

Pursuing the Endless Frontier: Research at Indiana University

State of the University 2002 President Myles Brand

Each year we gather to make an account of the state of the university that we all love and serve. Today, I can assure you that the state of our university is strong. It is very strong indeed, thanks to the dedication of our talented faculty and staff and students, the guidance of our Board of Trustees, and the support of our friends and donors.

Last spring, we graduated 14,500 new alumni, including our first class of Kelley Scholars and informatics majors. All of our campuses began the academic year with growing enrollments and some with record enrollments. University-wide, we've seen a significant increase in minority retention over the last 10 years. Indiana University Northwest continues to be the most diverse campus in the Midwest, and we have just learned that Kelley School of Business has the highest percentage of black students of among the nation's top 25 business schools. At IUPUI, the diversity cabinet has developed a report card that will measure progress toward campus diversity goals. Last winter we dedicated the Neal-Marshall/Theatre Center on the Bloomington campus. It is the best black culture center and one of the best educational theatre centers in the nation.

Our faculty members continue to win coveted national and international awards, to push forward the frontiers of knowledge, and to improve the health and quality of life of the world's citizens. Indeed, competitively won research grants at IU have tripled in the last decade. We have risen from the bottom of the Big Ten to first place in named and endowed professorships. We have maintained and advanced our national leadership position in information technology. And this year, IU was first nationally among all public universities in voluntary support. I never cease to be moved by the loyalty and affection of our 440,000 living graduates, who play such a vital role in the life of the university. IU, in turn, gives back by engaging with and contributing to the economic well being of the state and nation, a topic I explored at length in my last state of the university address.

IU is fulfilling its core missions of teaching, research, and public engagement, and it is doing so with an unshakable commitment to excellence and the common good. These missions are interconnected by a dynamic synergy. Today, I would like us to think together about the university's research mission and explore how it supports both teaching and public engagement. At IU, research encompasses not just scientific discovery, but also scholarship and creative work, such as textual analysis, performance, and artistic creation. Today I want to share with you my vision for research at IU, discuss some of the challenges we face, suggest viable approaches to meeting those challenges, and chart new directions for the future.

I think everyone would agree that Americans have a fascination with frontiers. From Lewis and Clark to Watson and Crick, from geography to genomes, we map new territory and strive to transcend the boundaries of what is known. University research has played a crucial role in that effort. From the discovery of the polio vaccine to the development of the digital computer, academic researchers have explored what Vannevar Bush termed “the endless frontier.” In a report he submitted to President Franklin Roosevelt in the 1940s, “Vannevar Bush correlated national security with research strength, and outlined a system of federal funding for university research that endures today.

Prior to the Second World War, America’s universities had difficulty competing with the long-established educational centers of Europe. After the war, in which university scientists made pivotal contributions to national defense, the United States set an international precedent by providing significant federal support for academic research. As a result, America’s universities have become the best in the world, and others have sought to emulate our successes.

Indiana University researchers have long pursued that endless frontier that Vannevar Bush identified as an “essential key to our security as a nation, to our better health, to more jobs, to a higher standard of living, and to our cultural progress,” and they continue to do so with vigor and commitment.¹ Over the years, IU faculty have pioneered cures for such devastating diseases as testicular cancer. They have saved a nation from tooth decay and produced music and art that offer insight into our shared humanity. IU faculty and students engage in the grand panoply of creative and original work that constitutes research.

But let me be clear about one important point: by focusing on the university’s research mission in this annual speech, I do not mean to undervalue teaching excellence. I have emphasized the importance of teaching in previous state of the university talks, and on many other occasions. Both teaching and research are central missions of Indiana University. In fact, these missions are not merely complementary, they are inseparable and mutually supporting. Without question, IU needs to do both well. It can and it does.

Vision

Indiana University has an illustrious history as a research institution. It also has a bright and productive future. We must work together to ensure that future. My vision for research, scholarship, and creative work at IU focuses on our traditional areas of excellence and on nurturing our emerging strengths. For example, the Bloomington campus has truly extraordinary programs in the social sciences, the arts and humanities, and the professional schools. These require continued and enhanced support. On each campus, there are also programs that are good and growing, which have the potential to become genuinely excellent. Some of these programs, such as those in the life sciences, are developing momentum from a foundation of established strength; others are building as they go. These emerging areas of excellence often cross disciplinary and campus boundaries. Our new School of Informatics provides a case in point, a new field of study that gives students the

¹ Vannevar Bush. *Endless Horizons* (Washington, D.C. Public Affairs Press: 1946).

skills to apply information technology to a wide range of disciplines, from journalism to healthcare to economics. We must be dedicated to growing these programs on the frontiers of discovery.

Success in research at IU depends fundamentally on the quality of the faculty and the support they attract from external sources. We face challenges in this area, and competition is keen. For instance, the salary gap between faculty salaries paid by private and public research universities continues to widen. In 1980, the gap was \$1,400. In 2001 it was \$22,100. In the face of such discouraging statistics, we need to nurture our junior faculty, hire and retain the best senior faculty, and assure that compensation and working conditions for all faculty are among the best. We must supplement excellent faculty members with excellent staff, and we must attract high performing graduate and undergraduate students. Despite constrained state resources, we must do everything within our power to ensure that the university is second to none in information technology, in research infrastructure, in support for the arts and humanities, and in public engagement.

These are ambitious aspirations, to say the least. But as Herman Wells was fond of saying, “When you aim, aim high.” Today, I want us to think together about the challenges we face in achieving international superiority in research, scholarship, and creative work and determine how we can make good progress in meeting our high aspirations. IU presently occupies a strong position among research institutions. Let us consider how best to make its future one of growing leadership.

The Changing Face of Research

Research is a grandly experimental and dynamic human endeavor. In the words of Isaac Newton, “no great discovery was ever made without a bold guess.” Good researchers are always prepared to depart in new directions, to test and adopt exciting new possibilities. This is true not only in the sciences and technology, but also in the liberal and fine arts.

Each of these disciplines has seen dramatic change in the past several decades. Now more than ever before, research is a collaborative activity that transcends geographic barriers, crosses disciplinary boundaries, and scales the ivy covered walls that previously separated the academy from the private sector. The lines between disciplines, between basic and applied research, and between academic and so-called industrial research are breaking down. In the humanities, the interdisciplinary and multidisciplinary approaches that have gained prominence over the last quarter century are evolving into what Louis Menand calls “postdisciplinarity,” in which disciplinary boundaries and methodologies blend or become increasingly irrelevant.

With the mapping of the human genome, we entered the Age of Biology, which promises better health and longer life for everyone. Thus federal support for life and health sciences is on the rise. Funding allocations for the National Institutes of Health will have doubled between 1999 and 2003. The National Science Foundation may see comparable increases. On the other hand, the NEH currently has little more than one-third of the annual resources

in real dollars that it had 20 years ago. The NEA fares only a little better, though funding for both agencies has stabilized in recent years.

Support for Research at Indiana University

Over the past decade, sponsored research at IU has more than tripled, going from \$113 million in 1990 to \$397 million in 2001, which was a banner year that included a major gift of \$105 million from the Lilly Endowment to support the Indiana Genomics Initiative (INGEN). In 2002, grants and contracts totaled \$340 million. Our research record stands out as a superb performance, especially since just doubling inflation is the standard measure of excellence. The largest gains were in the School of Medicine. Grants and contracts for medical school researchers nearly quadrupled over the 1990s, going from \$46 million in 1990 to \$254 million in 2001. These grants funded such projects as investigations into the causes of heart attacks, stroke, atherosclerosis, and arthritis. It is incumbent on us to continue this momentum, a point to which I will return. But before I proceed, I want to compliment our faculty, staff, and students for their commitment to discovery and learning, which is the life's blood of our enterprise.²

The university also bears responsibility for directly supporting research. In some fields it is very difficult to attract adequate external funding. In other cases, research must be seeded or continued between grants. Research and the University Graduate School (RUGS) distributes funds on a competitive basis for research equipment and non-equipment needs, for the Research Investment Fund (RIF) on the Bloomington campus, and for laboratory startups and renovation, with matching monies from the schools, campuses, and the Office of the President. IUPUI administers its RIF locally. Among other programs, RUGS oversees the Intercampus and Multi-campus Research Fund, which has been especially helpful for regional campus faculty members. RUGS supports research for undergraduate students through its Undergraduate Research and Creative Activity Partnership. When the state budget is sound, we receive funds for renovation and facility maintenance. Unfortunately, state monies for this purpose have practically disappeared during the current biennium. It is difficult to predict the level of this funding for the 2003-05 biennium, which will depend heavily upon the state's economy.

Research support also comes in the form of our sabbatical policy, which enables qualified faculty members to undertake sustained research. In fields in which external funding is rare, sabbaticals provide uninterrupted time for study and creative work. It is easy to discount the sabbatical program, since it is commonplace among universities. But sabbaticals are one important way in which the research mission has become embedded in the culture of the university.

Generally speaking, research is a cost to the university. For instance, the School of Medicine estimates that for every dollar it receives in externally sponsored research, it must

² To learn more about research at IU, I refer you to the magazine, *Research and Creative Activity*, which offers in depth stories about the endeavors in which our faculty and staff are engaged. The broad range of support programs for research administered by RUGS is more comprehensively described in the January 2002 RUGS annual report, *New Horizons in Research and Learning*.

add 15 cents from other sources to conduct that research. Nonetheless, research is a core mission for Indiana University, and we are committed to developing the resource base necessary to conduct research at the highest levels.

This year the Bloomington campus will undertake an extensive strategic planning process, which will be phased in beginning Fall Semester 2003. A major goal of this planning process will be to identify selected areas for research investment, mostly through faculty hiring. The plan will be implemented through funding from the Commitment to Excellence tuition increment, which, combined with a new fund raising campaign now being planned for the campus, will present a unique opportunity to make significant progress in a number of specific academic areas. Another goal of the strategic planning and fund raising process is to provide fellowship support for 300-400 graduate and professional students. Undergraduates will benefit by a lower student/faculty ratio, and by enhanced opportunities to participate directly with faculty members in their research projects. This strategic planning process and its implementation will significantly enhance selected areas of academic strengths and enable, in a few cases, new research initiatives.

Arts and Humanities

In my state of the university talk two years ago, I stressed the importance of research, scholarship and creative work in the arts and humanities. Indiana University has a proud tradition in these fields. IU, I further argued, should take a leadership position in support of the arts and humanities and thereby establish a national model for others to emulate. I committed from my office four million dollars over a four-year period to support faculty research in the arts and humanities on all IU campuses. This money, which is allocated on a peer-reviewed basis, quadruples the funding IU normally secures for the arts and humanities through external grants. Despite state budget cuts of over \$110 million this past year, we have sustained this commitment. Arts and Humanities grants have funded such projects as studies of U.S./Greek relations in the postwar era, the ways émigré intellectuals conceptualize the Holocaust, and the creation of new musical compositions. Sixty-four faculty members have received funding support in the first two rounds of awards.

In that state of the university talk, I also indicated that a university-wide task force for the arts and humanities would be formed to make recommendations to enhance our programs and their impact. In their preliminary report, the task force pointed out that the special needs of arts and humanities faculty, such as art supplies and publication subvention, are not covered through the current grant process. As a result, I have added funds to the original allocation for this year. The task force also recommended that we work to increase local and statewide engagement in IU's arts and humanities programs. In the near future, I expect to be able to announce an approach to meet this recommendation.

Administrative Restructuring

Now more than ever before, a supportive administrative infrastructure is critical to the achievement of our research mission. The business operations necessary for an efficient and effective \$400 million annual research enterprise are not trivial. In fact, they are becoming

increasingly complex and costly! Compliance issues, increasing federal regulations, processing grants and contracts, providing leadership to the university's centers and institutes, and motivating and supporting exciting and new research ventures require good organization and progressive leadership.

Indiana University is most fortunate to have had George Walker as its vice president for research and dean of the University Graduate School for these past 11 years. George's tenure has been characterized by hard work, good judgment, great loyalty to IU, excellent knowledge of the Washington scene, irrepressible optimism, and a "can-do" attitude. He represents IU well nationally, serving recently, for example, as president of the Association of American Universities' Association of Graduate Schools.

This is a transition year for George. He has assumed the role of director for the Carnegie Foundation's initiative to redesign graduate education in America. George is uniquely qualified for this assignment, and his leadership will have a lasting impact on generations of future graduate students and faculty members.

In light of the changing face of university research, now is the time to take a close look at our research and graduate education administrative functions and ensure they will serve the university well in the future. I have consulted widely with faculty members and others, heard and considered good suggestions, and have arrived at an approach I believe best fits IU at this time. Over the course of the next year, we will transition to the following structure.

I am asking Vice President for Information Technology and University Chief Information Officer Michael McRobbie to assume the additional responsibilities of vice president for research. Michael holds faculty appointments in the Departments of Computer Science and of Philosophy. He is an internationally respected researcher, who has produced important work in such areas as artificial intelligence, automated theorem proving and computational logic, high performance networking and the non-numerical applications of parallel supercomputing. Michael is principal investigator on a number of multi-million dollar NSF grants, including the creation of IU's Digital Music Library. He has had notable success in raising Indiana University into a national leadership position in information technology infrastructure and services, and I fully expect him to bring his considerable energy and expertise to this new assignment, helping to expand IU's national and international presence in research, as he has so successfully done in the field of information technology.

Michael will work in collaboration with George Walker and faculty advisory committees to determine how UITS and RUGS can both benefit from these new arrangements and to identify organizational changes that will minimize duplication. While there may be some reassignments, we want to ensure that the superb people now engaged in supporting IU's research and technology enterprises will continue to be so engaged.

As vice president for research, Michael McRobbie will bear responsibility for research university-wide, with an additional emphasis on attracting new federal funding to the university, including federally sponsored centers and major grants. Within this new

structure, the vice president for research will be charged both with supporting research excellence in all fields—from the laboratory sciences to the professional disciplines to the arts and humanities—and with motivating new research ventures. No one person can have personal experience in each of these fields. Hence, advice from faculty members engaged in a multitude of research fields will be vital. We will review the current faculty advisory committee structure with the goal of strengthening it.

IUPUI currently has a full-time vice president for research, Mark Brenner, who works directly on campus issues and provides leadership on specific university-wide matters. This approach has worked well, and we will institute a parallel structure for the Bloomington campus. Our current associate vice president for research on the Bloomington campus, Jeff Alberts, has served the campus with great skill while pursuing his own research. Because of the many duties which will fall under the purview of this position, we will expand it to full-time status and undertake a national search for an associate vice president for research for IU Bloomington. Both the IUPUI and the Bloomington associate vice presidents will report to the university-wide vice president for research. Secondary, or “dotted line,” reporting relationships with the campus chancellors will help coordinate the research infrastructure with the campus’ priorities.

We will partially decouple administration for graduate studies from research, thus adopting the standard model used at most major research universities. IU’s new university dean for graduate and professional studies will report to the vice president for research, with a dotted reporting line to the vice president for academic affairs (who is also the IU Bloomington chancellor). The dean, who will be appointed as the result of a full search, will also have oversight for post-doctoral education, a point to which I will return shortly.

Given the state’s economic downturn and the attendant declining state support, Indiana University has recently absorbed nearly \$110 million in cuts and withheld appropriations. We have chosen to take these cuts in administrative areas and to protect the academic units as much as possible. I firmly believe this is the right strategy, and we will continue it. Eliminating one vice presidency, decreasing duplication of administrative support activities, and using existing positions to make the organizational changes I outlined will yield an overall decrease in administrative costs, the savings from which will be reinvested in our research mission. The amount of savings will depend on the results of the changes in RUGS and UITS.

This new organizational structure will provide strong leadership in research—especially in federal and other sponsored research. It will enhance the ability of the Bloomington campus to focus on its research needs. And it will assist all the campuses in the development and oversight of their graduate and professional programs. We will fully review the new structure two years after it is put in place in order to ascertain progress. Let me now turn to some of the issues to be addressed within this new structure.

Basic and Applied Research, Intellectual Property, and Technology Transfer

One of the boundaries that continue to shift is the distinction between basic and applied research. Research is basic only if the researcher's interests are not driven by a specific practical issue. Pure mathematics falls into this category, as does much of theoretical physics. But the sciences do not have a monopoly on basic research. For example, in my own discipline of philosophy, investigations of analytic ontology qualify; in the social sciences, abstract work in rational choice and game theory may also qualify.

Basic research is knowledge generated for its own sake, it is an intrinsic good. Applied research also adds to the store of human knowledge. It can alleviate suffering, enhance quality of life, stimulate economic development, and, in the case of the arts, offer insight into our shared humanity. It is an extrinsic good.

The distinction between basic and applied research carries implicit value judgments that well may not be justified. Some disciplines have a covert bias that the value of basic research is superior. Some persons, including many in the general public and their elected officials, have a bias that applied, practical research is superior. We should abandon all such biases. Both basic and applied research are valuable and, indeed, they are difficult to separate. For example, basic research into the structure of genes may be applicable to drug discoveries; the resolution of economic and social problems may draw on theoretic work in computer modeling, and so on. The key issue for both basic and applied research is whether it is original and substantive.

Just as the division between basic and applied research is increasingly untenable, the distinction between university and industrially based research cannot be wholly sustained. Entrepreneurial-minded faculty members wish to engage in industrially related research. They may have developed a procedure or product that they believe will be widely beneficial—a drug or medical device, for instance, which could only be manufactured and distributed through the corporate sector.

Of course, not every faculty member will choose to engage in entrepreneurial activity, but major research universities—IU included—have the obligation to assist interested faculty members by facilitating technology transfer to the private sector. One key function of ARTI (the Advanced Research and Technology Institute) is to assist Indiana University faculty members in patenting and licensing their discoveries and, when appropriate, to help them start companies based on these discoveries. To facilitate company startups based on Indiana University research, ARTI has recently acquired a building that will house the Indiana University Emerging Technologies Center (ETC). The ETC will operate as a “business incubator,” providing financial support and management services and nurturing new companies through the start-up process. The ETC will be a new and important addition to the emerging corridor of 21st century research and business development from West Lafayette to Indianapolis to Bloomington. It is worth noting that during the 2000-2001 academic year, this corridor produced \$510 million in research income. The Bloomington/Indianapolis corridor produced more than \$312 million of that total.

Clear, well-understood guidelines for conflict of interest are essential to the technology transfer process. When a faculty member conducts research that produces intellectual property with commercial potential, sound conflict of interest policies will protect both the faculty member's and the university's rights. An educational program that informs faculty members about the importance of sharing and transferring technologies and offers insight into ways of minimizing real and perceived conflicts of interest is vital.

As more faculty members choose to engage in private sector research and development, and as the conditions under which they do so become more complex, conflict of interest policies must be updated and refined. That process is underway at Indiana University. In consultation with the University Faculty Council and others, RUGS is overseeing the implementation and refinement of current procedures in accordance with the conflict of interest policy approved by the Board of Trustees.

Research Infrastructure

Other challenges to university research are more difficult to meet. The infrastructure needs and regulatory requirements for the conduct of research have grown substantially in recent years. In addition to state-of-the-art laboratory facilities and instrumentation, information technology support has become crucial for scientific research. Increasingly, visual and performing artists use these new technologies. And scholarly research depends not only on a well-stocked library, but also increasingly on access to electronic databases and online materials.

Fortunately, Indiana University has become a national leader in IT infrastructure and services and has successfully leveraged these in the service of the university's research mission. Not long ago, many aspects of our information technology infrastructure and services were badly organized and outdated. Though there were some areas of excellence, students, faculty, and staff across the university lacked access to integrated resources and support as well as to computing power, storage, networks, and information systems commensurate with a world-class university. Now, five years after the initiation of the Indiana University Information Technology Strategic Plan, faculty, staff, and students on all of IU's campuses enjoy IT infrastructure and services of the highest quality.

We work on common platforms, use the latest software, and are networked as well as any university in the world. University Information Technology Services (UITS) now provides uniform, integrated services throughout the university and it is staffed by individuals with high levels of expertise. IU's life cycle replacement program, rare if not unique among universities, both ensures that students, staff, and faculty have the computing power they need and minimizes maintenance costs. No longer must we wait for a crisis before there are upgrades. At the other end of the spectrum, with help of the Lilly Endowment, IU presently has one of the fastest university-owned supercomputers in the nation, a teraflop machine that is capable of a trillion operations per second. Through I-Light, the statewide optical fiber network pioneered by IU, we are able to join this machine to Purdue's supercomputer to still further enhance the capacity available to our scientists.

Our success in developing this superb IT infrastructure is made possible in part because of our strength in negotiating with vendors. Indiana University can command excellent values when it leverages its very substantial total buying power in IT. There is a lesson here: IU is advantaged when we work as a single university to meet our common goals.

Bricks and Mortar

Today's research requires major infrastructure support in addition to information technology. Research space is by far the most pressing need on both the Bloomington and Indianapolis campuses. Indiana University's ability to compete at the highest levels for grants, contracts, and talented new faculty directly depends upon the addition of new research space. The enormous research productivity of our faculty and research staff challenges the state to accommodate the dynamic growth their commitment is generating.

This challenge is especially severe in the sciences. The Indiana Genomics Initiative, funded by the Lilly Endowment, provides an enormous opportunity—a once-in-a-lifetime opportunity—for the School of Medicine and related schools and departments at IUPUI and the life sciences on the Bloomington campus. This \$105 million grant can enable IU to take a quantum leap forward and to compete at the highest levels in this fast growing field. However, our current research space is inadequate to house the projects generated by INGEN and by other grants and contracts.

The School of Medicine alone will need an additional million square feet of research space in the near future. Like other academic medical centers, the school has in the past been able to draw funding from its clinical activities to support research, including capital projects. But in the last decade, this ability to cross-subsidize research has diminished significantly. Managed care, a highly competitive health care marketplace, and cut-backs in federal reimbursement have diminished the school's flexibility. While Clarian, IU's partnership with Methodist Hospital, has saved us from the financial losses suffered by most academic medical centers, it provides only modest support for the school's research mission. The school is constructing some new research facilities through combining revenue from faculty physician practice plans, private fund raising, partnerships with the private sector, indirect costs from grants, a major commitment from the IUPUI Research Investment Fund (RIF), as well as some funds from Clarian. The Riley Memorial Association provided some funding for the Research Institute II building, which we will dedicate this fall, and pledged additional monies for Research Institute III, which is in the early planning stages. However, the school's ability to continue to provide new research space is all but exhausted. Within the next few years, we must find new sources of funding to meet these space needs.

Research space for the Bloomington campus presents similar challenges. The life sciences are blossoming at IUB. We responded to the need for more modern research space for molecular biology laboratories with the renovation of Myers Hall. The research facilities offered by Myers Hall will help us enhance the work of the fine community of biologists at IUB and will make possible the hiring of new outstanding faculty and the recruitment of graduate students.

In the last biennium, funding was secured for Phase I of a new multi-disciplinary science complex. We will seek additional support from state, federal, and private sources for Phases II and III. This building and others included in the project will be designed to facilitate interdisciplinary collaboration, to enable research growth, and to generally assert the importance of the sciences on the IUB campus. The Bloomington campus, which has long been known for its excellence in the liberal arts and professional schools, must be highly visible, too, for its excellence in the sciences across a wide range of disciplines.

Research efforts on the IUPUI and Bloomington campuses are not merely parallel; they are mutually supporting. As in the case of information technology infrastructure, Indiana University is advantaged by bringing together its critical mass of excellent faculty and staff. If the School of Medicine is to reach its goal of ranking among the nation's top ten public medical schools, it must collaborate with the outstanding scientists on the Bloomington campus. Similarly, if the life sciences on the Bloomington campus are to compete at the highest levels, they will benefit substantially from working with the School of Medicine. Given the fact that more than half of federal funding goes to support health care and clinical research, life science departments can only gain by their association with medical schools.

The principle here, as elsewhere, is clear: Indiana University will achieve its aspirations in scientific research excellence only through genuine collaboration across academic units and across campuses.

The sciences are not the only disciplines in need of new or renovated research space. On the Bloomington campus, Ballantine Hall needs to be replaced or seriously renovated. Our international programs require more and better designed space. The Bloomington main library is in desperate need of extensive renovation. At IUPUI, faculty offices and classrooms, especially in Cavanaugh Hall, must be renovated. As the regional campuses and the medical education centers enhance their research capabilities, space will have to be added or renovated.

The challenge lies not merely in constructing new space, but also in providing annual funding to operate these facilities. Unlike most states, Indiana does not currently provide operating funds for research facilities. "Plant expansion," to use the common budget parlance, has been restricted to facilities for teaching. Even in these cases, changes in the funding formula established by the Commission for Higher Education yield an allocation below the actual cost of facility operation. For example, IUPUI must dedicate several million dollars annually from its academic budget to meet the costs of operating new buildings. The Commission for Higher Education is expected to support a change in plant expansion so that research facilities are included; we will join with Commission to take this case to the Legislature.

Lack of capital and maintenance funding for research space is representative of Indiana's under-investment in its research campuses, which are an essential resource as the state works to move from an economy very highly dependent on basic manufacturing to one that includes strong, 21st-century, knowledge-based industries. This new economy will rely on strong research campuses, both to provide well-educated graduates and to develop the

intellectual property that results from basic and applied research. All this is well known and widely acknowledged. However, Indiana has not taken all the steps necessary to successfully achieve this transformation. In particular, it has not funded its research universities competitively. Since William Lowe Bryan's day, IU and Purdue have been the least well funded of all Big Ten public universities. Indeed, it would take an increase of \$80 million in state appropriation and student fee income to bring IU Bloomington to the *average* per-student funding level.

Specifically, with regard to new university research facilities, the Hoosier state needs to take immediate steps. Indiana could follow the example set by Ohio, which is undertaking an initiative for \$500 million of bonding authority for university research facilities statewide. I believe that this idea of special bonding authority for university research facilities is definitely worth exploring for our state.

Regulatory Compliance

Increased regulatory requirements and the resultant need to monitor and report compliance are also changing the face of university research and administration. Given new fields in the life sciences, such as genetic research, the increase in federal regulations is understandable. Changes in regulatory requirements for human subjects research offer a case in point. Clearly, informed consent is essential to protect individuals from exposure to potentially harmful side-effects of clinical trials or experiments in which they participate. In order to assure proper protocols, universities are required to establish Institutional Review Boards that screen and monitor all research involving human subjects. IU strongly supports the principles of responsibility and accountability that underlie these new requirements, and we are in the forefront of setting and enforcing high standards in the public interest. Nevertheless, the necessary increases in staff required for record keeping and faculty time expended in meeting these regulations drive up the costs of research. The federal and state governments rarely provide additional resources for these purposes.

Of course, compliance failures can be devastating, both for principal investigators and the universities. Not long ago, the U.S. Department of Health and Human Services shut down all sponsored research at several prominent medical schools, including Johns Hopkins, the University of Illinois at Chicago, and the University of Pennsylvania. I am happy to say that Indiana University has had no such problems. We have had recent site visits from the NIH and the Food and Drug Administration and we have received excellent reviews. But we must remain vigilant and accommodate new and existing regulations in a systematic and effective manner. Oversight for compliance university-wide is assigned to RUGS.

Graduate, Professional, and Post-doctoral Education

While much has changed regarding university research, one thing has not. Educating the next generation of faculty and professionals remains a key mission of a research university. Indiana University takes this responsibility seriously. We have nationally competitive graduate and professional programs, which attract the highest performing students. Strong

graduate and professional programs, in turn, help attract and retain the best faculty members.

Our campuses have differing needs. On the Bloomington campus, which requires better support for graduate programs, we will establish a matching program for endowed graduate fellowships. We will base this program on the remarkably successful matching program for endowed faculty chairs and professorships, which enabled IU to rise, over a five-year period, from near the bottom of the Big Ten to first place. Our goal with the matching program for endowed graduate and professional fellowships is to create 300-400 additional fellowships on the Bloomington campus. This long-term fund raising effort will be led by the new university dean for graduate and professional studies.

The new graduate fellowship program will also improve undergraduate education. Assuming that the total number of graduate students on the Bloomington campus remains approximately constant, additional graduate fellowships will lower the number of associate instructors. These teaching positions will be filled by new faculty members hired using the special funds from the Commitment to Excellence Program, the tuition increase that will be assessed to new students starting in fall of 2003. This will have multiple benefits. It will put more professors in the classroom and provide our students with more opportunities to interact with faculty members.

On the IUPUI campus, we will develop new graduate and professional programs. For example, we can expect to initiate programs related to the health sciences, as well as other professional areas and in the liberal arts. The IUPUI campus is the major provider of advanced degree graduates for Indianapolis. Indeed, it is among the top 15 campuses in the nation in graduate professional enrollments. As the needs of our capital city increase because of a diversified economy, the campus must respond.

Post-doctoral fellows are essential to successful research programs in a number of areas, especially the laboratory sciences. Indiana University has a large proportion of post-doctoral students as compared with other research universities. That is good. It enhances our research capabilities and expands IU's role in developing the next generation of scientists and faculty members.

We must take seriously our obligation to introduce new post-doctoral students to the frontiers of discovery so that they will become good stewards of their disciplines. A few years ago, the Association of American Universities undertook a national study of post-doctoral education. This study revealed disparities within campuses of post-doctoral students' responsibilities and working conditions.³ Unlike graduate and professional programs, which benefit from university oversight, post-doctoral programs are often administered by individual faculty members on the local level. Most universities did not even know how many post-doctoral students were working on their campuses! Clearly, the faculty member in whose laboratory a post-doctoral student works has primary responsibility for the student's academic and research program. But the university has responsibilities too. I will ask the new university dean for graduate and professional studies to review the current

³ The AAU Postdoctoral Education Committee Report (1998)

state of post-doctoral education at IU and to recommend any needed changes, using the recent AAU report as a benchmark for good practices.

The Relationship Between Research and Teaching

I have thus far focused my attention on the nature of university research and its relationship to post-baccalaureate education. Before closing, I want to address the dynamic relationship between research and undergraduate teaching. As I noted earlier, these two missions of the university form a continuum of mutually supporting activity, both for our faculty and our students. Faculty members who are engaged in research bring an added element to their teaching. The freshness of ideas and discoveries creates an excitement that is hard to resist. I am talking especially about engaging students in discovery itself.

Learning is ubiquitous at a great university or college. College students learn not only during the fifteen hours or so that they are in the classroom, the time spent in the library, or working on their computers doing assignments, but also through interactions with other students, for example in study groups, with faculty and staff during office hours and other informal occasions, as they attend public lectures by provocative speakers, through internships and co-curricular clubs and events, as well as at rallies, debates, and during those late night conversations that are so much a part of residential college life. It is the combined effects of all these occasions that help students refine their values and goals and develop habits of mind such as critical thinking and the clear expression of ideas. Classroom instruction provides the content and the catalyst for learning, but it takes the developmental activities of college life to generate lasting lessons. This is true for all our campuses, including our regional campuses.

Interactions with faculty members outside the formal classroom environment play a crucial role in students' development. Plato, who first conceived the idea of a university, believed that education transforms a person and that this transformation occurs when teacher and student enter into dialogue with one another. It is within this dialogue, says Plato in *The Republic*, "that a spark may suddenly leap, as it were, from mind to mind, and the light of understanding, so kindled, will feed itself." Engagement with faculty members in research provides the best opportunities for learning not only subject area content, but also the essential values of the academy.

Direct engagement in faculty research enables students to internalize central intellectual values such as intellectual honesty and curiosity. Intellectual honesty includes, but also goes beyond, taking credit only for one's own work, reporting data accurately, and acknowledging predecessors. It also entails solving hard problems, refusing to accept facile answers to difficult questions, and resisting the temptation to publish superficial or inaccurate results. Intellectual honesty is a virtue students learn and practice through participation in research.

I would define intellectual curiosity, which is the companion virtue of intellectual honesty, as the combination of persistence and excitement that leads one to delve ever more deeply into a topic and pursue a central and relevant argument past a first analysis. It is the

motivation to go beyond what is known or has been done before to make a scientific discovery or to create a work of art or a performance that breaks new ground. It is the will to expend great energy and time to get below the surface, to explore, and to understand. Intellectual curiosity requires dogged persistence and a deep dissatisfaction with conventional wisdom. The intellectually curious are never satisfied. Their journey of discovery on the endless frontier never ends. By engaging students in their research, faculty members take students with them on this journey. They assume the role of Virgil, guiding students to the gates of knowledge.

Many undergraduate students are involved in research at IU. While direct engagement of students in faculty research is common in the physical and life sciences and even in the social sciences, it is harder, but not impossible, to involve students in arts and humanities research. I am not referring to asking students to undertake library or web searches, bibliographic background work, copyediting, or some such. Rather, the idea is for students, singularly or in groups, to work collaboratively with faculty members on a research problem or in the creation of a work of art.

For example, the College of Arts and Sciences on the Bloomington campus provides outstanding undergraduate students access to the Science, Technology, and Research Scholars (STARS) program. STARS students take part in four years of research under the direction of leading faculty scientists. On the IUPUI campus, undergraduate students are encouraged to work with faculty mentors on research or other creative projects through the support of the campus-wide Undergraduate Research Opportunities Program. Indeed, the campus will host the National Conference on Undergraduate Research in 2004. The IU South Bend campus supports the research activities of undergraduate students in many ways, including by gathering their work in the interdisciplinary Undergraduate Research Journal.

Let us establish the goal of increasing the number of undergraduate students on all our campuses who are engaged with faculty members in research, scholarship and creative activity and let us work to increase the quality of those experiences. At IU, it should be the norm that students have the chance to participate in a faculty-mentored research project at least once before graduating. I am aware that not every student will want to take advantage of this opportunity, and I am not suggesting that it become a requirement. But such opportunities could advantageously become a hallmark of an Indiana University degree.

To further the goal of enhancing the quality and quantity of student opportunities in faculty research, I will establish a study committee to ascertain the current state of affairs with respect to student participation on each campus and secondly, to make recommendations for progressing toward this goal. For instance, we will work to broaden opportunities offered through the Undergraduate Research and Creative Activity Partnership. Of course, the study committee will need to be cognizant of and sensitive to faculty time and effort commitments. If we can develop a sound approach, undergraduate education will improve and faculty members will have more young collaborators in their research. I will ask RUGS to provide support and assistance to the study committee and to members of the Faculty

Colloquium on Excellence in Teaching (FACET) to take a lead role in these deliberations and to bring to the discussion their expertise about teaching and learning.

There is a role here also for the Indiana University Scholarship of Teaching and Learning Initiative (SOTL), which is a faculty-driven and community-building program that enhances undergraduate learning through the promotion, support, and dissemination of rigorous research and creative activity. This program has supported and fostered the individual research efforts of our faculty and helped them to pursue research in diverse areas of student learning. This exciting program—which includes Carnegie Outstanding Professor of the Year Craig Nelson, four Carnegie Scholars, and faculty from all units on the Bloomington campus—is having a substantial impact on undergraduate student learning.

While I do not expect radical change in the short term, if we proceed thoughtfully, over time we can affect the culture of the university. By acknowledging the synergistic relationship between teaching and learning, we can enhance undergraduate education and encourage students to more fully embrace the values of intellectual honesty and curiosity, which will both advantage them in life and make them better citizens. If we succeed in so educating our students, we will have done our jobs well.

Final Words

One key distinguishing characteristic of leading universities is their commitment to and engagement in research, scholarship, and creative work. At Indiana University, this is one of our core missions. I have argued that the distinctions between applied and basic research, between academic and industry related research, and between teaching and research are not absolute, but rather represent continua of activities. The role of the university is to nurture discovery and preserve the freedom of inquiry and openness through which dissemination of results can be maximized. The principle of free inquiry means that universities are ‘safe harbors’ for faculty members to follow new directions in their research.

We will reorganize the administrative support structure for research and graduate education in order to best meet emergent needs. In particular, the vice presidencies for research and for information technology will come under single leadership. While the two organizations, RUGS and UITS, will remain distinct, we will also take steps to identify organizational changes that can increase effectiveness and minimize duplication. On the IU Bloomington campus, we will establish the position of a full-time associate vice president for research. We will also appoint a university dean for graduate and professional studies. All these changes will better position IU to seek and obtain federal grants, including large center grants, support new research ventures, promote graduate education and decrease administrative costs—a critical factor in this time of reduced state support. We will thoroughly review this reorganization two years after it is put in place in order to ascertain progress.

Consistent with the goals of free inquiry and openness and within the limits of sound conflict of interest policies, IU should continue to facilitate faculty members’ engagement in strengthening the state’s economy through the licensing and patenting of their discoveries.

Similarly, we should seek to enhance the quality of life of Indiana's citizens through research and assistance in not-for-profit endeavors and local and state governmental initiatives. We should enrich the cultural lives of our communities and beyond through musical performances and other works of art.

The state of Indiana needs the help of its research campuses to successfully transition into a sound 21st-century economy. Infrastructure needs, most especially space for research, present a substantial barrier to success. Indiana has to date historically under-funded all three of its premier public research campuses. Nevertheless, IU has risen to these challenges. Over the past decade, annual sponsored research has tripled, with the School of Medicine showing the strongest increases. IU is leading the way toward growth in the life sciences industries, as well as in information technology.

Research and teaching are intimately connected. The dynamic relationship between teaching and research provides special opportunities for students to learn the intellectual values and habits of mind that characterize the academy. Engagement of undergraduate students in faculty research enables the assimilation of these values and develops more widespread understanding of the nature and importance of research. Indiana University will strive to broaden and enhance these opportunities for students.

The contemporary research university is many things to many people. It is a marketplace of ideas, to use the Socratic metaphor. Given its commitment to freedom of inquiry, scholars, artists, and scientists find in the contemporary university an environment committed to freedom of inquiry and uniquely suited to the creation of art and knowledge.

It is also a place for undergraduate students to get a superior education, both in class and in informal settings. It is a driver of economic development and improved quality of life. The modern research university occupies a position of pride for many, including alumni who remain connected through friendships, athletic events and professional association.

But let us not forget—indeed, I have been emphasizing—that these institutions are also centrally engaged in pursuing the endless frontier of research, scholarship and creative activity. Indiana University is proud of its commitment to research and of its achievements. We will not rest on our laurels, however. For us that tradition is a challenge: we will continuously seek to do better and better.

Myles Brand
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