G.I. Bill.

A very important one was a middle school science teacher, Joseph Cummings. Until Mr. Cummings, I'd only had white teachers, and he was black. He was incredibly enthusiastic about science. He sparked my interest in it. Till then, I'd thought that blacks were not that well educated and that they were, in general, very angry. And here was this black science teacher, and he was opening up worlds to all the students, white and black. He changed me about race and science.

Another mentor was Isiah M. Warner, an analytical chemist at Emory University, where I did my graduate work. He couldn't get his Ph.D. at L.S.U. because he was black. Today, he's a dean there and they are producing more black chemistry Ph.D.'s than any other school in the country

Finally, there's Freeman Hrabowski, who, at age 12, went to jail with Dr. Martin Luther King in Birmingham, Ala. This program was his idea. He inspired me to believe there was something that I could do — me, a white Southern male — to help level the playing field.

Q. *Has your research suffered because of your diversity work?*

A. I don't think so. I've published in Science and Nature. But if I knew that I wasn't going to be on this earth tomorrow, it wouldn't be those papers that would give me the greatest satisfaction, it would be the things I've done here with Freeman. So far, we've graduated about 550 Meyerhoffs, and 271 of them went on to do graduate work in a scientific area. That's what really warms my heart.

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