

SPECTRUM



A report on underrepresented minorities in astronomy

The Fate of Affirmative Action

by Keivan Guadalupe Stassun

As this issue of *SPECTRUM* goes to press, the US Supreme Court is considering the constitutionality of affirmative action policies in the admissions practices of the University of Michigan. Most observers agree that the Supreme Court's decision will be the most important ruling on affirmative action in 25 years. As Dr. Mary Sue Coleman, president of the University of

Michigan, has noted: "This is a moment of great significance in our nation's history. We stand at the threshold of a decision that will profoundly affect America's higher education system and race relations in general."

"I agree with the judgment of the Court only insofar as it permits a university to consider the race of an applicant in making admissions decisions. I do not agree that [the University's] admissions program violates the Constitution. For it must be remembered that, during most of the past 200 years, the Constitution, as interpreted by this Court, did not prohibit the most ingenious and pervasive forms of discrimination.... Now, when a State acts to remedy the effects of that legacy of discrimination, I cannot believe that this same Constitution stands as a barrier."

From the separate opinion of Justice Thurgood Marshall in *Regents of the U. of California v. Bakke* (1978)

The current law of the land regarding affirmative action in higher education is articulated in the so-called *Bakke* decision of 1978, in which the Supreme Court judged explicit racial quotas to be unconstitutional, but affirmed the use of race as a legitimate factor in admissions and hiring decisions.

In *Bakke*, Justice Lewis F. Powell wrote, "The fourth goal asserted by petitioner [the University] is the attainment of a diverse student body. This clearly is a constitutionally permissible goal for an institution of higher education. Academic freedom, though not a specifically enu-

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CSMA Hosts Session on Role of Minority Serving Institutions at Seattle AAS Meeting

by Keivan Guadalupe Stassun

In response to its charge from the AAS Council, the Committee on the Status of Minorities in Astronomy (CSMA) has been working to identify promising strategies for enhancing the participation of underrepresented minorities in the astron-

omy profession. At the January 2003 Meeting (Seattle), the CSMA organized a Special Session highlighting the important role of Minority-Serving Institutions (MSIs) and Research Experiences for Undergraduates.

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HIGHLIGHTS:

- Learn about the impact of affirmative action policies in higher education over the past 40 years.
- Learn about consumer research with implications for selecting job candidates and invited speakers.
- Read one author's provocative opinions on the moral justification for affirmative action.

The Fate of Affirmative Action (cont'd)

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merited constitutional right, long has been viewed as a special concern of the First Amendment. The freedom of a university to make its own judgments as to education includes the selection of a student body. Thus, in arguing that its university must be accorded the right to select those students who will contribute most to the ‘robust exchange of ideas,’ petitioner involves a countervailing constitutional interest, that of the First Amendment.”

While proponents of racial quotas considered the *Bakke* ruling to be a setback, universities have nonetheless continued their affirmative action efforts more or less successfully within *Bakke* by virtue of the “diversity argument”—that diversity is key to achieving the kind of “robust exchange” referred to in Justice Powell’s opinion.

A number of studies published in the past few years have attempted to demonstrate that affirmative action policies have had an overwhelmingly positive impact in American higher education specifically and in American society more broadly. Perhaps the most prominent of these is the book *The Shape of the River*, co-authored by the presidents of Princeton and Harvard. An executive summary of their findings is presented in our feature article (p. 4), *A Report Card on Affirmative Action*.

In some cases, research from seemingly unrelated disciplines has been used to view the issues surrounding affirmative action from different perspectives. In her article *The Lessons of the Grocery Shelf Also Have Something to Say About Affirmative Action* (p. 14), Virginia Postrel presents consumer research that suggests very practical reasons for considering race when, e.g., seeking out job interview candidates or identifying potential invited speakers.

In seeking out alternatives to affirmative action, the efficacy of so-called “percentage plans”, such as that instituted in Texas and favored by the Bush administration, has been debated. A new report from the U.S. Civil Rights Commission (see p. 13) criticizes such plans, citing among various reasons that the success of such plans depends on segregated K-12 schools.

Of course, affirmative action was discussed and debated long before the Michigan case popped onto the political scene. Those who criticize affirmative action often argue, quite reasonably, that affirmative action violates such “neutral” principles as “fairness” and “merit”. As Stanley Fish argues on p. 6, neutral principles are the wrong context for the debate, suggesting instead that affirmative action is guided by a different kind of principles: moral.

CSMA Special Session at Seattle AAS Meeting (cont'd)

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ates (REU) programs. The goal of the session was to assemble a panel of MSI faculty, REU directors, and AAS members to identify specific strategies, and then for the CSMA to synthesize these suggestions into a set of recommended actions.

As a result, the CSMA has produced a “white paper” summarizing the session. The report is entitled “Enhancing Diversity in Astronomy: Minority-Serving Institutions and REU Programs. Strategies and Recommended Actions”. We include here the Executive Summary. The full report, which can be accessed from the CSMA website, will be formally presented to the AAS Council at the Nashville AAS meeting and published in *BAAS*. The CSMA is now working with the AAS Council to effect these strategies and action items.

Executive Summary

Minority-serving institutions (MSIs) are major producers of minority undergraduates in physics. Tapping the undergraduate talent at these institutions may be key to enhancing diversity at the higher levels of the astronomy profession. The loss of these students at the undergraduate/graduate transition represents a significant “leak” in the pipeline of minority talent into astronomy.

Key strategies:

- Establish relationships with MSIs. This requires efforts that are deliberate, aggressive, and ongoing. Continuity is key to building successful partnerships. Visitation programs need to be sus-

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CSMA Special Session at Seattle AAS Meeting (cont'd)

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tained efforts; “one-shot” recruiting is generally not effective.

- Work with MSIs to develop programs that “grow talent from within”, in which students first participate in research at their home institution, with thoughtful and nurturing transitions to mentors at other institutions.
- Create, and take advantage of, informal networks to open pathways from MSIs into astronomy graduate programs. Implicit here is that relationship-building requires cooperation both logistical

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<http://www.astro.wisc.edu/csma>

and personal; building trust with MSI faculty is central to building successful partnerships with those institutions.

- Address the perceived disconnect between the educational atmosphere present at many MSIs and that which characterizes many of our graduate programs. MSI faculty are working to develop dynamic undergraduate programs that respond to student needs, that incorporate current pedagogical methods, and that inculcate an appreciation for teaching as part of the profession. These values should be extended to the graduate level to allow for a more seamless “handoff” of students from one program to the next, and to address the issue of minority retention at the graduate level. MSI faculty often do not trust that their students will be “taken care of” in graduate programs at majority institutions, and many students believe the teaching activity is undervalued.
- Increase the visibility of a diversity of astronomers at the K-12 level to “put a face” on the profession, and to communicate opportunity and inclusiveness. This emphasizes the value of “having diversity to get diversity”.

Four specific action items emerged for the AAS itself. The AAS should:

- Develop a small grants program to support minority recruiting efforts by AAS-affiliated institutions and individuals.
- Partner with professional societies of minorities in physics, such as the National Society of Black Physicists and National Society of Hispanic Physicists.
- Encourage reform of graduate education in astronomy to (1) impedance-match with reforms taking place at the undergraduate level in MSIs, and to (2) place additional value on teaching, including increased preparation of graduate students for teaching.
- Advocate via policy and direct activities to support the infrastructure needs at MSIs. These institutions support a broad base of students; they should develop the same kinds of opportunities normally attributed to R-1 schools.

FEATURE ARTICLE

A Report Card on Affirmative Action

by William G. Bowen, Derek Bok, and Glenda Burkhardt — excerpted with permission from the January 1999 issue of Harvard Business Review

New research not only documents the success of race-sensitive admissions but also provides insight into what works and why.

The subject of race in America is as sensitive and contentious as it is important. For the past 30 years, the nation's selective colleges and universities have used race-sensitive admissions policies to increase the number of black, Hispanic, and Native American students they enroll. Now those policies have come under heavy fire in both the political arena and the courts.

Until now, the debate has proceeded without much empirical evidence about the effects of such policies and their consequences for the students involved. We felt that after 30 years it was time to look at the data, to ground in fact a discussion often charged with emotion. Working from a massive new database that we call the *college-and-beyond (C&B) database*, we were able to conduct a more careful quantitative analysis than has been possible before. (See the insert "The Research Behind *The Shape of the River*" on the next page.)

By almost every measure we examined, race-sensitive admissions policies are working. The individuals who are admitted because of these policies are succeeding in school, and they are going on to successful careers while playing an active role in civic life at disproportionately high rates. Moreover, students of all races are benefiting educationally from diversity on campus.

Clarity of Mission

The aims and values of an educational institution are often revealed most vividly by the choices it makes in selecting students. That being so, why have virtually all highly selective colleges and professional schools tried so hard to enroll substantial

numbers of black and Hispanic students? Why did these schools decide in the first place to take race into account as one factor among many in the admissions process?

Fundamentally there were two reasons. The first was a recognition that the quality of education really does depend on the diversity of an institution's student body. If you have classmates who are all very much like you, you will not learn nearly as much as you will if you have classmates who are very different from you. Improving the educational experience for students of every background was one objective.

The second goal was to contribute larger numbers of talented minority students to the mainstream of American life. As these schools looked at U.S. society in the mid-1960s and saw how few African American or Hispanic people were in leadership positions in corporate America and in the professions, they feared for the health of society in the long run. Since one of the main

missions of these schools for a long time had been to contribute leaders and to contribute in other ways to a democratic society, increasing the flow of minorities into the mainstream was seen as important.

Measured against those two objectives, the schools have done very well. Alumni testify in overwhelming numbers to the contribution that diversity made to their education and to their preparedness to live and work in a diverse society. The data show that the minority students admitted to selective colleges and universities graduated at very high rates relative to national benchmarks and that they have done very well after leaving college. At the end of the day, the most selective colleges and universities have succeeded in educating sizable numbers of minority students who have already achieved considerable success and seem likely to occupy positions of leadership throughout society.

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"Critics claim that race-sensitive admissions policies require merit to be put aside. But that argument rests on a highly abstract definition of merit."

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(See “A Report Card on Race-Sensitive Admissions” on p. 9.)

The Myth of Pure Merit

Critics claim that race-sensitive admissions policies require merit to be put aside. But that argument rests on a highly abstract definition of merit. In essence, it asks us to believe that colleges and universities want only the most book-smart, test-smart students, and that considering race interferes with the precise science such a criterion implies. This argument, held and celebrated by many, is what we

call “the myth of pure merit.”

In fact, the schools in our study have done nothing except admit relentlessly on the merits. But what does merit mean? Highly charged words such as fairness, merit, and achievement take on different connotations depending on the speaker and the context. In particular, merit is a word that has taken on so much baggage that we may have to reinvent it or find a substitute for it. At a minimum, we must “unpack” its meanings and clarify the consequences of embracing one or another of them.

Numerical measures of academic qualification

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THE RESEARCH BEHIND *THE SHAPE OF THE RIVER*

The college-and-beyond database allowed us to track the experiences both during and after college of thousands of students of all races who entered 28 selective colleges and universities in the fall terms of 1976 and 1989. The C&B database was compiled by a team of researchers working under the auspices of the Mellon Foundation.

Our findings have been published in *The Shape of the River* (Princeton University Press, 1998). The book’s title was inspired by Mark Twain’s *Life on the Mississippi*. The image of the river is central to our story about the flow of talent—particularly of talented black men and women—through the country’s system of higher education and on into the marketplace and the larger society. The winding river, with its twists and turns and its rapids and slow channels, is a far more helpful way to think about the process of nurturing talent than the more pervasively used “pipeline” metaphor, with its misleading connotation of a smooth, well-defined, and well-understood passage.

Our large-scale study of how race-sensitive admissions policies have been applied during their 30-year history—and the consequences of those policies—was based on data culled from a representative group of the approximately 200 selective schools in the nation. Only 20% to 30% of all undergraduate institutions in the United States have more qualified applicants than they have places in the entering class, so it is primarily at these most selective schools that race plays a role in admissions and thus sparks controversy. The 28 schools chosen for the database include a mix of liberal arts colleges (for example, Wellesley and Williams) and universities both public (the University of Michigan) and private (Stanford).

The selective schools provide a disproportionate share of leaders to business and the professions. While it is true that superlative talent can come from almost anywhere, top organizations often focus their recruitment efforts on these schools because they offer a large pool of talent that has already been screened.

The riverboat pilots on the Mississippi had to know every depth, snag, and shoal of the river. They had to understand how the bend they were navigating at any moment fit in to the 1,200 mile river. Similarly, pilots in the development of talent need to know what has happened around bends and curves—in college, in graduate school, and then 20 years downstream.

Our research charts what race-sensitive admissions policies have meant over a long stretch of the river—both to the individuals who were admitted and to the society that has invested in their education and counts so heavily on their future leadership.

When Principles Get in the Way

By Stanley Fish—Reprinted with permission from *The New York Times*

Suppose you were arguing for something but were told that you would have to make your case without the facts that supported it. This is the situation proponents of affirmative action face when they find themselves defending their position in terms of principle rather than policy.

A policy is a response to actual historical circumstances; it is directed at achieving a measurable result—like an increase in the representation of minorities in business and education. A principle scorns actual historical circumstances and moves quickly to a level of generalization and abstraction so high that the facts of history can no longer be seen.

Affirmative action is an attempt to deal with a real-world problem. If that problem is re-characterized in the language of principle—if you stop asking, “What’s wrong and how can we fix it?” and ask instead, “Is it fair?”—the real world fades away and is replaced by the arid world of philosophical puzzles.

The recipe for making real-world problems disappear behind a smoke-screen of philosophizing was given to us years ago by the legal scholar Herbert Wechsler in his enormously influential 1959 Harvard Law Review article “Toward Neutral Principles.” Wechsler was trying to justify the Supreme Court’s decision in *Brown v. Board of Education*, which declared segregated schools unconstitutional. What troubled Wechsler about *Brown* was that the Justices, in reaching their decision, seemed moved by a practical desire to secure a result they favored (integrated schools) rather than by some general principle whose application would yield that result independently.

Unable to find any such principle spelled

out in the Court’s arguments, Wechsler was driven to provide one himself: the “right of freedom of association.” But in attempting to make this case, he soon realized that the principle of freedom of association turned out not to justify *Brown* but to make it even more of a puzzle. “If the freedom of association is denied by segregation, integration forces an association upon those for whom it is... repugnant,” he wrote. And “given a choice between denying the association to those... who wish it and imposing it on those who would avoid it,” he was unable to find a principle that would justify either the one or the other.

Here in as naked a form as one might like (or not like) is the logic of neutral principle.

When Wechsler characterizes the choice as being between the rights of those who wish to associate and the rights of those who wish not to, these two wishes have lost all contact with the issue that made their opposition meaningful—whether the schoolhouse door should be open or shut. Once the historical specificity of that issue is lost, there no longer

seems to be any moral difference between the two sides, although the difference was perfectly clear before Wechsler began his tortured analysis.

In other words, the puzzle of *Brown* is only a puzzle if you forget everything that made the case urgent in the first place—the long history of racism and its effects. You have substituted philosophical urgencies for social urgencies. This is what the demand for principle does, and what opponents of affirmative action intend it to do. After all, isn’t it convenient to be able to deny a remedy for longstanding injustices by invoking the higher name of principle?

It is a very bad game, but it is alive and well

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The phrase ‘reverse racism’ makes the actions of college admissions officers who give preference to minority candidates equivalent to the hate crimes of the Ku Klux Klan.”

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in the phrase “reverse racism,” which does in an instant what Wechsler needed an entire essay to do. The phrase makes the actions of college admissions officers who give preference to minority candidates equivalent to the hate crimes of the Ku Klux Klan. It does so by claiming that each is motivated by race-consciousness, an argument that makes sense only if the very thought of race, no matter the content or context, is considered the sin. Like the freedom of association in Wechsler’s argument, race-consciousness invoked as an abstraction rides roughshod over history while laying claim to the noblest of motives.

That is in effect what Justice Clarence Thomas did in his concurring opinion in *Adarand v. Pena*, in which the Court struck down the policy of giving incentives to Federal contractors who hired minority subcontractors. “It is irrelevant,” he wrote, “whether a government’s racial classifications are drawn by those who wish to oppress a race or by those who have a sincere desire to help those thought to be disadvantaged. In each instance, it is racial discrimination, plain and simple.”

But both the plainness and the simplicity are apparent only if the complex facts of history have been suppressed or declared out of bounds. In his dissent, Justice John Paul Stevens returned to history to make the truly plain and simple point: “There is no moral or Constitutional equivalence between a policy that is designed to perpetuate a caste system and one that seeks to eradicate racial subordination.”

The important word in Justice Stevens’s statement is “moral,” for it shows that the choice here is not between the principled and the non-principled. It is between neutral principles, which refuse to acknowledge the dilemmas we face as a society, and moral principles, which begin with an awareness of those dilemmas and

demand that we address them.

Those who favor affirmative action are moved by moral principles—principles that recognize the reality and persistence of historical inequities. And yet those who favor affirmative action are often maneuvered into using a vocabulary designed to remove from sight the very realities on which their case depends.

Of course, you could also try to work within that vocabulary and fight over its terms, arguing that “fairness,” “equality” and “color blindness” really belong on your side. But even if you got good at the game, you would be playing on your opponent’s field and thus buying into his position, and why would you want to do that?

It would be far wiser to refuse the lure of “fairness,” “merit” and “equality,” now code words for ignoring the effects of the long history of racial oppression. Let’s be done with code words and concentrate on the problems we face and on possible ways of solving them. Those who support affirmative action should give up searching for theoretical consistency—a goal at once impossible and unworthy—and instead seek strategies with the hope of relieving the

pain of people who live in the world and not in the never-never land of theory.

Let’s stop asking, “Is it fair or is it reverse racism?” and start asking, “Does it work and are there better ways of doing what needs to be done?” Merely asking these questions does not guarantee that affirmative action will be embraced, but it does guarantee that the shell game of the search for neutral principle will no longer stand between us and doing the right thing.

Stanley Fish is professor of English and law at Duke University. This article originally published in *The New York Times* December 26, 1996. Reproduced by permission.

FEATURE ARTICLE

A Report Card on Affirmative Action (cont'd)

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(principally SAT scores and high school grades) play an important part in the sorting and sifting of applicants to selective schools, but they are by no means the only factors considered. The truth is that admitting students is far more an eclectic and interpretive art—with decisions based on judgment, experience, and perhaps even accumulated wisdom—than a series of formulaic calculations. Test scores and grades are indicators of whether people can do the work, but above that basic threshold a whole set of other factors comes into play.

What does this view of merit mean for university admissions? It means that selecting a class is about much more than simply rewarding students who are thought to have worked especially hard. The job of the admissions staff is not to decide who has earned a “right” to a place in the class; admission to a selective university is not a right possessed by anyone. What admissions officers must decide is which applicants, considered individually and collectively, will take fullest advantage of what the college has to offer, contribute most to the educational process in college, and be most successful in using what they have learned for the benefit of the larger society.

An institution’s admissions processes should, of course, be fair. Fairness, however, has to be understood to mean only that each individual is to be judged according to a consistent set of criteria that reflect the objectives of the college or university. Fairness should not be misinterpreted to mean that a particular criterion has to apply—that, for example, grades and test scores must always be considered more important than other factors and characteristics so that no student with a B average can be accepted as long as some students with A averages are being turned down.

Nor does fairness imply that each candidate should be judged in isolation from all others. It may be perfectly fair to reject an applicant because the college has already enrolled many other students very much like him or her. There are numerous analogies. When making a stew, adding an extra carrot rather than one more potato may make excellent sense—and be eminently fair—if there are al-

ready lots of potatoes in the pot. Merit depends on what the stew requires to achieve a blend of flavors. It is fair to choose the carrot over the potato when the carrot may have more to contribute.

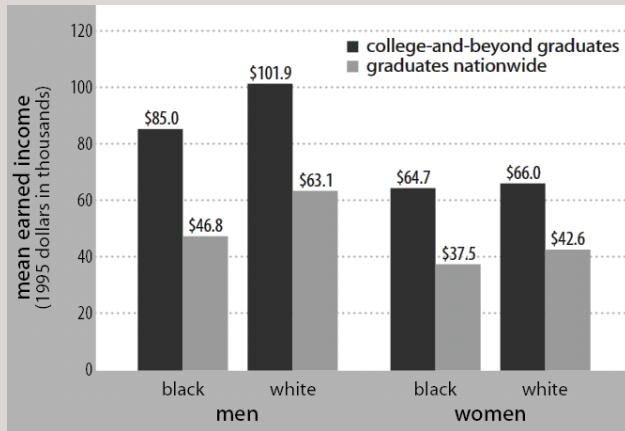
Critics argue that in admissions and in recruiting, people should be chosen as individuals, not as representatives of groups. We agree. But let’s be careful not to confuse bad implementation with a good principle. In choosing individuals, all their attributes are relevant, including the multiple groups to which they belong and the relationship of their attributes to those of the other people being considered. If you have an academic department with only men in it and think that it is important for the students and for the values that the institution represents that there be some women, then it makes sense to consider the fact that a particular candidate is a woman.

Considering candidate A because she is a woman doesn’t mean you’re going to appoint her for that reason alone. That would be ridiculous—just as ridiculous as admitting someone to college simply because he is black. But as ridiculous as it seems, narrow definitions of job qualifications are not uncommon in practice. Consider the legitimate frustration voiced by one of the graduates in our study: “I was looking for a place where my skills would be appreciated. I’m really at the point where I say that straight out in interviews: ‘Look, if you want me because I’m a woman and because I’m African American and because I’m trotting along this series of degrees, don’t bother. Don’t think about how many diversity committees I can head up or how many admissions fairs I can go to or how many times you can stick me in your yearbook to make yourself look diverse. But think about what I can really offer.’”

To admit on the merits, then, is to follow complex rules derived from the institution’s own mission and based on its own experiences of educating students with different talents and backgrounds. These rules should not be thought of as abstract propositions to be deduced through contemplation in a Platonic cave. Nor are they rigid formulas that can be applied mechanically. Rather, they should

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A REPORT CARD ON RACE-SENSITIVE ADMISSIONS



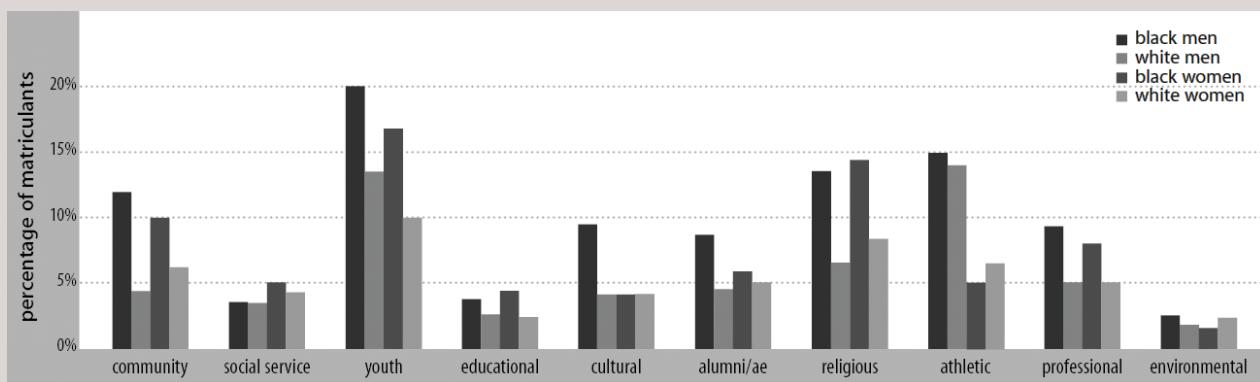
Black C&B graduates have done well in the marketplace, although blacks earn less than whites, and women earn less than men.

Black male B.A.'s from the cohort of 1976 who worked full time earned 84% more than the average for all black males B.A.'s working full time nationwide. For black women the comparable advantage was 71%. The minority students from the C&B schools have helped to form the backbone of the emergent black and Hispanic middle class.

The Impact of Diversity on Education

Survey data show

- a strong and growing belief among graduates in the value of enrolling a diverse student body;
- the affirmation by 79% of white graduates that race-sensitive admissions policies at their alma mater should either be retained or strengthened;
- almost exactly the same level of support for diversity by white matriculants who had been turned down by their first-choice school (and who might therefore be expected to resent race-sensitive admissions policies);
- a significant degree of social interaction between the races during college;
- the belief among graduates that college had contributed much to their ability to work well and get along with members of other races.



Black graduates contribute as civic leaders in higher proportion than their white counterparts.

The data refute the argument by some black intellectuals that the black students admitted to selective schools would benefit personally but would contribute little to society.

FEATURE ARTICLE

A Report Card on Affirmative Action (cont'd)

(Continued from page 8)

be rough guidelines that are established largely through empirical examination of the actual results achieved over long experience. For a school, that means asking how many students with characteristic *x* have done well in college, contributed to the education of their fellow students, and gone on to make major contributions to society.

Increasing diversity does not mean setting quotas or accepting unqualified applicants. But it probably requires being sensitive to race when setting recruiting policies, and it surely requires a greater degree of thoughtfulness about merit. The overriding lesson is that making progress on diversity requires a thoughtful articulation of the meaning of merit in the specific context of the organization.

Above all, merit must be defined in light of what an institution is trying to accomplish. In our view, taking account of race in admissions helps colleges and universities achieve three objectives that are central to their mission: identifying individuals of high potential, permitting students to benefit educationally from diversity on campus, and addressing the long-term needs of society.

Performing to Potential

Opponents of race-sensitive admissions policies argue that they victimize the very people they are designed to help. They claim that minorities with board scores of 1100 who are put in schools where everyone else has scores in the 1300s will be intimidated and ultimately will fail. In fact, the data show over and over that the student with an 1100 board score who is admitted to a school where the average is 1300 does better on almost every count than does the student with an 1100 board score who is admitted to a place where the average is 1100. What lessons can be drawn from these data? Two seem particularly clear: it's important to set high expectations and it's necessary to provide mentors.

Setting High Expectations. The data show that the more selective the college attended, the higher the graduation rate of blacks. Somehow "less qualified" students are rising to the challenge and are graduating at rates markedly higher than the

national average.

Surely many factors come into play, including the substantial resources the most selective colleges have to offer—in facilities, in people, in financial aid. Based both on our research and our experience, however, we believe that a driving factor is high expectations. At the most selective schools, the assumption is that you will graduate. It's the norm. Students rise to the challenge because that is what's expected of them.

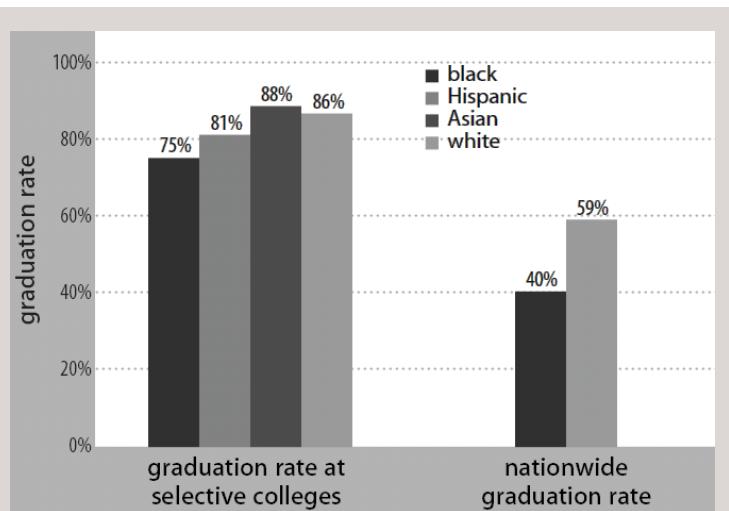
All schools and businesses could benefit by getting the expectations right. The Stanford psychologist Claude Steele has demonstrated that people's stereotypical ideas about themselves and about others have a significant impact on performance. [Editor's note: An article summarizing Claude Steele's research appears in the June 2002 issue of *SPECTRUM*.] The successful programs we've encountered typically have an aura of high expectations. The emphasis is on students' meeting intellectual challenges rather than on their receiving remediation to achieve a minimum standard. They convey to students and employees that when you're capable of getting an A, getting an A– is not good enough. The C&B research is full of stories, some of them quite poignant, of individuals who have been stretched and challenged by their college experiences. The expectations are high—and students have had to work hard to meet them.

The lesson we draw from the data is that it is a disservice to compromise on standards. Everybody deserves a chance not only to succeed but also to fail.

Mentoring. Setting high expectations is just the beginning. All of us must then provide the support and encouragement that allow people to meet those expectations.

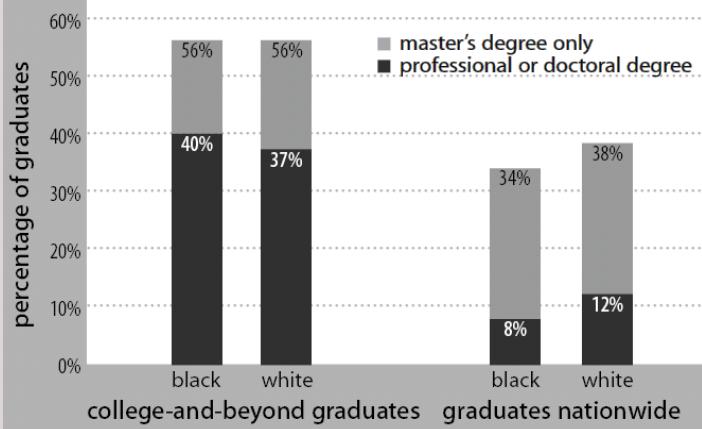
The evidence in our study suggests that large size is a handicap for an institution but one that can be overcome by carving out smaller environments. According to some of the data, the most effective learning environments have been small enough to allow meaningful mentoring and to make the individual feel important. Moreover, the successful programs that we have observed—in our research and

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Blacks entering selective institutions have high rates of graduation.

In fact, they graduate at higher rates than the benchmark figures for all students, white or black, nationwide. These statistics must be read with care. Some students who do not graduate from the school they entered transfer and earn a B.A. within six years from another college. Others take longer than that to complete their studies. Moreover, the disparity between black and white graduation rates at the C&B schools may be due to nonacademic factors (financial, personal) because such factors account for the majority of student withdrawals nationwide.



Large numbers of black C&B graduates go on to earn advanced degrees.

Blacks were slightly more likely than white to obtain professional degrees in law, business, and medicine. C&B graduates are far more likely to earn advanced degrees than are college graduates nationwide.

in other studies—often match up students with successful minority professionals in the community who act as mentors. We also learned that superb mentoring occurs across racial lines.

Mentors play an important role in teaching minorities the informal rules that govern a predominantly white culture—whether that mentoring occurs in school or on the job. To get a flavor of what that means in practice, consider the recollection of a black woman in the 1989 cohort at Princeton: ‘I had a religion professor who was a huge influence on me. We disagreed a lot.... We always ended up agreeing to disagree but it was good for me, because it allowed me to understand that it’s okay to believe something other than what the professor is saying. In [my] Haitian culture, if you disagree with your elders, you’re not supposed to say anything.’

‘In class one day early on, he saw that I wasn’t saying anything and he asked me—in French—’What do you think?’ So I told him that he knew that I couldn’t say anything because I disagreed—he clearly knew about my culture. And he said, ‘No, this is different. You should say what you believe.’ Throughout college, he would check on me and say, ‘Are you remembering to say what you think?’ He’s the one who ultimately made me realize that at Princeton, you have to talk. Otherwise people won’t know that you understand the issue at hand or that you have your own opinion.’

It is difficult to overstate the value of such mentoring to the process of nurturing talent. One finding of our research, therefore, warrants particular attention: the data show that patterns of mentoring differ by race. For blacks, mentoring is more likely to be top-down, with deans and other administrators devoting more time and attention to this process than many faculty members. When asked who served as their mentors, 84% of white students with mentors in the 1976 cohort cited faculty members, as compared with only 66% of black students. On the other hand, 39% of black students with mentors cited college deans or other administrators, as compared

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FEATURE ARTICLE

A Report Card on Affirmative Action (cont'd)

(Continued from page 11)

with 15% of white students. This top-down pattern may be inescapable for now, but over time, and with greater awareness on the part of institutions, we hope it will change.

The Work Ahead

When a distinguished black educator visited the Mellon Foundation, he noted, with understandable pride, that his son had done brilliantly in college and was being considered for a prestigious graduate award in neuroscience. "My son," the professor said, "needs no special consideration; he is so talented that he will make it on his own." His conclusion was that we should be indifferent to whether his son or any of the white competitors got the particular fellowship in question. We agreed that, in all likelihood, all the candidates would benefit from going to the graduate school in question and, in time, would become excellent scientists or doctors. Still, one can argue with the conclusion

reached by the parent. "Your son will do fine," another person present at the meeting said, "but that isn't the issue. *He may not need us, but we need him!* Why? Because there is only one of him."

That mild exaggeration notwithstanding, the relative scarcity of talented black professionals is all too real. It seemed clear to a number of us that day, and it probably seems clear to many others, that American society needs high-achieving black graduates who will provide leadership in every walk of life. This is the view of many top officials concerned with filling key positions in government, of CEOs who affirm that they would continue their minority recruitment programs even if there were no legal requirement to do so, and of professional organizations that have repeatedly stressed the importance of attracting more minority members into their fields. In view of this need, we are not indifferent to which student gets a graduate fellowship.

Clearly, the quest for more talented minority executives and professionals must be conducted

with skill and good judgment. None of the authors of this study has any sympathy with quotas or any belief in mandating the proportional representation of groups of people, defined by race or any other criterion, in positions of authority. Nor do we include ourselves among those who support race-sensitive admissions as compensation for a legacy of racial discrimination. We agree emphatically with the sentiment expressed by Mamphela Ramphele, vice chancellor of the University of Cape Town in South Africa, when she said: "Everyone deserves opportunity; no one deserves success."

We all share a common interest in increasing the pool of people from diverse backgrounds who are well prepared and well qualified to do good and productive work. Educators and business leaders are like Mark Twain's riverboat pilots, navigating the development of talent through snags and shoals. While we have reason to celebrate the accomplishment of much of what we set out to do, we still have a long way to go.

"Don't compromise on standards. Everyone deserves a chance not only to succeed but also to fail."

William G. Bowen is an economist and the former president of Princeton University. He currently heads the Andrew W. Mellon Foundation in New York City. **Derek Bok** is the 300th Anniversary University Professor at Harvard's Kennedy School of Government in Cambridge, Massachusetts. He was dean of Harvard Law School and served as Harvard University's president for 20 years. Bowen and Bok are coauthors of *The Shape of the River* (Princeton University Press, 1998), a study of the long-term consequences of race-sensitive admissions policies in colleges and universities. **Glenda Burkhardt** is a former senior vice president of the Reader's Digest Association and corporate vice president of the Millipore Corporation. She is currently based in New York City and is working with William Bowen and Derek Bok to encourage business and professional leaders to think about the study's implications.

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Civil Rights Commission Finds Fault With Percentage Plans

by Charles Dervarics, Reproduced with permission from Black Issues in Higher Education

Panel says plan is no substitute for actively recruiting students of color

So-called "percentage plans" that guarantee college admission to students who finish near the top of their high school graduating classes do not promote diversity or successfully reach underrepresented groups, according to the U.S. Commission on Civil Rights.

Venturing into a potential political minefield given some states' support for these programs, the commission nonetheless has issued a report asserting that such policies are not substitutes for comprehensive efforts to recruit and support students of color.

"Simply guaranteeing admission to a certain percentage of students is not enough. The plans must be supplemented with proactive recruitment, financial aid, outreach and academic support programs," says Dr. Mary Frances Berry, chairwoman of the commission.

The report examined efforts in California, Texas and Florida to replace some or all affirmative action policies with a college admission plan based on students' class rank. The policy began in Texas following the Hopwood v. State of Texas decision, which curtailed affirmative action in the region. In its place, the state guarantees public college admission to the top 10 percent of its high school classes.

Minority enrollment that declined severely after Hopwood has rebounded, the study says. But enrollment in many areas is below pre-Hopwood levels. For example, minority enrollment at the University of Texas School of Law remains down about 7.5 percent from the year following Hopwood.

At the undergraduate level, minority applications to the University of Texas-Austin have increased since the start of the percentage plans. Yet fewer Blacks are admitted to the school, and the

number of those actually enrolling has declined, says the report, *Beyond Percentage Plans: The Challenge of Equal Opportunity in Higher Education*.

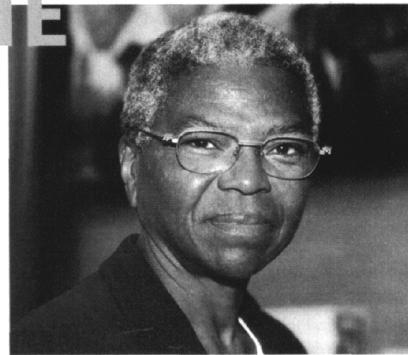
From 1996 to 2001, the number of African Americans applying to UT-Austin increased by 25 percent. Yet the percentage of applicants admitted declined by 19 percent.

In Florida, African Americans continue to be underrepresented in higher education as they were immediately after the state enacted the affirmative action ban. The same trend is evident among His-

QUOTE of NOTE

"If percentage plans grow in popularity, it is inevitable that the number of minority students attending the most prestigious public universities will decrease."

— Dr. Mary Frances Berry, Chairwoman, U.S. Commission on Civil Rights



panics at more selective universities, the commission said. In California, plans to use alternate measures to overcome a ban on race did not stem reductions in enrollment among African Americans, Hispanics and American Indians in the University of California system overall. However, the declines were particularly evident at UC's top-tier universities, namely the Berkeley, Los Angeles and San Diego campuses, commission staff say.

"If percentage plans grow in popularity, it is inevitable that the number of minority students attending the most prestigious public universities will decrease," Berry says. Percentage plans can work only if affirmative action is in place and students also receive adequate financial aid and support services.

For more information, contact the commission at (202) 376-8317 or visit the web site at: www.usccr.gov.

The Lessons of the Grocery Shelf Also Have Something to Say About Affirmative Action

by Virginia Postrel, reprinted with permission from The New York Times

When dozens of brands are available, shoppers actually consider a far narrower selection.

Deciding which shampoo or toothpaste to buy seems a long way from the emotionally charged debate over affirmative action. But an analytical tool developed by marketing scholars to analyze how consumers make brand choices can in fact illuminate that debate.

People have limited time, memory and attention. So when they make buying decisions, they simplify their choices.

"On the shelf you may have 30, 40 brands of shampoo, or 20, 30 brands of toothpaste," explained Jagdish N. Sheth, a marketing professor at the Goizueta Business School of Emory University. But consumers don't take the time to examine every possible choice.

Rather, they reduce their selection to a smaller set of options, based on experience and exposure. "Through learning over time, consumers are really efficient in terms of reducing their transaction costs," Professor Sheth said.

In the 1960's, he and John A. Howard, the Columbia University marketing scholar who died in 1999, developed the idea of the "evoked set" to describe this process of selection.

Shoppers start not with every single brand they are dimly aware of but with a group of options—the evoked set—uppermost in their minds.

"An evoked set consists of the brands in a product category that the consumer remembers

at the time of decision making," according to "Marketing: Best Practices," a textbook edited by K. Douglas Hoffman.

(An alternative term, "consideration set," is sometimes used for the same concept and sometimes for the smaller set of choices that remain after consumers eliminate unacceptable options from the evoked set.)

Ask a grocery shopper to name toothpaste brands, for instance, and you'll probably hear "Crest and Colgate." Only when pressed to

name others will the shopper come up with, say, Rembrandt and Mentadent. Crest and Colgate are the evoked set, the one from which most shoppers will choose to buy—especially if they aren't looking at snappy product displays for other brands.

The downside of this process is that the results depend on exactly how we sort the possibilities into categories.

"The way this information is recorded in memory can influence consumers' preference for brands, and whether the brand will be considered for purchase," Barbara E. Kahn and Leigh McAlister, two marketing professors, wrote in "Grocery Revolution" (Addison Wesley, 1997).

If, for instance, a store arranges yogurt first by brand (like Dannon and Yoplait) and then by flavor within each brand, consumers will tend to select their flavors from the same brand.

On the other hand, the authors write, "If the products had been displayed with all the strawberry yogurts together, then all the lemon-lime yogurts, and so forth, consumers would most

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likely choose which flavors they wanted first, and then choose which brand name they would most like for that particular flavor.”

Similarly, American supermarkets display meats by animal type—beef, chicken, pork, etc.—and then by cut. In Australia, by contrast, grocers arrange meats by the way they might be cooked, and stores use more descriptive labels, like “a 10-minute herbed beef roast.” The result is that Australians buy a greater variety of meats.

How we classify goods changes how we make consumer choices. “The composition of the set of final possibilities can have subtle effects on choice,” write Professor Kahn of the Wharton School at the University of Pennsylvania, and Professor McAlister of the University of Texas at Austin. As a result, “brand choices can be influenced without changing the actual preference for a brand per se, but merely by changing the content of the consideration set.”

What is true for yogurt and meat is true for Supreme Court appointments, award nominees, TV talking heads, corporate board members, conference speaker selections and many mundane hiring decisions.

Decision makers start with an evoked set of possibilities—the people who immediately spring to mind. Who makes it into that evoked set depends in part on how people are categorized on the mind’s “grocery shelf.”

Last summer, for instance, The New York Times ran an article on Hollywood’s search for young action heroes. Old standbys like Arnold Schwarzenegger and Harrison Ford were getting a bit long in the tooth, leading studios to turn to newcomers like Matt Damon and Vin Diesel. The piece left the impression of a vast genera-

tion gap, with no heroes from the latter half of the baby boom.

But one huge action star was inconspicuously absent: Wesley Snipes, born in 1962. Another, Will Smith, born in 1968, was mentioned only in passing.

The evoked set of “action stars” didn’t overlap with the evoked set of “black movie stars.” There was no racial hostility at work, just the limits of human minds and the categories they create.

Overcoming those limits is the argument for a certain type of affirmative action—not quotas or preferences, but an active effort to select from the full range of possible candidates, not merely the first evoked set. (This analysis does not apply easily to cases like college admissions, where the selection is made from a large pool of people who actively present themselves for consideration.)

If you are looking for the best possible conference lineup, just listing the speakers who immediately come to mind may inadvertently exclude good candidates. You should also search through the other categories your mind uses to classify people.

Some of those categories may be the politically fraught ones of race and sex. But, depending on the context, this “affirmative action” might include others, like geography, political persuasion, age, educational background or professional discipline.

The goal is not to meet numerical targets but to make the final selection from a broad enough sample to ensure not only fairness but quality. What’s efficient for picking toothpaste isn’t good enough for people.

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“If you are looking for the best possible conference lineup, just listing the speakers who immediately come to mind may inadvertently exclude good candidates.”

Increasing Diversity in the Science, Engineering and Technology Workforce

by Audrey T. Leath, reprinted with permission from The American Institute of Physics Bulletin of Science Policy News

“Is the United States developing the human capital to remain the world’s most productive economy while at the same time meeting a formidable new national security threat?” This question is posed in a new report, “The Quiet Crisis: Falling Short in Producing American Scientific and Technical Talent.” The report indicates that the U.S. is not doing what is needed to develop the necessary S&T workforce for the future, and calls for greater efforts to increase the representation of women and minorities in the fields of science, engineering and technology.

The report was issued by BEST, an organization seeking to foster “a stronger, more diverse U.S. workforce in science, engineering and technology by increasing the participation of under-represented groups.” BEST, which stands for Building Engineering and Science Talent, is a three-year partnership of government, industry, and academic leaders (for more information see www.bestworkforce.org).

As a follow-on to recommendations of the Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development (see www.aip.org/enews/fyi/2000/fyi00.087.htm), its purpose is to determine what has been proven effective in encouraging “women, African-Americans, Hispanics, Native Americans, and persons with disabilities to choose and stay with science and math educational paths.” The findings of this interim progress report, issued one year into BEST’s lifespan, were made public at a congressional briefing on September 26.

This building crisis, the report warns, “stems from the gap between the nation’s growing need for scientists, engineers, and other technically skilled workers, and its production of them.” The report

cites data from the Labor Department and the National Science Board regarding the expected creation of new S&T jobs, the decline in undergraduate and graduate degree production in engineering and the physical sciences since the early 1990s, the low percentage of women and minorities in science, engineering and technology compared to their representation in the entire U.S. population, the reliance on foreign workers, and the anticipated retirement of many in the S&T workforce.

Closing this projected gap, the report says, “will require a national commitment to develop

more of the talent of all our citizens, especially the under-represented majority—the women, minorities, and persons with disabilities who comprise a disproportionately small part” of the S&T workforce. Initial recommendations include tools to help communities develop workforce diversity, a coherent national strategy and increased federal, state and local resources for expanding “educational opportunities in mathematics and science for under-represented

groups.”

Research universities are urged to become more involved in elementary and secondary science and math education, make greater efforts to slow the attrition rate of women and minorities at the undergraduate and graduate levels, and provide more and better faculty role models. Companies are also encouraged to strengthen their presence in pre-K through 12th grade education, use diversity as a criterion in partnering with universities, and “create a culture of inclusiveness in the workplace.”

The report calls on professional societies, foundations, and other non-profit groups to work together, “project a more positive public image of science, engineering, and technology,” and “mobilize at the grass roots” level to encourage diversity.

“The report indicates that the United States is not doing what is needed to develop the necessary science and technology workforce for the future ...”

Meet Louis Strolger at STScI

by Keivan Guadalupe Stassun

Dr. Louis Strolger is a recent astronomy graduate of the University of Michigan. I met up with Louis at the Space Telescope Science Institute, where he told me all about himself and his research on supernovae at high redshift.

Born in San Antonio, Louis grew up in Reston, Virginia. His family eventually settled outside of Dayton, where he attended a small high school.

Louis says he has “always, always been interested in space,” and remembers spending Saturdays with his father at the Smithsonian Air & Space Museum in D.C. His mother is a Star Trek fan, which he believes also had an influence. In addition, Louis remembers doing “lots of geeky things” as a child: he attended space camp, went to science fairs, stuck metal into electrical sockets.

After high school, Louis attended Earlham College in Richmond, Indiana, which he describes as “yet another small school in a small town.” He majored in physics, but also became deeply interested in Japanese Studies. He also played defense for the football team.

At Earlham, Louis became involved with the NASA University Joint Venture (NASA/JOVE) program, an initiative to enhance student research at colleges and universities with little or no previous involvement with NASA. Working with Dr. Ray Hively, he re-investigated Einstein Observatory data to determine the AGN X-ray emission contribution to the cosmic X-Ray background.

From Earlham, Louis entered the astronomy graduate program at Michigan, where he almost immediately became involved in supernova studies. With Dr. Gordon MacAlpine, he investigated the distribution of the products of oxygen burning about the Crab Nebula Remnant.

Shortly thereafter, the results of the supernova search projects at high redshift were on the verge of announcing that the universe’s expansion is accelerating. “But,” explains Louis, “while the surveys were on their way to gathering enough supernovae to make this effect statistically convincing, there was, and remains, some question as to the possible systematics that may be skewing the high-z data.”

Dr. R. Chris Smith, then a postdoc at Michigan and now an associate astronomer at CTIO, was involved with the high-z supernova search effort. To-

gether, he and Louis designed a dissertation project involving a bulk search for low-redshift supernovae to address these and other questions about supernovae.

In the end, Louis successfully surveyed over 500 square degrees on the celestial equator and discovered 42 supernovae. His dissertation focused on the rate of supernovae in the local ($z < 0.1$) universe for both thermonuclear (Type Ia) and core-collapse (Type II, Type Ib/c) events. Louis explains: “It was unique in that it was a campaign-style field survey at low redshift using survey and reduction methods very similar to the high-redshift surveys. It was completely CCD based which removes biases within the brightest regions of hosts galaxies. It was a field survey, which allowed for a more complete analysis of core-collapse rates.”

Louis is now working with Dr. Adam Riess on the Great Observatories Origins Deep Survey (GOODS) Higher-z Supernova Search (HRZSS) project, looking for the highest redshift supernovae ($z > 1.2$) to gain leverage on the cosmological parameters of the universe. They hope to establish more concretely that the high-z data can indeed be interpreted as a non-zero cosmological constant, and not to something that makes Type Ia supernovae systematically fainter with higher redshift.

“There is quite a lot we still do not know about these supernovae,” says Louis. “Yet they may be our most accurate measure of extragalactic distances, giving us new insight on the nature of our universe. This demands that we understand the underlying physics of these dramatic events.”

There remain some puzzling issues with supernovae. For example, while models for thermonuclear events (SNe Ia) can reproduce the spectral energy distributions of the range of SN Ia luminosities and spectral ages, there is still uncertainty about what the physical progenitors of these events are. “We know that white dwarf stars are involved, but from where do they accrete the mass necessary to prompt the explosion? Red giant stars, other white dwarfs, the ISM?”

With core-collapse SNe, Louis says the pro-



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Groups Gather to Discuss S&E Workforce Issues

by Audrey T. Leath, reprinted with permission from The American Institute of Physics Bulletin of Science Policy News

Many interested organizations joined together last month at a summit addressing the size, training and capacity of the nation's science and engineering (S&E) workforce. Representatives from at least 40 scientific and engineering societies, government agencies, think tanks and professional associations gathered for a day and a half to present their views at this "Pan-organizational Summit on the U.S. S&E Workforce," sponsored by the National Academies' Government-University-Industry Research Roundtable. Low domestic production of S&E workers, the approaching retirement age of many in the S&E workforce, and the nation's dependence on foreign workers have made this a topic of concern for many.

It was apparent that the economy has affected various fields of science and engineering differently, with some experiencing unusually high unemployment and others seeing a pressing need for more workers. Even so, there seemed to be a consensus that K-12 science, technology, engineering and math (STEM) education must be improved, that more and timelier data is needed, and that the costs and rewards of pursuing an S&E career must be better understood. There was also general agreement that the capacity of the S&E workforce would be enhanced if workers' training prepared them to adapt to shifting employment needs.

Shirley Malcolm of the American Association for the Advancement of Science pointed out that while the U.S. is still the world leader in the S&E enterprise, its leadership position depends in part on the foreign workers that help make up the S&E workforce. With other countries building their R&D capacity and creating more opportunities for skilled workers, she said, continued dependence on this influx of workers is risky and the U.S. should focus on strengthening its domestic workforce. To do so, many speakers agreed, will require that the

"... while the U.S. is still the world leader in the S&E enterprise, its leadership position depends in part on the foreign workers that help make up the S&E workforce."

U.S. strengthen its pre-college STEM education, and determine how to make science and engineering careers more attractive, particularly for women, underrepresented minorities, and the disabled.

"Those who are concerned about whether the production of U.S. scientists and engineers is sufficient for national needs must pay serious attention to whether careers in science and engineering are attractive relative to other career opportunities available to U.S. students," warned Michael Teitelbaum of the Alfred P. Sloan Foundation. He and others emphasized the significant time and financial commitment of earning a graduate degree in science compared to other professional degrees. It has been "commonplace" in the last 10-15 years, he said, to hear claims about looming shortages in the S&E workforce, but "labor market projections that go very far into the future are notoriously problematic." Teitelbaum cited evidence that "overall labor markets for scientists and engineers are relatively slack" and vary considerably across fields and over time.

Harris Miller of the Information Technology Association of America stated that the slowdown of the information technology (IT) industry "has resulted in a decreased demand for IT workers." However, he said employers are still having problems finding qualified IT workers with needed skills, and his organization is concerned about the field's long-term ability to produce and maintain an adequate supply of workers. Other speakers reported that some types of engineering- and chemistry-related jobs were moving offshore and demand was down for U.S. workers in those fields. On the other hand, the manufacturing industry is anticipating a labor shortage, said Phyllis Eisen of the National Association of Manufacturers, and is "scared" that it does not have the qualified workforce to respond to customers' needs and stay competitive.

Representatives from several federal agencies

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described difficulties hiring qualified S&E workers, and expect the situation to worsen as the federal S&E workforce ages. According to Mary Good of the Alliance for Science and Technology Research in America, over 50 percent of federal S&E workers may retire in the next decade. She remarked that U.S. production of bachelor's degrees in engineering and the non-life sciences dropped during the 1990s and suggested that the decline might be attributable, at least in part, to the long-term decline in federal funding for mathematical and physical sciences and engineering. Good presented data showing that, for these fields, students' degree choices correlate strongly with the availability of federal research funding.

There was substantial agreement that more timely and comprehensive data is needed to understand S&E employment trends and the factors that affect them. Bill Butz of the RAND Science and Technology Policy Institute presented a paper that posed the questions, "Is there a shortage of scientists and engineers? How would we know?" The paper, using production of PhD scientists and engineers as an example, looked at a number of possible definitions of a shortage: declining production; competitors' share of production increasing; production lower than producers desire or the nation deems necessary; or production not meeting market demand. Butz indicated that much of the available data is not current enough, and the definitions of shortage used by various groups are not consistent enough, to give definitive answers.

It became obvious, as the summit continued, that there are differing conceptions of "shortage" that address different disciplines, segments of the

workforce, and degree levels, over differing time horizons. Most participants agreed, though, that in order for the nation to be prepared for future economic developments and S&E workforce needs, it is necessary to improve K-12 STEM education so students are well-prepared to pursue careers in science and engineering, and that if S&E workers are trained to be flexible and agile, the nation's capacity to fill its future S&E workforce needs will be enhanced. Some disciplines are considering how to revise their degree programs to increase the broad-based general education of students even as the fields require ever-more-specialized knowledge. Several speakers raised the idea of bachelor's-plus or professional master's degree programs.

The result of the summit was a series of consensus recommendations for further action. Working groups are being formed to address each of these items: (1) Develop a coordinated, multi-sector effort to improve the "domestic S&E pipeline issue;" (2) Make STEM education better and more attractive and improve teacher training; (3) Target student financial aid to S&E majors; (4) Reform the S&E undergraduate experience, both curriculum and pedagogy, to attract a wider variety of students; (5) Address the "poor effort-reward ratio" of S&E careers; (6) Design interconnecting career and education pathways and resources so S&E workers and students can develop "agility;" (7) Ensure federal support of lifelong learning, and focus H-1B visa fees on retraining of S&E workers; (8) Increase participation of women and minorities in the S&E enterprise; and (9) Develop a comprehensive national database and a model of S&E education and workforce pathways to understand the relevant factors and "guide intelligent policymaking."

Meet Louis Strolger at STScI (cont'd)

(Continued from page 17)

genitor picture is a little more clear. "These are massive stars that cease to produce energy in their cores and collapse upon themselves, which eventually produces shock-induced and neutrino-driven explosions." But while the mechanism seems pretty clear, there are still questions. "The observed rate of core-collapse SNe widely varies from one investigation to the other, most likely due to the lack in addressing the effects of dust reddening and extinction." For example, estimates of the SN rate sug-

gests that there should be between 1 and 10 SNe per century in our own galaxy. However, the last SN that we know for sure occurred in our galaxy was that which produced Cassiopeia A around 1670 A.D., some 400+ years ago.

As for future work, Louis says "The future is now. I'd like to continue to investigate SNe contributions to distance studies and the cosmological parameters of our Universe, but also contribute to understanding progenitors and environment's role in producing different SNe."

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