

Scientific Research and Related Topics at the University of Pittsburgh



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On behalf of the University of Pittsburgh, I would like to address with you the value of robust research programs to the Commonwealth. Research activity at the University encompasses externally funded research, as well as research the University funds internally, and also is a core part of our graduate, professional and undergraduate education. Technology transfer and economic development partnerships are one outgrowth of our research enterprise. As the Vice Provost for Research, I am charged to oversee the research enterprise of the University and provide assistance and guidance to the faculty and students in their research efforts. The fundamental role of the University is not simply to disseminate the knowledge that already exists, but to create—through research—new knowledge. The creation of this new knowledge has multiple positive impacts on students, local and national economic development, and potentially human health and the environment.

The University of Pittsburgh is a research powerhouse that was awarded \$737 million in research funding in fiscal 2009, more than \$700 million of which came from non-Pennsylvania sources. The Commonwealth supported research comes from agencies including the DCED, Penn DOT, the Pennsylvania Department of Health, PEMA and the tobacco settlement funds. The annual research support from these Commonwealth sources is about \$20 million annually, and has produced useful output in areas as diverse as bridge safety, smoking cessation, and other areas of direct benefit to the citizens of the Commonwealth. In addition, the Commonwealth provides funds for construction of buildings which house the infrastructure where important research is undertaken. While the Commonwealth support has been generous, the bulk of the University's research funding is federal. In the recent federal ARRA Stimulus grant program, the University of Pittsburgh received 509 grants, contracts and subcontracts with a total value of \$207 million. In the last quarter of 2010, the University reported that 442 jobs were retained or created solely by these ARRA federal awards. Of course, the University receives federal funding under other federal programs besides ARRA, and this is just a part of the employment benefit to the Commonwealth of the University of Pittsburgh's success in this area.

The U.S. Department of Labor estimates that 36 jobs are supported for every \$1M in research and development expenditures. Pitt's research expenditures for 2010 will have supported, directly and indirectly, more than 26,500 jobs. The impact of the University of Pittsburgh research that imports more than four dollars in research funding for every one dollar of state appropriation goes beyond simply providing employment opportunity. This research generates the ideas and technologies that will define our economic future.

The University of Pittsburgh ranks in the Top 10 of university recipients of federal science and engineering research awards from all federal agencies, and ranks fifth in the country in terms of faculty research support from the National Institutes of Health. The University's high achieving faculty has made the University an internationally respected center of pioneering research. Over the course of the past decade, Pitt's cumulative research expenditures have totaled \$5.35 billion. The annual research revenues received by the University of Pittsburgh, as well as other distinguished research universities in the Commonwealth, collectively rival the revenues of more traditional industries and are vital to the continued economic vitality of the Commonwealth. These imported funds are mostly locally spent and provide the financial foundation for tens of thousands of local jobs. In addition to direct employment, construction work related to research expenditures further contributes to the economic vitality of the region. During the past three years, the university has averaged \$140.7 million in construction projects annually, which generated 1,300 jobs and \$51 million in personal income. Two recent projects where external funds directly generated local construction jobs were two grants received by the University totaling approximately \$30 M from the National Institute for Standards and Technology and the National Institutes of Health. These two projects, in addition to the immediate job creation, will further strengthen the University's research infrastructure in nanotechnology and medical research.

Beyond the impact on jobs and the local economy, University based research has improved human health in a way that touches us all on a daily basis. The Pitt-based efforts that led to the Salk polio vaccine development is just one legendary example of our research accomplishments. Researchers in our Center for Vaccine Research continue the legacy of Jonas Salk as they develop new vaccines to protect against emerging diseases, and to tackle continuing public health challenges such as AIDS. Dr. Thomas Starzl and his colleagues have developed surgical techniques, therapies and drugs that have made human organ transplantation not only possible, but common. Dr. Andrew Schwartz is heading up a research initiative that received nearly \$7 million in federal support over the next three years to test two different types of brain implants. This cutting edge work could, if proven safe and effective, someday permit paralyzed individuals, including our "wounded warriors," to control prosthetic limbs through the power of their own thoughts.

The University's research excellence is by no means limited to health science topics. A more thorough synopsis of University research programs, including descriptions of the relevance of this work to us all, is provided in the Research Excellence document, which has been provided to you separately. To increase the efficiency of the support systems underlying our faculty's research, as well as to bring together scholars from multiple disciplines, the University has created centers and institutes in broad subject areas. At the University of Pittsburgh, we have over 250 Centers and Institutes covering a wide range of topics and disciplines, and these centers

and institutes are periodically reviewed to determine whether they continue to address current research needs. Some of these groups include:

- Learning Research and Development Center
- University Center for International Studies
- University Center for Social and Urban Research
- European Union Center of Excellence
- University of Pittsburgh Cancer Institute
- McGowan Institute for Regenerative Medicine
- Petersen Institute for NanoScience and Engineering
- Center for Energy
- Simulation and Modeling Center

Key Collaborative Research Efforts in the Energy Area

One instructive example of the multiple benefits of university research to the Commonwealth is in the area of energy. Developing safe, adequate energy sources is a key challenge for our country and Commonwealth. The University of Pittsburgh has over 50 faculty and dozens of students and post doctoral researchers exploring the vast and complex energy scene. Teams of researchers in different disciplines, with many different approaches, are studying problems related to the generation and conservation of energy. A partnership with Penn State, CMU, WVU and Virginia Tech with the DOE National Energy Technology Laboratory is providing cutting edge energy research by exploring increased efficiencies in using fossil fuels as well as transitioning toward renewable energies. Another collaborative research project studies energy efficiency in buildings and is being undertaken in collaboration with fellow research universities, led by our colleagues at Penn State. In August, the federal government announced that this research consortium headed by Penn State (which include seven Pitt researchers) bested more than 100 competitors nationwide to earn a \$129 million grant to develop an "energy innovation hub" at the Philadelphia Navy Yard. This grant is aimed at developing sustainable technologies that save energy and reduce pollution. Experts believe these technologies will create new businesses and as many as 100,000 "green sector" jobs in the next decade, as well as creating a living laboratory right here in Pennsylvania for energy technology.

Undergraduate Research

While a fundamental mission for the University is to create new knowledge through the research of its faculty, an equally important goal is to produce students who are prepared to contribute to the store of human knowledge. Whether those students pursue additional graduate study, or whether they go directly into the workplace, the creative problem solving skills they gain from involvement in research will go with them. The University provides a rich environment for undergraduate students to engage in research at many different levels. Because Pitt is a major research university, the research experiences we can offer our students from their freshman year to their senior year are fundamentally different from those offered at primarily undergraduate institutions. Our students have access to some of the top researchers in their fields, and get to work with scholars who truly are on the cutting edge of their disciplines. Research experiences are part of the core curriculum of many programs, and specialized programs provide

resources to support this important part of our undergraduate students' education. As one example, through our Honors College some 40 undergraduates are provided summer stipends to work with a variety of faculty from across the University from Arts and Sciences to Medicine. Each week the students come together to discuss their research progress, brainstorm over problems and share in the collaborative process that is key to the research enterprise. At the conclusion of the program, the students have a full day retreat to discuss and present their research findings.

Graduate and Professional Education

The role of a top research university is not only to create and communicate knowledge, but also to prepare the next generation of leaders in their fields. Pitt has more than 10,000 graduate and professional students in various programs. These students represent 42 percent of all degrees granted. The University is ranked in the top 25 among public universities in producers of doctoral degrees. Advanced education at Pitt is designed to provide innovators for all fields. These students take the advanced knowledge they have gained and create or lead the companies and institutions that benefit us all. Ideas are born, nurtured and develop by the students and their faculty advisors. Some notable examples of graduate and professional student successes at the University of Pittsburgh are:

- General Roscoe Robinson, Jr. who earned his M.S. degree in international affairs and was the first African American to achieve the rank of 4-star general in the U.S. Army.
- John A. Swanson who received his Ph.D. degree in mechanical engineering founded ANSYS Inc., a computer software company whose code is used in almost every mechanical and structural design in the world and the winner of the John Fritz Medal, referred to as the highest American award in the engineering profession.
- Herb Boyer, a Ph.D. from Biological Sciences and founder of Genentech, one of the first and most successful biotechnology companies.
- Alumnus from the School of Law have been prominent in public service:
 - Senator Orin Hatch
 - Senator Benjamin L. Cardin
 - Former Congresswoman Melissa Hart
 - Allegheny Chief Executive Officer Dan Onorato
 - Former Chief Justice of PA Ralph Cappy
 - Former Speaker of the PA House K. Leroy Irvis
 - Former Governor and U.S Attorney General Dick Thornburgh

Office of Technology Management and Economic Development Impact

One method of directly translating University research to the broader community is through licensing of University patents and other intellectual property. Pitt's Office of Technology Management is creating new business opportunities out of ideas emerging from the lab and classroom. Over the past seven years, OTM's efforts have helped launch 43 companies many of which are operating and employing people in the Commonwealth of Pennsylvania, generating tax revenue for local and state coffers. The University of Pittsburgh, through its

Office of Technology Management, continues its commitment to develop and commercialize innovations that emerge from Pitt's diverse research endeavors. Such commercialization activities not only have created a more "academic entrepreneurial" culture on campus, they also have contributed greatly to the Pittsburgh region's economy and its prospects for technology-driven prosperity.

The University has further collaborated on a wide range of technology-driven economic development initiatives, including: the Pittsburgh Life Sciences Greenhouse, Innovation Works, Idea Foundry, Pittsburgh Technology Council, NanoMaterials Commercialization Center and The Technology Collaborative. Supporting such initiatives is a natural extension of the University's own technology commercialization efforts. Although still relatively recent, these Pitt-created technologies have produced enviable results in recent years. During the past decade, our OTM received 1550 patent disclosures from Pitt researchers, and filed 709 new U.S. patent applications. In addition, 303 new patents were issued, 443 licenses or option agreements were executed, and 59 start-up companies tied to Pitt technologies were formed. Of these 59 companies, 24 are in operation, at least in part, in the Commonwealth of Pennsylvania today. As one example of our success in this area, Cohera Medical Inc., which spun out of the University in 2005-06 and has raised millions of dollars in funding, is wrapping up clinical trials that should allow it to begin selling its urethane-based, biocompatible and biodegradable TissuGlu™ in the next year or so. The annual report of OTM, which has been separately provided to you, gives further details on our economic development activities in this area.

OTM has also fostered entrepreneurship among faculty and students by offering a variety of courses including "From Benchtop to Bedside," a special 10 week course designed to help scientists, graduate students, and others, learn how to translate basic science discoveries into clinical applications. OTM also offers an "Academic Entrepreneurship" course to educate faculty and students on pursuing the commercialization of the ideas first generated through University research.

Conclusions

The Association of American Universities (AAU), the 63 member Research University Association, has highlighted the profound impact of university research in its document entitled "Far Reaches of University Scientific Research." The AAU prepared this informative set of reports to document how University research affects various parts of the economy. Laser applications, laser guided weapons for the military, laser printers, fiber optic communications, bar code scanners, CD players, laser vision corrective surgery, hologram authentication, DVD players and the detection of nuclear materials are some of these impactful developments that span the years of 1969-2011. In the area of automotive applications of basic research, LCD monitors, speech recognition technology, lithium batteries, catalytic converters, shatterproof windshields, adjustable seats, center brake light, transistors, airbag deployment sensors, CD players, GPS, remote car locks, extended tire life and car bumpers are a few of these developments. For the military, there is a vast number of developments that empower and support our troops in combat, such as the hemcon bandage, interceptor body armor, joint precision air drop systems, laser designators, meals ready-to-eat, night vision goggles, and

translation devices. The creation of new knowledge through university research has profoundly changed the world in which we live for the better.

The University of Pittsburgh is proud of its own rich history of breakthroughs in science, engineering and health, and it is proud to be part of the broader history so ably summarized in the AAU reports. As these examples illustrate, the University of Pittsburgh is a preeminent research organization that annually imports hundreds of millions of dollars in funding into the Commonwealth. In addition to the direct benefit of these monies in the form of employment and construction, Pitt researchers also cultivate the seeds of new technologies that ultimately will form the basis for tomorrow's successful businesses and industries. The University's leadership in developing and marketing new technologies born in our research laboratories will continue to stimulate broad-based economic opportunities.