



ommunicator

Volume XXXVIII, Number 4

May 2005

The Tangible Contributions of International Graduate Students An Alternative Approach and Some Evidence from the University of Rochester

by Bruce Jacobs, University Dean of Graduate Studies, University of Rochester

Prologue

Many who come to the United States from other countries to earn graduate degrees have a beneficial impact on our educational institutions and the nation at large. Anecdotal evidence of such effects appears frequently in a number of settings. Sometimes a news story sums up the accomplishments of a lifetime. At other times we can read about the beginnings of what may be a productive career that contributes to the innovations highly prized in the marketplace. Two recent examples follow.

Yale News Release

For Immediate Release: February 11, 2005 (#43)

In Memoriam: Science Advisor to Former Bush Administration and Former Dean of Engineering at Yale, D. Allan Bromley
New Haven, Conn. Renowned nuclear physicist D. Allan Bromley, the first Sterling Professor of the Sciences and Dean of Engineering at Yale from 1994 to 2000, died February 10 at age 78. From 1989 to 1993, he served under George H.W. Bush as the first Assistant to the President for Science and Technology and Director of the Office of Science and Technology Policy. One of the world's leading nuclear physicists, Bromley was founder and director of the A.W.Wright Nuclear Structure Laboratory at Yale from 1963 to 1989. He carried out pioneering studies on both the structure and dynamics of atomic nuclei and was considered the father of modern heavy ion science, a major field of nuclear science. From 1972 until 1993, he held the Henry Ford II Professorship in Physics at Yale, and from 1970 to 1977, he served as chair of the Yale Physics Department.

"Allan Bromley was a great scientist and a great leader. In three successive careers, he built our physics department, served the nation with distinction, and thoroughly revitalized engineering at Yale. With intelligence, energy, and enthusiasm he inspired countless students and colleagues," said Richard C. Levin, President of Yale University. "Where he led, we willingly followed."

Allan Bromley was a graduate student from Canada who earned his Ph.D. degree in physics at the University of Rochester. Some years later he became a U.S. citizen.

Rochester Democrat and Chronicle (March 1, 2005):

"UR team is refining camera-photo's heart"

In just a few short years, it has grown from a fad for techno-geeks into arguably the fastest-growing new product in history. Now researchers at the University of Rochester have developed technology that down the road could improve the increasingly popular camera-cell phone and lead to similar devices. Mark Bocko and Zeljko Ignjatovic, professors of electrical and computer engineering, have developed what they believe is a breakthrough approach to imaging sensors, which serve some of the same functions as photographic film. Their approach involves a more efficient method for converting light into digital images that can be viewed on computer display screens...

Zeljko Ignjatovic was born in Yugoslavia and came to the University of Rochester to earn his doctoral degree in electrical and computer engineering. He and Professor Bocko now have six inventions at various stages of the patent application process.

Introduction

In recent years there has been a fair amount of concern in the graduate school community about the significant decline in applications from foreign students and, perhaps to a lesser degree, their declining presence among enrolled students. The most frequently cited data are from a survey done by the Council of Graduate Schools, which reported an average 28 percent decline in foreign applications and a 6 percent drop in their numbers in entering classes for 2004 (Brown, Syverson, and Doulis). The latter figure followed decreases of 10 percent and 8 percent in the prior two years (Syverson and Brown, 2003 and 2004). Last month the Council released new data indicating the downward trend has continued, albeit at a slower pace (Council of Graduate Schools).

These developments have been attributed to a number of factors. Important among them has been the impact of new regulations that have had the effects of slowing down the issuance of student visas and making trips outside the U.S. subject to uncertainty about whether and when the students can return (Kless). Some have observed that an outgrowth of these trends has been a feeling among international students they are

continued on page 2

❖ Inside ❖

The Tangible Contributions of International Graduate Students.....1,2,6,7

Federal Relations Update.....3,5

Data Sources..... 4,5

New Members.....7

The Tangible Contributions of International Graduate Students continued from page 1

not welcome in this country. Another factor has been the emergence of increasing competition from graduate schools in other countries, including those in Australia, Canada, and Europe. Also deemed important has been the growth of the "high tech" sector of economies in China, Taiwan, and India.

However, there is some uncertainty about the dimensions of the problem. Some have questioned, for example, whether we actually face a shortage of scientists and engineers in our labor market (Monastersky). While over a number of years there has been an increased reliance on foreign born scientists trained in this country, some question how serious the problem of declining applications is at elite schools. As one graduate dean has suggested, "one can argue that the best and the brightest will still gravitate toward the very best faculty in the very best institutions" (Pell). MIT, for example, has experienced only very modest declines in international student enrollments in a number of graduate programs (Atwood). There is also some uncertainty about which part of the applicant quality distribution has dropped the most. Anecdotal evidence from a number of schools suggests the greatest reduction of foreign applicants may be among those least qualified. Finally, recently published stories indicate the waiting time for student visas has been declining (Puzo) and governmental decisions promise to lengthen clearance times for foreign students and scholars (U.S. Department of Homeland Security).

Nevertheless, a general sense of concern persists in the leadership of many graduate schools. Even if the decline in applications and enrollments comes to an end, the number of international students will have settled at a much lower level. Some have argued that we need to "make the case" for governmental efforts to counteract the decline. Yet, the case can not focus solely on the shrinkage of the foreign applicant pool, even if it includes some of the best and brightest students schools fight so hard to recruit. The reductions in foreign applications and enrollments (28 percent, 6 percent and so on) represent the "input" side of the graduate school process. The larger issue, however, is what contributions these talented foreign students make to our society - the "output" side.

Of course, a number of contributions immediately come to mind. Many have argued that a declining interest among American students in science and engineering has been counteracted by young people in other nations who have come to this country to study. Others have spoken about the role international students play in developing technological advances that help fuel our economy. Many believe when graduate students return to their own countries they actually serve as "ambassadors" who extol the virtues of our nation. However, some of these contributions, while important, are not easily quantified or measured. Making the case effectively will require gathering empirical evidence of the tangible contributions of international graduate students. A necessary quality of such evidence is that it be perceived as valid indication these students provide something of significant value to this nation. Another is that universities should be able to gather these data without Herculean efforts by their staffs.

Here I suggest two kinds of evidence I think both accessible and likely to be perceived as valid. Undoubtedly other tangible contributions share these characteristics. My suggestions are simply offered as options to measure the "output" side of graduate education for international students.

Educating America's Best and Brightest

When faculty members train graduate students at the most prestigious schools in this country, their endeavors serve a number of purposes. Perhaps most important are the transmission of knowledge

and development of skills enabling program graduates to carry out significant research, thus helping this country remain competitive in the academic world. Equally valuable is the research professors pursue themselves in the university environment (frequently in partnership with their students). In many disciplines such work is sustained by substantial grants and contracts.

There is also a parallel objective graduate schools have in this process -- nurturing doctoral programs' reputations. Among the most important factors affecting these reputations is each program's complement of faculty members. Indeed, when the National Research Council asked their survey respondents to rate different programs in a discipline, the information they received consisted largely of a list of faculty members at each school.

All of this suggests universities have a strong incentive to recruit (and hold on to) the very best professors available. This may seem obvious, but the importance of this incentive is hard to overestimate. Simply put, it is both in each school's interest and in the national interest to sustain excellence among the faculty.

We all realize a significant number of faculty members at the most prestigious schools, who are given the important responsibility of training our very best students, were once international graduate students at American universities. What we do not know is the magnitude of that number. It is fairly safe to assume American universities do not have a bias against American graduate students in making their faculty hiring and promotion decisions. Therefore, the presence of former international students in these positions can be seen as a valid indicator of their value in academe -- an output measure.

In principle, it should be fairly easy to ascertain how many members of a faculty have done their graduate work as international students in this country. Each school could canvass its departments and forward such information so national estimates could be produced. While we do not know what numbers would emerge from such a survey, data now available at the University of Rochester provide at least some hint of what the findings might be.

The university maintains a list of professors with Rochester Ph.D. degrees who teach in "top 25" doctoral programs and schools: <http://www.rochester.edu/gradstudies/PhDs.html>. (I call them "academic leaders" for want of a better term.) For the purpose of this exercise I focus on several disciplines that might be perceived as most directly linked to the national interest. To the STEM fields I add economics and business administration, since the latter programs train faculty members who will teach future generations of business managers, financial analysts, and others central to the workings of the economy. I do not mean to shortchange the humanities and other social sciences. At Rochester, for example, we believe graduates of the university's Eastman School of Music provide significant tangible benefits to the nation. However, the argument upon which their inclusion would be based might be less obvious to some and would possibly be a distraction from the main point of this exercise.

Former international students now on the Rochester "leader list" come from 29 different countries. While India is the most frequent nation of origin, a number of others have noticeable contingents: China, Italy, Korea, Israel, Poland and Turkey. The table on page 6 illustrates some of the variation in national origin and faculty rank across prestigious universities. Each university listing is limited to one Rochester graduate. There are twice again as many graduates not in the table. The most prestigious and largest American universities, of course, have trained more faculty members, but aggregate national data might well tell the same story as emerges from the University of Rochester.

continued on page 6

Federal Relations Update

by Patricia H. McAllister, Director of Government Relations and Public Affairs

This article reviews recent proposals to implement new systems or policies that impact higher education institutions and graduate students.

Student Unit Record (UR) System proposed by U.S. Department of Education

In March, the U.S. Department of Education submitted to Congress a report titled "Feasibility of a Student Unit Record System Within the Integrated Postsecondary Education Data System." The report examines the feasibility of implementing a student unit record system that would replace the student related components of the Integrated Postsecondary Education Data System (IPEDS).

IPEDS is the core postsecondary education data collection program designed and implemented to meet the mission of reporting on the condition of postsecondary education in the United States. The program is housed and managed in the National Center for Education Statistics (NCES) in the Institute for Education Services (IES) in the U.S. Department of Education. IPEDS is a single, comprehensive system that includes over 10,000 institutions whose primary purpose is to provide postsecondary education. The system collects institution level data in the areas of enrollment, program completions, graduation rates, faculty, staff, finances, institutional prices and financial aid.

The proposed Unit Record System (UR) involves the collection of individually identifiable records about students (Social Security number, date of birth, race/ethnicity, address based on their enrollment, price paid, financial aid and attainment at different points in time.) The proposed UR system stems from growing interest within the postsecondary education community for more accurate measures of net price and graduation rates, particularly measures that account for institutional mission and student mobility. There is also Congressional concern about holding postsecondary institutions accountable for student outcomes and this too is driving interest in the UR system.

The use of aggregate data currently collected via IPEDS has some limitations when compared with UR data, such as the inability to track the academic progress and experiences of individual students and difficulty in studying the longitudinal enrollment of different types of students. The current IPEDS framework does not accurately capture changing enrollment and completion patterns in the postsecondary education sector, including increasing numbers of nontraditional students, and cannot describe the prices various types of students face when financial aid is accounted for. The UR system would enable the collection of data that would lead to more accurate estimates of these variables. It would also develop a new range of measures such as net prices for specific groups of students, graduation rates that take into account institutional missions, persistence rates that consider student mobility and measure of enrollment patterns for nontraditional students and time to degree by field of study.

Currently, Unit Record systems are maintained by many colleges and universities to track registration for courses, academic performance, degree and certificate completion, financial aid and for other purposes. In addition, 39 states have at least one student UR system but most of these do not include data on students attending private institutions or students who transfer across state lines.

While it is clear that a UR system could be implemented at most institutions in the long term, a number of concerns about doing so have been raised. A major concern is student privacy and the confidentiality of individually identifiable student data as well as students' rights to withhold or control personal information. There are also

more practical technical concerns about unauthorized access to the data by hackers and identity theft. This later concern is particularly relevant given current plans to use SSNs to accurately link student information on financial aid with enrollment and completions as well as records from various institutions. Other technical concerns relate to creation and maintenance of a data base of millions of student records, coordination and flow of information and timing of data collections.

There would also be an institutional burden in terms of initial implementation and subsequent operations particularly for small private institutions and those in states that do not have any type of UR system. A field test would be necessary to assess the system prior to any full scale implementation.

The final decision about redesigning IPEDS and developing a UR system rests with Congress. Legislative authorization is necessary to give the Department of Education the green light to build the UR system. Such authority could be considered as part of the Reauthorization of the Higher Education Act this year. At present, the scope of the proposed UR system would encompass all aspects of the higher education enterprise including graduate students.

New Commerce Department Report Addresses Transfer of Sensitive Technology to Foreign Nationals

A new report from the Inspector General at the U.S. Department of Commerce assessed the effectiveness of existing dual-use deemed export regulations and policies, their implementation by the Bureau of Industry and Security (BIS) and compliance with the regulations by U.S. industry, academic institutions, and federal research facilities.

The U.S. controls the export of dual use commodities -- equipment and technologies that have both military and civilian applications -- for reasons of national security, foreign policy, antiterrorism and nonproliferation reasons under the authority of several different laws. The primary legislative authority is the Export Administration Act of 1979. The Commerce Department's Bureau of Industry and Security administers the Export Administration Regulations (EAR) by developing export control policies, issuing export licenses and enforcing the laws and regulations for dual-use exports.

According to the EAR any release to a foreign national of technology or software subject to the regulations is deemed to be an export to the home country of the foreign national. These "deemed" exports may involve the transfer of sensitive technology to foreign visitors or workers at U.S. public, private or government research laboratories and private companies. Several findings in the report are of interest to the higher education community and to graduate schools in particular:

- Current EAR exemptions eliminate a large number of foreign nationals from dual-use export controls.
- Confusion exists over what is meant by "use" of EAR-controlled equipment by foreign nationals.
- BIS deemed export control policy does not take into account all the nationalities a single, individual foreign national has ever maintained.
- BIS has approved deemed export licenses for foreign nationals from Iran and Iraq despite a "presumption" of denial policy.

Recommendations made to the Under Secretary for Industry and Security include:

continued on page 5

Data Sources: Reviewing Recent Research

by Heath Brown, Director of Research and Policy Analysis

Introduction

Recently, we have seen a variety of research reports that relate directly and indirectly the core concerns of graduate education. This research helps answer some critical questions and provides needed context for the reforms occurring across graduate education. The following summarizes two studies: one on postdocs and the other on the changing high-skilled labor force.

Postdoc Survey Findings

Comprehensive and conclusive research on the post-doctoral experience has been in short supply. Because postdocs play such varied roles in so many different types of institutions, including university departments, government institutes and laboratories, and biomedical research institutions, it has been hard to generalize and fully understand the postdoctoral experience. The lack of permanence for a typical postdoc position has hampered research and, at least anecdotally, been a source of dissatisfaction for some postdoc fellows.

A recent report, *Doctors Without Orders: Highlights of the Sigma Xi PostDoc Survey*, fills this gap in knowledge in an important way. The report provides valuable information on the demographic composition of the nation's postdocs as well as critical insights regarding the satisfaction and perceptions of postdocs. The findings of the report can help graduate schools understand these issues and potentially address problems that their postdocs face with new policies and practices.

The report, funded by the Alfred P. Sloan Foundation, is authored by Geoff Davis, a visiting scholar at Sigma Xi and former postdoc, and advised by Peter Syverson and Les Sims of CGS as well as other national leaders in the field. Sigma Xi distributed the survey to 22,000 postdocs a little less than half of the total number of postdocs working in the U.S. A highly representative, thirty-four percent of the postdocs responded to the survey permitting a fascinating analysis of the postdoc experience.

Characteristics of Postdocs

The report shows that the majority of postdocs are conducting research in the health or life sciences, with smaller numbers working in physical sciences, engineering and social sciences (See Table 1). In contrast, there is considerable variety in the age of postdocs. The majority of postdocs are between the ages of 30 and 35, but 17% are between 36 and 40 and 9% are over 40. Table 2 shows that, of the US citizen and permanent resident responders, a little more than half are women and three-quarters are White (17% Asian, 4% Hispanic/Latino, 4% Black/African American).

Satisfaction

One of the more interesting findings of the report is that most postdocs are relatively satisfied with their positions. Despite past concerns that postdocs are discontented, this report shows that 70% of respondents are generally satisfied with their position, 22% are dissatisfied, and 8% neutral. For those postdocs that did express dissatisfaction, concerns with low wages, benefits, advisors, and visa issues were most frequently raised by respondents. One might expect a survey of graduate students to identify a similar array of concerns.

Mentoring

Mentorship is a critical area for graduate school administrators and this report includes information on the mentoring of postdocs. While most respondents were satisfied with their advisors, 24%

report that they do not consider their advisors to be mentors. This is a critical concern for the progress and development of postdocs and a potential area for graduate schools to intervene by promoting, to the extent possible, a better mentoring environment for all advanced graduate students and new scholars.

Factors Associated with Success

Another area over which the graduate school may assert influence is related to the administrative structure that a postdoc encounters. Salary, benefits, training, and oversight often are monitored directly or indirectly by the graduate school. An interesting finding presented by this report is that there is a relationship between those factors and postdoc success. The report states: "Postdocs reporting the greatest amount of structured oversight and formal training are much more likely to say they are satisfied, to give their advisors high ratings, to experience relatively few conflicts with their advisor and to be more productive in terms of number of publications."

The report cautions that these relationships are correlative not causal, but it is an encouraging finding that many of the same factors graduate deans have concentrated on in reforming graduate education overall are positively associated with postdoctoral success. It would be interesting to pursue more in-depth qualitative research to investigate those institutions that have established such positive working relationships for postdocs. Identifying these best practices may provide substantial benefits for master's and doctoral students, as well as for institutions that may not yet be initiating these practices for postdocs.

To access the full report go to: <http://postdoc.sigmaxi.org/results/>.

Table 1: Postdoctoral Fields of Study

Top Research Areas	
Molecular biology	24%
Cell biology	20%
Biochemistry, biophysics, & structural biology	18%
Neuroscience & neurobiology	13%
Genetics, genomics, & bioinformatics	13%
Immunology & infectious diseases	11%
Chemistry	8%
Developmental Biology	7%
Microbiology	6%
Pharmacology, toxicology, & environmental health	5%
Oncology	5%
Physics	4%
Physiology	4%
Psychology	3%
Ecology & evolutionary biology	3%
Materials science	2%
Plant sciences	2%
Cardiology	2%
Biomedical engineering	2%
Hematology	2%
Earth Sciences	2%

Sources: *Doctors Without Orders: Highlights of the Sigma Xi PostDoc Survey*

*Subjects could select more than one field

continued on page 5

Data Sources continued from page 4

Federal Job Opportunities

Another recent report, *Where the Jobs Are: The Continuing Growth of Federal Job Opportunities*, provides a comprehensive analysis of federal employment demand. The report was prepared by the Partnership for Public Service and the National Academy of Public Administration.

The findings of the report, not surprisingly, show that the largest increases in federal hiring will be in highly-skilled fields. Specifically, security (37,515 new hires), medical and public health (25,756 new hires), engineering and the sciences (23,806 new hires), program management/administration (17,373 new hires), and accounting, budgeting, and business (12,959) show the largest likely increases.

The report summarizes two issues that are likely to greatly affect the federal government's ability to fill these positions: (1) the slowing rate of population growth in the US that will lead to a shrinking number of available workers, and (2) the increasing demand for highly-skilled knowledge workers (See Table 3). Along with the aging of the federal workforce, these are widely accepted factors that the country must face in maintaining and expanding prosperity into the future.

Interesting, these are also areas where graduate education has much to contribute. While the overall rate of population growth may be slowing, certain segments of the US population, in particular the number of Hispanic Americans, are growing. Yet at the same time we also know that many groups are underrepresented in

graduate education. For the federal government, and the country overall, to meet its highly-skilled labor force needs in the future, it is contingent upon graduate education to continue to educate and train large numbers of students, but also to expand and broaden access to

encompass many traditionally underrepresented groups.

To access the full report go to: <http://www.ourservice.org>

Implications

Taken together, these two reports raise several important points for graduate education. First, the postdoc report provides clear evidence to support the growing consensus that effective mentoring makes a difference for the development of new researchers. Graduate schools can be leaders on campus in communicating this message to key

stakeholders in order to insure the progress and success of postdocs, but also for graduate students overall. Second, the US labor force of the next 20 years is likely to demand more graduate school trained

workers than ever before. Given the nation's changing demographics, unless we increase participation of underrepresented students groups, it will be difficult to meet future labor force demands. In both cases, it is encouraging that many of the reforms in graduate education, including pro-

grams like PFF, the growth of professional master's programs, and the variety of programs to increase inclusiveness, are consistent with what research is telling us about current and future trends.

Table 2: Race/Ethnicity of Postdoctoral Fellows

Race/Ethnicity	Survey Population
White	78%
Black/African American	4%
American Indian/Alaska Native	1%
Asian	17%
Native Hawaiian/Pacific Islander	0%
Other	3%
Two or more races	2%
Hispanic/Latino (all races)	4%

Source: Doctors Without Orders: Highlights of the Sigma Xi PostDoc Survey

Table 3: Occupation Growth 2002-2012 (percent change)

Occupation	Federal Workforce	Civilian Labor Force
Criminal Investigators	42.7%	22.4%
Management Analysis	22.0%	30.4%
Biological Scientists	20.8%	19.0%
Lawyers	10.7%	17.0%
Computer Specialists	10.2%	35.8%
Production Occupations	-4.2%	3.2%
Office Clerks	-11.4%	10.4%
Secretaries	-17.2%	4.5%

Source: Where the Jobs Are adapted from the Bureau of Labor Statistics

Federal Relations Update continued from page 3

1. Modifying the definition of "use" in EAR in order to help licensing and enforcement officials better implement and enforce deemed export controls associated with the technology for the use of the controlled equipment.
2. Informing the U.S. academic community, industry, and federal agencies of the deemed export controls associated with the technology for the use of EAR-controlled equipment by foreign nationals.
3. Amending BIS' current policy to require U.S. entities to apply for a deemed export license when a foreign national employee or visitor was born in a country where the technology transfer in question is EAR-controlled.
4. Reevaluating its approval protocol of deemed export licenses for foreign nationals from Iran and Iraq to ensure such approvals are consistent with current law and deemed export control

- licensing policies and procedures.
5. Establishing and implementing a strategic outreach plan for deemed exports that has annual goals and identifies priority industries, federal agencies, and academic institutions that are not currently applying for deemed export licenses.
6. Developing a compliance program to evaluate deemed export license holders' compliance with license conditions and determine whether all research, including access to technology, is being performed in accordance with license conditions and that deviations to the foreign national's job responsibilities stay within the technical parameters of the license.

Comments on the proposed recommendations must be received by May 27, 2005. Copies of the full report are available at <http://www.oig.doc.gov/oig/reports/2004/BIS-IPE-16176-03>

The Tangible Contributions of International Graduate Students *continued from page 2*

Thirty two percent of Rochester's Ph.D. graduates who are "academic leaders" in the STEM fields, economics and business administration were born in other countries. This is a remarkable number, which may partly be a reflection of the fields sampled as well as the varied strengths of the university's degree programs. However, even if a comprehensive study of highly ranked doctoral programs came up with a percentage a third this size, it would rightly be seen as significant. It appears former international graduate students may well have a substantial role in training America's best and brightest. A survey of graduate schools could quantify the magnitude of this positive impact.

Developing Innovations Valued by the Public

Research universities are an integral part of this nation's economy. For example, they can be the largest employers in communities outside large central cities. More importantly, they are often the venues in which new technologies and other inventions grow out of research projects. When successful, these innovations meet the market test of value (i.e., there is a demand for the new products that will generate significant revenues). In a very real sense, these are the tangible contributions of the researchers who create new knowledge and products. While there is some ambiguity about the proper role of the university (e.g., the appropriate mix of basic and applied research) most schools now have offices that encourage and facilitate the development and diffusion of such innovations.

The traditional approach of academic work is to have a free flow of ideas and a communal access to them. For the most part, however, the incentive to develop new technologies and other inventions is tied to some form of ownership (of the intellectual capital) and, on occasion, some amount of secrecy. The ownership rights typically are realized through a patent issued by the federal government. The revenues generated by inventions often are in the form of licensing agreements with private companies. In some cases, a new (start-up) company is formed in order to realize the economic value of the innovation.

There is a multistage process through which patent rights are granted. In the first instance, a disclosure of invention is submitted by the research team to an office in the university. Upon the school's approval (based on scientific merit and potential commercial value), a patent application is prepared and submitted. The U.S. government then decides whether to issue the patent.

The University of Rochester submits many patent applications each year and several patents are issued to the university by the federal government. Rochester's licensing revenues rank among the top ten universities in the nation (Blumenstyk). Since the specification of "inventors" (the research team members) is required on both invention disclosures and patent applications, current records at the university allow us to assess the role of international graduate students in the process that translates ideas into things of tangible value to the public. The university's Office of Technology Transfer has provided the

necessary data to measure the magnitude of their contributions.

Over the last five years, research team members (listed in invention disclosures) who were not citizens of the United States represented 42 percent of all the inventors. Graduate students on the teams had a much higher international share than the faculty

researchers -- over half of the graduate students vs. a fifth of the faculty members. However, a number of the faculty members now U.S. citizens were previously international students, so the foreign share is actually underestimated. Quite clearly, international students at Rochester are a key component of the invention process.

In actual patent applications the core research team members are named. Most faculty members are listed, but graduate students are also included on the basis of their intellectual contributions. We can sort the patent research teams according to whether they have at least one member who is not a U.S.

citizen. Since the beginning of 2000, roughly a third of the patents granted to the University of Rochester have had at least one foreign inventor.

It is not clear what the best measure of international graduate students' contributions to the discovery and development of innovations might be. However, the simple percentage figures offered here (based on data easily gathered) suggest the contributions are substantial. A national survey of research universities would provide some valuable evidence on this point.

Conclusion

The contributions of international graduate students are widely believed to be substantial (at least in the academic world). The declining presence of these students in applicant pools and enrollments has alarmed many. However, absent some solid evidence indicating a continuation of this pattern would be detrimental to the national interest, it may be hard to make the case that governmental officials should respond aggressively to the threat. In this regard, empirical data measuring tangible contributions (the output side) might be of great help to the academic community. This exploratory exercise, based on University of Rochester data, suggests such an approach would be both feasible and effective.

Charles Phelps, Provost of the University of Rochester, provided useful suggestions and support for this article.

References

Atwood, Sally "Attracting Talent From Abroad," *Technology Review* (MIT News), March 2005.
 Blumenstyk, Goldie "Colleges Seek a Record Number of Patents," *The Chronicle of Higher Education*, December 3, 2004.
 Brown, Heath, Syverson, Peter and Doulis, Maria "Assessing a Year of International Graduate Admissions: Trends and Findings from the CGS International

A Sample of Former International Graduate Students at Rochester Now on the Faculties of Highly Ranked Programs and Schools*

Faculty Member at:	Graduate	Nation of Origin	Faculty Title
Harvard	Kelly Zou	China	Associate Professor of Radiology and Biostatistics
Princeton	Jose Scheinkman	Brazil	Wells Professor of Economics
Yale	K. Geert Rouwenhorst	Netherlands	Professor of Finance
Chicago	Young-Kee Kim	Korea	Professor of Physics
Stanford	Seungjin Whang	Korea	Singh Professor of Operations, Information, and Technology
MIT	Katharina Lewellen	Poland	Assistant Professor of Finance
Wisconsin	Sridhara Rao Dasu	India	Assistant Professor of Physics
Michigan	H. Nejat Seyhun	Turkey	York Professor of Business Administration
North Carolina	Yue Xiong	China	Professor of Biochemistry and Biophysics
Cornell	Tapan Mitra	India	Professor and Chair of Economics
UC San Diego	Stojan Radic	Yugoslavia	Associate Professor of Electrical and Computer Engineering
Carnegie Mellon	Daniele Coen-Pirani	Italy	Assistant Professor of Economics
Duke	Pranab Majumder	India	Assistant Professor of Operations
Northwestern	Yehia Ismail	Egypt	Assistant Professor of Electrical and Computer Engineering
Dartmouth	B. Espen Eckbo	Norway	Tuck Centennial Professor of Finance
Pennsylvania	Serguei Netessine	Russia	Assistant Professor of Operations and Information Management
Johns Hopkins	Ola A. Seines	Norway	Associate Professor of Neurology
Columbia	Eiichi Miyagawa	Japan	Associate Professor of Economics
Univ. of Washington	Rajesh P.N. Rao	India	Assistant Professor of Computer Science and Engineering
UC Berkeley	Ari Segev	Israel	Professor of Manufacturing and Information Technology
Penn State	Iam-Choon Khoo	Malaysia	Professor of Electrical Engineering
NYU	Gian Luca Clementi	Italy	Assistant Professor of Economics
Texas	Karol Lang	Poland	Professor of Physics

*The fields are restricted to science, technology, engineering, mathematics, economics & business administration. "Top 25" programs at the University of Rochester are excluded.

continued on page 7

The **#1** online graduate school resource
for students, recruiters and advisors



What makes GradSchools.com #1?

- Over 58,000 graduate program listings
- Over 10 million visits in the last year
- 50% of our visits result in clicks or inquiries
- Over 115,000 current student profiles in our database
- Number one on Google, Yahoo, and most search engines
- Well-respected in academic community & experts in our field
- Over 1,000 academic customers
- Established in January 1997

The Tangible Contributions of International Graduate Students continued from page 6

Graduate Admissions Survey," Council of Graduate Schools
Communicator, December 2004.

Council of Graduate Schools, "Council of Graduate Schools Finds
Decline in International Graduate Student Applications for the
Second Consecutive Year," Press release dated March 9, 2005.

Monastersky, Richard "Is There a Science Crisis? Maybe Not," *The
Chronicle of Higher Education*, July 9, 2004.

Kless, Sylvia H. "We Threaten National Security by Discouraging the
Best and Brightest Students From Abroad," *The Chronicle of Higher
Education*, October 8, 2004.

Pell, Eva "Who Will be the Intellectual/Technology Leaders of the
Future and What Will They be Doing?," Presidential Address to the
Association of Graduate Schools, September 2004.

Puzo, Matt "U.S. Hustles to Improve Visa Process," Associated Press
story reported in *Newsday.com*, February 7, 2005.

Syverson, Peter D. and Brown, Heath A. Graduate Enrollment and
Degrees 1986 to 2002, Council of Graduate Schools, 2003.

Syverson, Peter D. and Brown, Heath A. Graduate Enrollment and
Degrees 1986 to 2003, Council of Graduate Schools, 2004.

U.S. Department of Homeland Security "Homeland Security, State
Department Work with Foreign Students/Scientists," Press release
dated February 11, 2005.

CGS Welcomes New Institutional Members

**Marian College of Fond du
Lac**

**Polytechnic University of
Puerto Rico**

Universidad de Monterrey

**Winston-Salem State
University**

Communicator is published 10 times a year and is distributed by the
Council of Graduate Schools as a regular member service.

Subscriptions for nonmembers are available for \$110 per year.

Communicator encourages and welcomes members to submit arti-
cles of interest for inclusion in the newsletter. Current research, hot
topics in graduate education, new legislation, and other pertinent infor-
mation are desired. All manuscripts will be reviewed by a small group
of graduate deans and if selected for publication will be scheduled for
publication at the editor's discretion. Articles will be edited to conform
to style. Inquiries about proper formatting for submissions and com-
ments about *Communicator* may be directed to the Council of
Graduate Schools.

No endorsement by CGS of any product or service named herein
may be implied.

Editor: Heidi Miller, Director, Meetings and Member Services

Nominations Sought for CGS Board of Directors

Nominations are being accepted for membership on the CGS Board of Directors. If you are interested, or if you would like to nominate a colleague, please contact:

Lewis Siegel, chair of the CGS Nomination Committee c/o Cheryl Flagg at cflagg@cgs.nche.edu
on or before July 1, 2005.



July 9-13, 2005

Council of Graduate Schools

**SUMMER
WORKSHOP**

**For Graduate Deans and
NEW DEANS INSTITUTE**

Santa Fe, New Mexico

Communicator

Council of Graduate Schools
One Dupont Circle NW, Suite 430
Washington, DC 20036-1173

PRSRT STD
U.S. POSTAGE
PAID
AMI
22304

CGS Summer Workshop and New Deans Institute

July 9 - 13, 2005

Hilton of Santa Fe ❖ Santa Fe, New Mexico