



ommunicator

Volume XXXVIII, Number 10

December 2005

Doctoral Education: Reform on a Weakened Foundation*

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Graduate Education and U.S. Prowess in Science and Technology

Since the 1950s, graduate students have come to play a pivotal role in the American research enterprise. At the nation's major research universities, graduate students sustain the productivity and overall excellence of faculty in science and engineering. The quality of a university is often judged by the ranking of its doctoral programs, and those programs rise and fall on their ability -- or failure -- to attract excellent faculty and graduate students. In addition, universities are increasingly viewed as the engine that drives U.S. progress in science and technology.

It does not seem much of a leap to conclude that if graduate students are essential to the university research enterprise and the latter is essential to U.S. economic progress, then graduate students are essential to U.S. economic progress. Not surprisingly, a wide range of stakeholders have taken a lively interest in graduate education and tend to view with concern perceived threats to the preeminence that U.S. graduate education achieved in the last century.

Recognizing the national interest in ensuring a smooth flow of talent into the U.S. science and engineering workforce, these stakeholders have been troubled by the declining share of doctoral degrees awarded to U.S. citizens and concerned to better align the educational experience with the needs of today's marketplace. As a result, various efforts have been made to increase domestic participation in research and education in these fields and to advance a broader reform agenda.

While these initiatives have much to recommend them, they are being undertaken in the context of another disturbing trend -- sharp decreases in the amount of state support for America's public research universities. In this article, I suggest that increasing domestic participation and other elements of the reform agenda may be difficult to achieve in the environment of increasing resource scarcity in public higher education.

Historical Context

The excellence achieved by U.S. graduate education in the twentieth century did not occur serendipitously. Rather, it grew out of visionary public policy that has shaped U.S. higher education in two

readily identifiable phases. The first of these was the land grant movement in the second half of the nineteenth century, which led to major public investments in higher education across the nation. As a result, access to universities grew on an unprecedented scale.

Building on this foundation was the vision of a federal-university partnership advanced by Vannevar Bush as World War II came to a close. In *Science: The Endless Frontier* (1945), Bush advocated that federal funds be invested in university research with the goal of increasing U.S. scientific capital and with the expectation that the investment would pay dividends for the U.S. economy, its national security, and the health and welfare of its citizens. Complementing *Science: The Endless Frontier* was John Steelman's less well-known *Science and Public Policy* (1947), which designated graduate education as the proper training ground for future scientists. Both Bush and Steelman stressed the importance of integrating research and education, insisting that research is required for the teaching of science.

Over the next half century, these visions of a federal-university partnership became fully institutionalized. In 1995, an influential science policy paper titled "Allocating Federal Funds for Science and Technology (The Press Report)" asserted that "a distinctive feature underlying the excellence of the U.S. research and development system is the substantial reliance on university-based research." The report recommended that "federal science and technology funding should generally favor academic institutions because of their flexibility and inherent quality control and because they directly link research to education and training in science and engineering." As parsimoniously expressed by the National Science Board in the 2004 edition of *Science and Engineering Indicators*: "U.S. universities and colleges are major contributors to the nation's scientific and technological progress. . . . Academia is a national resource (emphasis mine) whose vitality rests on the scientists and engineers who work and study there."

Initiatives to Reform Graduate Education

In this context, concerns about the health of graduate education in the sciences have serious implications. Universities have pondered ways to make

continued on page 2

❧ ❧ Inside ❧ ❧

Doctoral Education on a Weakened Foundation.....	1, 2, 6	Data Sources.....	4, 5
Government Relations Update.....	3,5	Best Practices in McNair Scholars Program.....	5, 8

Doctoral Education: Reform on a Weakened Foundation continued from page 1

graduate education more attractive and meaningful, and since the mid 1990s, they have been joined by professional associations, federal agencies, and foundations in calling for reform in doctoral education.

Prompted by lengthening time to doctoral degree and doctoral attrition, the AAU Association of Graduate Schools published a booklet titled "Institutional Practices to Improve Doctoral Education."

(1990) AGS deans urged that:

- Graduate student participation in research and teaching should be pedagogically motivated and designed as an educational experience;
- Innovative coursework should be integrated into the curriculum to provide information and training necessary to pursue careers in current and emerging job markets;
- Faculty teaching and mentoring should help students develop a clear sense of professional responsibility and ethics; and
- Student progress and performance should be evaluated within well-articulated departmental expectations.

Here and elsewhere in the reform agenda, several themes arise frequently: increasing interdisciplinary training, diversifying the academy by increasing the representation of women and ethnic minorities in science and engineering, and preparing PhDs for careers beyond the academy. In 1995, the Committee on Science, Engineering, and Public Policy devoted virtually all of its report on *Reshaping the Graduate Education of Scientists and Engineers* to occupational issues: a more versatile education for a changing global marketplace.

While reform efforts have had salutary effects in enhancing interdisciplinary training, improving professional socialization, and increasing the participation of previously underrepresented groups, I am concerned that we may be neglecting the national resource -- the U.S. higher education system -- which is the foundation for U.S. pre-eminence in graduate education. I refer here to the decline in state support for America's great public research universities, which award 70% of U.S. doctoral degrees and comprise almost 70% of the top 100 U.S. universities as measured by federal investment in academic research.

The Bottom Line

For more than a century, the business plan of these universities has relied on state funding. As that funding has been incrementally withdrawn, the business plan is faltering. In California, this has been glaringly evident. In the 1960s, state funds provided more than 60% of the budget for the University of California and UCLA. At UCLA that percentage has declined to less than 25%. Paralleling this divestment has been a steady decline in the adequacy of financial support going directly to graduate students.

There are signs that the decline in state funding has put in motion a chain of consequences that may operate at cross purposes to the preservation of a great national resource. In this environment of increasing scarcity, there are risks that doctoral education in science and engineering will become both less accessible and less attractive to young people.

The AAU graduate deans attached a very important postscript to the recommendations (outlined above) for improving doctoral education: Adequate and reliable funding is necessary to attract students to pursue advanced degrees. This may well provide a clue to today's situation.

Four years ago, the University of California's Commission on the Growth and Support of Graduate Education issued a report, *Innovation and Prosperity at Risk: Investing in Graduate Education to Sustain California's Future* (2001)—a title that sharply captures its conclusions. California's investment in graduate education in the 1960s and 1970s

paid off in many of today's innovations, the Commission said. Now, however, UC campuses have a lower proportion of graduate students than comparable universities. If graduate students are necessary for a healthy university research enterprise and a growing base of science and technology to fuel the economy, then California is clearly in trouble.

As for the national context, University of Wisconsin Chancellor John Wiley recently pointed out that public universities rely on state taxpayers for the economic resources that private universities draw from wealthy donors. However, the per capita investment in public higher education is about \$221 nationwide, an inadequate sum when laid against the heavy responsibilities public universities have been asked to shoulder.

As a result, public universities have changed in a number of ways that may directly and indirectly impede the flow of talent into graduate education and undermine their long record of contributions to American science and technology.

Higher Tuition and Declining Access

Looking for ways to balance the budget in the face of declining state contributions, public universities have found the easiest and most obvious alternative: raising tuition and fees. Once free or almost free to residents of their respective states, these universities have increased fees and tuition to the point where the cost of attendance is on a par with private universities. At the University of California, fees for California residents have increased from \$2,200 to \$8,900 since 1990. On top of that, nonresidents must pay tuition, which has increased from \$6,400 to \$14,700 in the same period.

This hits hardest at students of limited means, in particular, underrepresented minorities, many of them from working class or even impoverished families. While many programs have encouraged them to pursue doctoral education and helped them prepare for its rigors, the increasing costs of doing so work against this tide. Graduate study, even in the sciences, is increasingly subsidized by loans and families. Minority students are less likely to have family resources they can call on.

As tuition has risen, state contributions to fellowship and scholarship support have not increased commensurately. Because research assistants draw support primarily from federal sources, graduate students in science and engineering have fared better than their colleagues elsewhere. Nevertheless, changes in university support are affecting them indirectly.

It is telling that graduate students in these fields routinely refer to their faculty PI's and mentors as their "bosses." After the first year of graduate study, students typically find themselves dedicated almost exclusively to the research of the professor who provides their financial support. As a result, they have little time to acquire the breadth of interdisciplinary knowledge and the professional skills that employers and others say our graduating PhDs lack. Graduate study is no longer a period when students can be free of mundane cares while they enrich their minds in the extraordinary intellectual environment universities offer. Instead, it is replete with financial insecurity, significant financial sacrifice, and of even greater significance, insecurity about what lies ahead.

The Academic "Career Path": Is This What You Want to Do?

The dwindling supply of state money has also led public universities to rely more and more on raising money from outside sources. Faculty invest energy in identifying, applying for, and managing research and training grants, and university deans and

continued on page 6

Government Relations Update

by Patricia McAllister, Director, Government Relations and Public Affairs, Council of Graduate Schools

As the end of the year and Congressional adjournment approach, many issues of interest to graduate school deans remain to be resolved. A brief overview of outstanding issues and other recent developments follows.

Higher Education Act (HEA) Reauthorization

This year, HEA reauthorization is complicated by the fact that both House and Senate Committees with jurisdiction over education have been directed to cut spending on mandatory programs, including student loans. The Senate reconciliation bill cuts about \$9.6 billion from student loans and the House bill would cut about \$14.6 billion.

The Senate passed its Budget Reconciliation bill on November 3. The bill saves approximately \$39 billion over 5 years by reducing federal spending on entitlement programs including student loans. Specifically, the bill cuts \$9.6 billion from the federal student loan program. An amendment by Senator Mike Enzi (R-WY) provided \$900 million to reduce student loan origination fees from three percent to two percent, and \$1.7 billion for aid to K-12 students and schools impacted by Hurricane Katrina. Senator Enzi noted the \$2.6 billion would be paid for by reductions in the student loan programs. The Senate reconciliation bill carries within it the bill to reauthorize the Higher Education Act.

The House budget reconciliation bill cuts \$53.9 billion over five years with \$14.6 billion coming out of student loan programs over the five year time period. The House bill includes only student financial aid provisions (Title IV) from its HEA reauthorization bill (H.R. 609). As of this writing the full House had not passed its reconciliation package.

Federal programs of interest to graduate school deans, including the GAANN and Javits programs, have not changed from earlier reports. As noted in previous reports, CGS prefers the Senate HEA reauthorization proposal (S. 1614) because it does not contain the provision placing a priority in the GAANN program on training the education professoriate.

The complicated aspects of intertwining HEA reauthorization with budget reconciliation and the different approaches taken by each house make it highly unlikely that HEA reauthorization will be completed by the end of this year. There are provisions within both versions of the bill that CGS supports. In S. 1614, these include: increasing graduate student loan unsubsidized borrowing limits from \$10,000 to \$12,000; permitting graduate students to participate in PLUS loans; maintaining current language concerning GAANN awards. CGS prefers language in the H.R. 609 concerning transfer of credit policies.

FY 2006 Appropriations

As of this writing in mid-November, only five of eleven appropriations bills have been enacted: Agriculture, Foreign Operations, Homeland Security, Interior, and the Legislative Branch. Table 1 pro-

vides an overview of the status of appropriations bills of interest to CGS.

Recent GAO Reports

During the month of October, the General Accountability Office (GAO) released several reports of interest to CGS including the following:

A report titled Federal Science, Technology, Engineering and Mathematics Programs and Related Trends found that 13 federal agencies spent about \$2.8 billion in 2004 on programs designed, in part, to increase the numbers of students and graduates pursuing STEM

(Science, Technology, Engineering and Mathematics) degrees and occupations or improve educational programs in STEM fields, but the agencies have reported little about the effectiveness of these programs. The report found that the number of students enrolled in STEM fields increased by 21 percent from 1995-96 to 2003-04 (compared to an increase of 11 percent in other fields). However, most of the growth occurred among bachelor's and master's students, while the number of students enrolled in doctoral programs in those fields actually declined. GAO recommendations to encourage more students to pursue STEM fields include enhancing the role of the federal government in creating a national agenda for

science and technology education, and providing more funds for academic research, perhaps along the lines of the National Defense Education Act of 1958.

CGS staff met with GAO study directors in the beginning stages of the report and CGS's white paper NDEA 21: a Renewed Commitment to Graduate Education is included in the bibliography. The full report is available at: www.gao.gov/cgi-bin/getrpt?GAO-06-114

The report titled Transfer Students was requested in connection with the reauthorization of HEA to assess requirements that postsecondary institutions have in place to assess requests to transfer academic credits. The report notes that a student's inability to transfer credit may result in longer enrollment, more tuition payments and additional federal financial aid, but the full extent to which these occur could not be determined because institutions do not collect specific data on students unable to transfer credit. The report recommends that Congress consider amending the HEA to require postsecondary institutions eligible for financial aid to issue a statement in their transfer of credit policy that they will not deny the transfer of credit on the basis of a sending institutions' type of accreditation.

In fact, the Senate HEA reauthorization bill goes beyond these recommendations and requires institutions to make available publicly their transfer of credit policies that must include:

- A statement that the transfer of academic credit is not solely denied on the basis of

continued on page 5

	FY 2005 Final	FY 2006 President's	FY 2006 House Final	FY 2006 Senate Final	FY 2006 Conference	FY 2006 Signed
National Institutes of Health						
National Research Service Awards (NRSA)	762	764	764	764		
National Science Foundation						
Integrative Graduate Education and Research Traineeships (IGERT)	24.5	24.6	24.6	24.6	24.6	
Graduate Research Fellowships	88.47	88.57	88.57	88.57	88.57	
Graduate Teaching Fellowships in K-12	41.73	41.83	41.83	41.83	41.83	
Department of Education						
GAANN	30.4	30.4	30.4	30.4		
Javits	9.8	9.8	9.8	9.8		
Fulbright-Hays Doctoral Research Abroad	2.2	2.2	2.2	2.2		
Foreign Language and Area Studies	29.2	28.2	28.2	28.2		
			836.54	836.54		
TRIO (Overall)	836.543	369.39	3	3		
Department of State						
Fulbright Grants for Graduate Study and Research Abroad	204	238	227	243.4	240.7	
Environmental Protection Agency						
General fellowships	12.04	8.33	12.03	12.04	12.04	12.04
Department of Agriculture						
Graduate fellowship grants	3	4.5	4.5	4.5	3.738	3.738
Department of Defense						
SMART/NDEA Phase I	2.5	10.3	10.3	20		

Data Sources: Post-baccalaureate Education and Graduate Certificate Programs

by Heath Brown, Director of Research and Policy Analysis

Introduction

In Kohl and LaPidus' publication, *Postbaccalaureate Futures: New Markets, Resources, Credentials* (2000), the authors assert: "The rise of postbaccalaureate education may be seen as a precursor of inevitable changes in the entire higher education enterprise...The forces promoting postbaccalaureate education derive principally from the knowledge economy." (p. 231) To respond to these changes, the authors call for the "need to collect and analyze improved data about providers of postbaccalaureate programs and postbaccalaureate learners" (p. 235). This article seeks to meet some of the need for improved data collection and analysis by focusing on recent findings on graduate certificates, an important component of postbaccalaureate education.

Previous Research on Certificates

In 2004, the Council of Graduate Schools (CGS) in conjunction with the University Continuing Education Association (UCEA) conducted a survey of the memberships of each association. The CGS portion of the survey was reported in the CGS *Communicator* in September 2004 (Brown and Syverson 2004). That report revealed important information about the relationship between graduate schools and certificate programs as well as other policy trends. Overall, 76 percent of responding graduate schools reported that they offered at least one certificate program. Public institutions were much more likely (86%), than private institutions (50%) to offer a certificate program. Compared to Research I and Doctorate-Granting institutions, Master's-Focused institutions were the most likely (77%) to offer a certificate program.

The report showed that graduate certificate programs tend to be centrally managed. Nearly 80 percent of institutions reported that they had authority vested in a single unit on campus, and of those institutions 58 percent had a graduate school that was in charge. This centralization of authority mirrors the type of control graduate schools maintain over master's and doctoral programs. Graduate certificates further resemble traditional graduate programs in terms of the delivery of course work. More than 90 percent of graduate certificates use face-to-face on campus as a mode of instruction. About half of the institutions (51%) reported using a hybrid approach that combines face-to-face and on-line instruction.

New Findings on Certificates

What many earlier reports have lacked was current information of how many certificates were being awarded and the variation that is occurring across fields, institutions, and student groups. As a component of the 2004 CGS/GRE Survey of Graduate Enrollment, specific questions were added to the survey questionnaire to target this

knowledge gap. This paper summarizes those findings for the first time.

In 2003-2004, nearly 20,000 graduate certificates were awarded nation-wide (See Table 1). Not surprisingly, education is by far the most prevalent field of study for certificates (See Table 1). In fact, over half (52%) of the certificates awarded were in the field of education (5,194), and teaching certificates (elementary, secondary, and special) are the dominant types. Certificates in student counseling and curriculum/instruction were also popular fields for students earning certificates in education.

Students also earn large numbers of certificates in the fields of health sciences (10%) and social sciences (8%). Within the health sciences, 958 certificates were awarded, 809 in the social sciences.

Within engineering (519), students earn degrees in a variety of areas: a

third in engineering—other, 29% in industrial engineering, 18% in electrical engineering, 10% in civil engineering, and 9% in mechanical engineering.

Findings on Certificates by Sex

Table 1 also reveals the different patterns of graduate certificates by sex. By a 2-to-1 margin, women (13,530) outnumber men (5,867) in earning graduate certificates.

The primary reason for this is the larger number of women earning certificates in education. Over three-quarters of education certificates (76%) are earned by women, totaling nearly 4,000 certificates. Women also earn the largest number of certificates in biological sciences, health sciences, humanities and arts, public administration, social sciences, and other fields. Education is also the largest field for certificates for men, but men earn the most certificates in business (53%), engineering (71%), and the physical sciences (59%).

Findings on Certificates by Institution Type

The growth of Master's-Focused institutions revealed in the recent report on Graduate Enrollment and Degrees, 1986-2004, is reinforced by the growth of graduate certificates. More graduate certificates are awarded by Master's-Focused institutions than either Research I or Doctorate-Granting institutions (See Table 2). The large number of education certificates is the main reason for this difference; nearly 70% of graduate certificates awarded by Master's-Focused institutions are in education. Relatively small numbers (less than 10%) of certificates are given out in each of the other broad fields. In comparison, Doctorate-Granting institutions award fewer than half (42%) of their certificates in education. More certificates are awarded in social science, engineering, and other fields at Doctorate-Granting than Master's-Focused institutions.

Even more dramatic are the differences between Master's-Focused and Research I

Table 1: Graduate Certificates awarded by sex and field, 2003 -2004

Major Field	Total	Graduate Certificates			
		Men	Women	Men	Women
Total	19,397	5,867	30%	13,530	70%
Biological Sciences*	161	76	47%	85	53%
Business	152	80	53%	72	47%
Education	5,194	1,272	24%	3,922	76%
Engineering	519	370	71%	149	29%
Health Sciences	958	221	23%	737	77%
Humanities & Arts	480	156	33%	324	68%
Physical Sciences	704	413	59%	291	41%
Public Admin. and Services	331	66	20%	265	80%
Social Sciences	809	258	32%	551	68%
Other Fields**	603	262	43%	341	57%

NOTE: Because not all institutions responded to all items, detail variables may not sum to total. Percentages are based on total of known gender.

*"Biological Sciences" includes agriculture.

**The category "Other Fields" includes architecture, communications, home economics, library science, and religion.

Source: CGS/GRE Survey of Graduate Enrollment

continued on page 5

Best Practices in McNair Scholars Programs

By Priscilla Fortier, Assistant Dean and Associate Director, McNair Scholars Program, University of Illinois at Urbana-Champaign

The Ronald E. McNair Post-baccalaureate Achievement Program is one of several TRIO programs within the U.S. Department of Education. There are 179 McNair programs at four-year colleges and universities, each funded through a competitive grant that is written every four years. Named after Dr. Ronald E. McNair, one of the astronauts killed in the 1986 Challenger accident, the McNair Program's ultimate goal is to help diversify the American professorate. To that end, the individual programs offer a number of services that are designed to help facilitate participants' entry into graduate programs.

Federal law requires that two-thirds of the individual students in each program be within the first generation in their family to attend college and must also meet federal low-income guidelines. If they do not meet both these criteria, the other one-third must be members of groups underrepresented in academia, specifically African-American, Hispanic, and American Indian students. Program funds may be used to support only students who have not yet earned a baccalaureate degree. Only juniors and seniors may earn a stipend of up to \$2800, which is usually given for participation in an intensive research experience.

In 1989, the first fourteen programs were funded. By 2002, there were 156 programs and over 4000 participants, with 23 more programs added in 2003. Becoming a McNair scholar is a competitive process, as the programs tend to be very popular on their individual campuses, but each program serves an average of only 26 students each year. As the number of programs has grown, the national community of McNair program directors and other staff have developed and refined a basic list of best practices and services that are designed to prepare nontraditional students for graduate school and an academic career.

The capstone experience that is offered by most programs is an intensive research project that involves working closely with a faculty member as well as graduate students or a research team in a laboratory setting. The research experience provides most McNair scholars with several "firsts," such as their first experience writing an abstract and a literature review and presenting their research at the end of the research program. In addition, a well-designed research experience allows students to establish a comfortable working relationship with a faculty member.

continued on page 8

Data Sources continued from page 4

institutions. Only a little more than a third (37%) of certificates awarded by Research I institutions are in the field of education. Research I institutions confer a larger number of certificates in health sciences, physical sciences, and social sciences. Further, relatively few certificates are awarded in engineering, 1% (or less than 30 certificates), compared to Doctorate-Granting institutions where engineering is a major field for certificates.

Implication and Conclusion

This paper provides a description of some aspects of postbaccalaureate education, specifically several trends in graduate certificates. Overall, more graduate certificates are awarded in education than any other field, significant institutional differences exist across fields, and more women than men earn graduate certificates. These conclusions broaden and deepen the collective understanding of the development of certificate programs as an important component of graduate education. These findings are also suggestive of many more in-depth

inquiries into the structure and governance of certificate programs as well as the characteristics of those students who earn these certificates. As Kohl and LaPidus speculated in 2000, if postbaccalaureate education is at the forefront of changes in higher education, particularly at the graduate level, a better appreciation of these trends may help stakeholders anticipate and initiate changes in other types of programs

such as those at the master's and doctoral levels.

Going forward, better data collection of graduate certificates, such as those led by CGS, will lead to a better understanding of trends and change over time. Based on the cross-sectional examination of this analysis and other empirical research, one

would expect for growth of the number of graduate certificates offered each year as the demands of a knowledge-based economy drive students and employers toward the acquisition of more education, skills and training.

Table 2: Graduate Certificates by field and institution type, 2003-2004

Major Field	Graduate Certificates					
	<i>Master's-Focused</i>	<i>Percent</i>	<i>Doctorate-Granting</i>	<i>Percent</i>	<i>Research I</i>	<i>Percent</i>
Grand Total	8,164		6,725		4,508	
Biological Sciences*	25	1%	81	2%	55	3%
Business	43	1%	41	1%	68	3%
Education	2,925	69%	1,536	42%	733	37%
Engineering	83	2%	409	11%	27	1%
Health Sciences	281	7%	250	7%	427	22%
Humanities	117	3%	193	5%	170	9%
Physical Sciences	226	5%	283	8%	195	10%
Public Admin & Svcs	191	5%	106	3%	34	2%
Social Sciences	171	4%	419	11%	219	11%
Other Fields**	180	4%	372	10%	51	3%

Government Relations Update continued from page 3

accrediting agency or association if the agency or association is recognized by the Secretary of Education and

- A list of institutions with which the institution has a transfer articulation agreement
- A report to the Department of Education containing the percentage of students who successfully transfer academic credit.

The House Reauthorization bill requires institutions to publicize their

transfer of credit policy and that the policy include a statement that the transfer of academic credit is not solely denied on the basis of the accrediting agency or association of the sending institution if the agency or association is recognized by the Secretary of Education. The full report (GAO-06-22) may be obtained at the GAO website at <http://www.gao.gov/cgi-bin/getrpt?GAO-06-22>.

Doctoral Education: Reform on a Weakened Foundation

continued from page 2

presidents devote an increasing amount of time to soliciting contributions and endowments.

University of Wisconsin Chancellor John Wiley has noted that it would take \$1.3 trillion in endowments to replace taxpayer support. At present, the total endowment for public and private universities is about \$200 billion, so any dramatic increase in endowment support is unlikely.

Besides its long-term impracticability, however, the new reliance on outside funding is changing the character of the university as an environment in which to work and study. First, public universities are moving away from the tenure track system, in which faculty were hired for entry-level positions as assistant professors, then made their way along a well-marked path to senior faculty status through their research, teaching, and university service.

Under pressure to produce cutting-edge research, universities are inclined to muster their hiring dollars so they can compete for senior research scholars and demonstrated rain makers who command big salaries and significant start-up funds. The budget is balanced by not filling faculty vacancies or by hiring less expensive part-time and non-ladder faculty.

How does all this look from a graduate student's perspective? As they scan the terrain for role models, graduate students are likely to find a daunting picture. Research is a labor-intensive enterprise, and regular faculty account for the smallest category of research personnel in today's universities. The rest of the team is made up of graduate students, postdoctoral fellows, and various nonfaculty research personnel who depend heavily for support on the federal government -- with the resulting insecurity.

Instead of dreaming of the day when they will pursue their own research agenda, graduate students are more likely to envision an extended apprenticeship as a postdoctoral fellow and even after that perhaps a job managing someone else's research agenda. A faculty appointment may well come without the security and status the tenure track confers. And should they reach the heights of principal investigator, they face the crushing pressure of constantly replenishing the funds for their own team.

Graduate students who hope to look outside the academy are unlikely to find much useful support or information among faculty members and other campus advisers. Faculty at research universities know their own careers better than anything else. They can't provide a role model of alternative career options or, in many cases, the connections to off-campus employers. Small wonder then that surveys of graduate students reveal significant insecurity about career prospects.

Conclusion

If it continues, the declining enrollment of young Americans in American graduate schools will have grave consequences for the nation's prosperity and for its social fabric. Even the best-considered efforts to reform the existing system have had relatively little impact on this trend. Moreover, this focus on internal strategies has neglected the broader context in which graduate education occurs: the society it serves and depends on for resources. To use a domestic metaphor, it's possible that we've been renovating the kitchen and putting up new curtains while termites undermine the very structure of the house.

The plight of public research universities also has potentially grave consequence for the nation's prosperity and for its social fab-

ric. Here's how an editorial in *The New York Times* describes the situation:

The United States has been sabotaging its future for decades by starving the public colleges and universities that have moved millions of Americans into the middle class. . . . The gap between state aid and the real cost of an education is glaringly evident at the flagship public colleges, which often receive a pittance from the legislature while maintaining expensive, world-class programs that compete with those of top private colleges and universities. (February 16, 2004)

If public universities are to preserve their historic role, their health must be secured. More than a century ago, the arrival of public higher education ushered in a new era of opportunity for Americans. Inaugurated 50 years ago, the federal university partnership has created astonishing advances in science and technology and a burgeoning in the American economy. The state divestment in public higher education threatens to dismantle that century of accomplishment. This must not continue, certainly not without a debate.

To summarize, here are the danger signs that are already visible:

- Graduate student tuition and fees rise as fellowship support dwindles. Our largest untapped talent pool, underrepresented minorities, often lacks the economic resources to meet these rising costs. The idea that access to public universities should be determined by merit rather than wealth may become an artifact of the past.
- Increasing pressure on public universities to produce scientific and technological discoveries makes their research mission increasingly dominant and further strains overstressed budgets. The federal share of funding for research performed in academia has actually declined from 68% (1972) to 59% during the last thirty years while the institutions share has tripled in the same period, standing now at 20%. (*Science and Engineering Indicators*, 2004)
- Pressure to do more research with less money takes place in the context of the displacement of traditional university processes and growing inequality in faculty salaries. Junior faculty in science and engineering fields are increasingly scarce, and the tenure track has suffered serious erosion.

As graduate students enter this pressure-filled environment -- and, of more concern, as undergraduates contemplate career directions -- all of this must serve as a cautionary tale. Should we wonder, then, why they find doctoral studies in science and engineering less appealing and choose to put their talents to other uses? In addition, the financial condition of public universities contributes quite directly to access issues by increasing the cost of graduate studies for those least able to pay.

The linkage between declining domestic participation in doctoral education and declining state support for universities may go well beyond a mere coincidence of time. If we are to safeguard the nation's economic prosperity, we must attend to the well-being of the public research universities that are its keystones. When we have done so, we may find that young Americans have renewed interest in the graduate education that can secure their future and ours.

**This article is revised from a paper originally presented at the annual meeting of the American Chemical Society, August 23, 2004, Philadelphia, PA.*



The University of Missouri at Columbia (MU) seeks a dynamic and visionary leader for the position of Vice Provost for Advanced Studies and Dean of the Graduate School. The position reports directly to the Provost, is an integral part of the Provost's Staff and the Council of Deans, and maintains positive relationships with the Office of Research.

This innovative teacher/scholar/administrator will provide leadership and strong advocacy for graduate and professional education, and will be responsible for: Effective recruitment; strategic and innovative interdisciplinary programs; effective economic development activities; initiatives contributing to campus diversity; prominence of graduate and professional education in strategic planning, enrollment management, and communications; positioning graduate and professional education with alumni, philanthropic, political, and other stakeholders; the highest standards of quality for graduate and professional education through collaboration with chairs, center directors, and other academic administrators; collaboration with the Graduate Faculty Senate and the Graduate Student Associations on issues vital to graduate and professional education; providing leadership and vision for future developments in graduate education both at MU and nationally.

Qualifications: The successful candidate must be a senior scholar with credentials appropriate for appointment at the rank of professor in an academic department. The candidate should have appropriate administrative experience, be a strong communicator, and a compelling voice for graduate and professional education. S/he should be engaged with issues in graduate and professional education and have a demonstrated commitment to excellence in graduate teaching and research. S/he should have the highest standards and personal integrity and be committed to the work of stimulating innovative graduate and professional degree programs.

Nominations, applications, and inquiries, which will be treated in confidence, are welcome and should be sent to: Dr. Richard Schwartz, Chair, Graduate Dean and Vice Provost Search, c/o Office of the Provost, University of Missouri-Columbia, 114A Jesse Hall, Columbia, MO 65211. Electronic submission is encouraged and may be forwarded to: umcprovost@missouri.edu. Applicants should submit: a letter expressing interest in and perspectives on the position, curriculum vitae, and other materials supporting your candidacy, including references. References will not be contacted until advanced stages of screening, and candidates will receive prior notification.

Formal review of applications and nominations will begin January 15, 2006, and will continue until the position is filled. Please contact the Chair of the Search Committee (via Linda Cook at 573/882-0159; cookl@missouri.edu) or Interim Associate Provost Kenneth D. Dean (537/882-6597; deank@missouri.edu) with questions.

The University of Missouri is an Equal Opportunity, Affirmative Action Employer. Applications from women and minorities are strongly encouraged. To request ADA accommodations, please contact our ADA Coordinator at (573)884-7278 (V/TTY).



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McNair Scholars Program continued from page 5

This may be the most important outcome of the research experience because first-generation and low-income college students often feel out of place or inappropriate in faculty-student interactions. Students receive exposure to the way in which research is conducted in a particular field, and begin to acquire a rudimentary understanding of graduate school expectations and the pressures and constraints that an academic career entails. Many McNair research experiences are structured so that students work full-time for eight to ten weeks (often, but not always, during the summer), thus affording an opportunity for faculty-student interaction in informal settings and through observation. Several weeks of full-time immersion in an academic department should also provide the opportunity for social interaction in informal settings and thus help nontraditional students to ultimately transition more easily into graduate school.

Another opportunity for developing academic presentation skills and facilitating networking with faculty and other McNair scholars at a regional or national level is afforded by attendance at one of several annual McNair research conferences. Besides the opportunity to present and attend research talks, most of the conferences also feature a graduate school fair. Therefore, students have an opportunity to present their research findings to a less local audience, to meet other students who are similarly serious about their academic work, and to meet and be courted by faculty and graduate school representatives. A listing of these conferences appeared in the June 2005 issue.

Besides the capstone research experience and McNair research conferences, all programs offer academic counseling, information about funding for graduate school, and various types of assistance with graduate admissions. The latter usually range from initial seminars on

requirements and the application process, to intensive individual assistance during the senior year on such specific aspects as seeking effective letters of reference and crafting a successful personal statement. Most programs also sponsor campus visits to doctoral-granting institutions and many provide career-awareness activities that include workshops and classes on higher education in general and academic career opportunities in particular.

The McNair Scholars programs across the nation provide an excellent source from which to recruit diverse students for graduate school. The joint committee of the Council for Opportunity in Education, (the national organization for TRIO staff), and the Council of Graduate Schools pledged to continue communicating and collaborating to provide graduate opportunities that enhance both the lives of the student participants and the institutions at which they matriculate.

References:

Beasley, P. (2005) "An Examination of McNair Program Models." Paper presented at the annual meeting of the Council for Opportunity in Education.

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U.S. Department of Education, Office of Postsecondary Education. (2005). "A Profile of the Ronald E. McNair Postbaccalaureate Program: 1997-1998 through 2001-2002." By M. Seburn, T. Chan & R. Kirshstein. American Institutes for Research.

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