RESEARCH INCENTIVE PROGRAM

SUMMARY OF RESULTS

FISCAL BIENNIUM 2004-2005

OVERVIEW

During the 2004-05 fiscal biennium the universities eligible to receive Research Incentive (formerly Research Challenge) Program awards received funding totaling $33,666,282. These universities, using the funds to enhance research productivity on their campuses, made awards of $32,797,167 to their faculty, staff, and graduate students. Through the summer of 2006, these awards have resulted in new external research funding to these universities of over $284,300,000, that is, for every $1 awarded by the Research Incentive (RI) Program to the universities, they were able to generate $8.67 from external funding sources to support their research efforts.

Highlights of each university's use of these funds as well as the results they achieved are summarized in the following sections. The complete reports submitted by the universities are on file at the Ohio Board of Regents offices.

University of Akron

Awards were made both to individual faculty and groups of faculty collaborating on a research project, with approximately 14% of the funds going to new faculty to assist them in starting up their research efforts. These awards also assisted in supporting 24 students who received their M.S degree and 28 students who earned a PhD degree. In addition, 208 scientific papers were published in peer reviewed journals by the individuals working under these awards, and 11 patents were awarded to the university as a result of these research projects.

In the Department of Polymer Science one project led to the formulation of a particular solvent that can prevent degradation of proteins and protein-based drugs up to 10 years. This invention may be important not only for pharmaceutical and bio-tech industries, but also for preserving protein-based vaccines against different diseases and biological/chemical weapons. Another project in this department resulted in the design and construction of a spectrometer that provides optical images with unprecedented lateral

resolution ~20 nm. This technology and its future development may significantly affect progress in science and engineering at the nanoscale.

Bowling Green State University

Bowling Green State University used their RI award to support faculty research efforts through a competitive process as well as using a portion of the funds for new faculty start-ups, matching funds on federal research grants, and to improve their research infrastructure.

In line with the campus-wide strategy for identifying research strengths and investment opportunities, interdisciplinary cluster groups were formed during this biennial period. The group in molecular photonics was the first to receive such investment and as a result, have garnered substantial federal research dollars, particularly from DOD/NAVY. One award specifically supported collaboration with chemists at the University of Toledo. Third Frontier activities have also been supported with Research Incentive funds and have contributed to this current success in drawing federal attention to our research efforts. The Research Enhancement Initiative continues to move forward with investments planned by supporting new faculty, post doctoral associates, new equipment, and research supplies. BGSU will continue to follow its approved plan to address opportunities and continue the support of basic research that shows potential for commercialization.

Case Western Reserve University

Research Incentive funds have provided critical support for the two Wright Centers of Innovation based at Case Western Reserve University, i.e., the Center for Stem Cell and Regenerative Medicine (CSCRM) and the Wright Fuel Cell Group. This alignment of Research Incentive funds with Third Frontier funds allows for much needed pilot funding, robust administrative cores and for strategic marketing and development activities such that the centers can ensure long-term sustainability. To this end, the CSCRM has secured federal funding to create the National Center for Regenerative Medicine. The Wright Fuel Cell Group has leveraged its Research Challenge support to produce increased levels of industrial funding for research collaborations and for fuel cell testing services.

In addition, eight interdisciplinary research projects were funded that involved faculty from two or more schools at Case. Several of these projects, such as one involving faculty from mechanical engineering and chemistry that was focused on energy transport in nanomaterials, have resulted in successful

applications to the National Science Foundation and the National Institutes of Health. In addition, several core facilities have been developed with Research Challenge funding. These facilities enable collaborative research activities of several faculty or provide much needed equipment, such as a sputtering system in the electronic design center, to support prototype development activities sponsored by Ohio industries.

Central State University

The Research Incentive program has proven to be an invaluable resource for Central State University as it continues to build upon and expand its research capability. As proven in our success with a program supported by the National Nuclear Security Administration entitled, "Science, Technology, Engineering & Mathematics Upgrade and Outreach" (STEM UP-OUT), Central State's collaborative research capabilities within the STEM fields have been significantly enhanced.

During this funding period the majority of funds were devoted to the enhancement of manufacturing engineering and water resources management, with the remaining funds being used in various physical science, mathematics, and computer science programs.

Through the use of incentive for collaboration funds, Central State University was successful in establishing (or continuing) research partnerships and initiatives with several academic institutions and business partners. Formal partnerships were established with Kent State University, Hiram College, University of Zambia, and Cheikh Anta Diop University, Dakar, Senegal. Direct business partners included SuperDrive Inc., Piqua, Ohio and Dayton Hydroelectric, Dayton. Ohio.

University of Cincinnati

Funding received from the RI Program continue to be critical for the success of the University of Cincinnati in obtaining significant extramural support from federal, industrial, private and Third Frontier sources. This support has been crucial for fostering development of innovative initiatives, enhancing the development of excellence and contributing to increased economic development in the region.

The Research Incentive Funds have been used for 4 basic functions:

- Recruitment and Retention of World-Class Faculty
- Cost-sharing for Extramural Grant Proposals and Equipment Funds

- Interdisciplinary Research Institutes/Centers (with shared research cores)
- Undergraduate and Graduate Research Programs

Among the interdisciplinary groups supported this year was the Chemical Sensors group, which is comprised of 6 faculty, 6 post-docs, 3 visiting scholars, 26 graduate students and 6 undergrads who have been involved in collaborative research projects, which have yielded 28 publications and 46 lectures and presentations at professional meetings in the past year. The faculty in this group submitted 27 grant proposals last year and are currently supported by 13 external grants (with several proposals pending). Members of this group have submitted 3 patent applications, and are involved in a number of new initiatives such as SEM Immunoassay, Nanobead Immunoassay, and "lab-on-a-chip" projects with industrial partners from Procter & Gamble and Yellow Springs Instruments. Together and separately, the faculty mentioned above as well others in the Chemical Sensors group are involved in several large-scale collaborative interdisciplinary NSF proposals (involving faculty in A & S and Engineering). All of these interdisciplinary efforts involve innovative approaches to biomedical, nanotechnology and materials research, and are potentially connected to "Third Frontier" activities.

Cleveland State University

At Cleveland State University Research Incentive funds were used primarily for new faculty start-ups and to respond to strategic opportunities to create collaborations with industry and or to enhance the acquisition of external research funding.

One project supported initially by RI funds in the Department of Chemistry was successful in obtaining additional funding from the National Institutes of Health for research on a new colorectal cancer (CRC) screening technology. CRC is the second deadliest cancer in US, and early detection is still the best way to save lives from CRC. This screening is currently performed with an invasive procedure known as a colonoscopy where a doctor inserts a long, flexible, lighted tube called a colonoscope into your rectum and slowly guides it into your colon. The scope transmits an image of the inside of the colon onto a video screen so the doctor can carefully examine the lining of the colon. However, with as with any invasive procedure there is significant discomfort and other risks associated with invasive procedures. Dr. Guo's technology provides a non-invasive diagnostic procedure that allows physicians to detect CRC in the early stages simply by analyzing fecal material utilizing DNA

analysis techniques. This non-invasive diagnostic procedure is based on several patents obtained by Cleveland State University which have been licensed to **GLC Biotechnology**, a new start up company formed by a CSU faculty member to commercialize the technology. The researchers are currently conducting a small-scale clinical trail to evaluate the technology, and if initial results continue to show promise full scale clinical tests will be initiated within a year or so.

University of Dayton

Awards from the Research Incentive Program were made both to support continuing research projects as well as to initiate new research projects. While the majority of support went to individual faculty members to support operational costs, approximately 20% of the funds were used for interdisciplinary projects and a small amount of funds to acquire new research equipment.

The focus of one project was to develop a micro-optic technology that can be fitted to infrared cameras in order to improve their collection efficiency. The micro-optics was made on a silicon substrate with the ability to collect and channel light towards the photosensitive elements of the focal plane array. The first goal of the project was to design the micro-optic elements through modeling and simulations. The second part of the project was to design a plasma etching process with a high degree of uniformity and reliability in order to create a commercially viable product. Both of the above goals were accomplished. Through this project we have developed a niche technology in silicon micro-fabrication. This technology is currently in transition into a commercial product at L3-Cincinnati Electronics. Hence, it has already enabled the creation and retention of high-technology jobs in Ohio. One of the longer term goals is to support other Ohio industries by offering silicon micro-fabrication and design service. Currently there are only a handful of companies in the country that offer expertise in optical micro-structures and MOEMS. This project will make it possible to create this service in the Dayton area.

The University of Dayton continues to collaborate with neighboring institutions in supporting the research initiatives of the State of Ohio and the Dayton-Miami Valley Region. Outreach to and partnerships with the community and industry are facilitated through our strong partnerships with organizations such as the Wright Brothers Institute; the National Composites Center; the Dayton Area Graduate Studies Institute; the Edison Technology Centers; Wright Technology Network; the Ohio Aerospace Institute; the National Center

for Industrial Competitiveness; and the Dayton/Miami Valley Entrepreneurs Center.

Kent State University

Kent State University distributed its 2004/05 Research Incentive Funds to support projects in accordance with the Ohio Plan and KSU Institution's Plan for Use in biotechnology/bioinformation/biopreparedness, materials science, and social sciences. Proposals covering areas critical to the quality of life in Ohio also earned special consideration. Proposals demonstrating strong collaborative components were granted special priority.

A research project entitled HIGH PERFORMANCE CARBON NANO TUBE – POLYMER COMPOSITES FOR SPACE APPLICATIONS enabled the research team to initiate research on the CNT dispersions in polymers which are being prepared for high-strength materials applications and in understanding the percolation phenomena that changes the conductivity of the composites by several orders of magnitude. This project helped establish active collaboration with researchers at NASA Langley and was able to leverage an additional two-year award from NASA Langley for $170,069 for the development of high-performance polymers and carbon nanotube polymer composite for space, as well as numerous domestic applications.

Another project entitled BIAXIAL NEMATIC AND SMECTIC PHASES AND CRITICAL PHENOMENA IN BENT-CORE AND TETRAPODIC MESOGENS allowed the team of research scientists funded by this award to conduct research on newly discovered biaxial nematic liquid crystal that promises to revolutionize the science and display industry due to its unique structure, physical phenomenology and two orders of magnitude faster switching times. The discovery of biaxial phase was picked up by Nature magazine in its *News and Views* column and highlighted by the *physical review focus* among other news magazines. Clearly, this work will lead to a significant impact on the NE Ohio's electro-optical devise industry, which includes LC based information displays.

Medical University of Ohio (*now University of Toledo Health Science Campus)*

The majority of Research Incentive funds during this biennium were devoted to projects in cellular and molecular biology, the molecular basis of disease, and the neurosciences.

Two of the programs supported by RI funding have been in the areas of migraine headache research and stroke research. These programs encompass both original research (current external support from NIH, American Headache Society, and GlaxoSmithKline) and industry-sponsored research trials (GSK, Eisai Medical Research, Boehringer Ingelheim Pharmaceuticals, NMT Medical, and Pfizer). The diverse areas of research include: the role of endothelial dysfunction as a link between stroke and migraine, biomarkers of migraine, migraine and physical and psychiatric comorbidities, the role of childhood abuse history in adults with migraine, treatment of menstrual migraine, thrombolytic therapy in acute stroke, efficacy of endovascular closure of patent foramen ovale in stroke prevention, the role of statins in secondary stroke prevention, antiplatelet therapy in stroke treatment. With the help of the institution's Center for Creative Instruction, this support has allowed the PI to establish a multicenter research consortium within a section of the American Headache Society using innovative technology for gathering and compiling data. In the past two years alone the research within the migraine and stroke divisions has resulted in 8 scientific presentations at national meetings, 8 scientific manuscripts published in peer-reviewed journals, two editorials (including in Lancet), and three chapters. Some of these publications have as co-authors medical students, undergraduates and high school students who have worked with the PI on these projects. The PI also used his experience in building a research team to extend this model to other divisions within the department (i.e. Epilepsy, Multiple Sclerosis), and the department has just been awarded a 3-year $300,000 grant from the Stranahan Foundation to build a self-sustaining team for clinical research and patient care.

Miami University

All RI funding awarded by Miami University was aligned with the goals of the Third Frontier Program and have been important factors in the University's efforts to increase their external funding for research, which has doubled from FY 2003 to FY 2006. In addition, since Miami University will be replacing about 30% of its faculty in the next 5-7 years while adding 50 new research faculty by 2009, approximately $200,000 of Research Incentive funds per biennium are designated as equipment start-up funds for Ohio Third Frontier related new faculty hires. This program continues to have the greatest leverage impact. It allows Miami University to hire better qualified research faculty. One additional benefit is that the equipment purchased for new faculty also assists existing faculty. This represents a leverage that we can not calculate.

Several faculty recently created a unique virtual environment (VE) system called the HIVE (for Huge Immersive Virtual Environment) on the campus of Miami University. The HIVE is the world's largest indoor immersive VE by a factor of four, offering precise, wireless, untethered tracking of users in a 572 m^2 gymnasium. The size and functionality of the HIVE make it one of the premier facilities in the world for conducting scientific research on the perception and mental processing of large-scale spaces. In the last two decades, there has been a great deal of interest in using real-time interactive 3-D computer graphics. To date, however, surprisingly little research has used immersive VEs to simulate large-scale spaces (i.e., those that require movement of the viewpoint to apprehend) primarily because most immersive VE systems have a limited tracking area and thus cannot simulate a large environment at a one-to-one scale. Research Incentive funds enabled researchers and educators to use the HIVE to simulate meaningful spaces and thus to investigate theories and applications of spatial cognition in large-scale spaces. It pursues three closely-related aims. First, two new lines of behavioral experiments are examined how 1) environmental properties and 2) the sensory information available during learning moderate the qualities of a person's mental representation of space. Second, it proposes programs that will leverage the unique features of the HIVE to advance education about the scientific principles that underlie VE technology, as well as the scientific research that is enabled by it. Finally, it proposes two specific collaborative efforts in which large-scale immersive VEs can be used as a tool to enhance the educational experience of undergraduate students across multiple academic disciplines at Miami University. This project has already attracted DoD funds of over $250K with several other proposals pending at DoD and NSF. The intellectual property position is being investigated and appropriate patents will be sought.

Northeastern Ohio Universities College of Medicine

Support of individual faculty projects was the primary goal of the Research Incentive funding at YSU during this biennium, with the goal of leveraging these initial research efforts into support from external sources. Two such projects are described below.

The goal of one project was to acquire preliminary data as part of an effort to develop new compounds for the treatment of nicotine addiction. The approach tested antagonists at the neurokinin receptors as potential therapies for nicotine addiction. The neurokinin receptors are a group of three G-protein coupled receptors termed the NK-1, NK-2 and NK-3 receptors. The endogenous

ligands for these receptors are the neuropeptides substance P, neurokinin A and neurokinin B. Previous proposals have been submitted to external agencies, but were not funded. One of the criticisms of these proposals has been that we do not have overwhelmingly convincing evidence that NK antagonists are effective in nicotine addiction. This project provided the PI with a start toward obtaining these important data and he was successful in applying the data gained as a result of this RI award to secure a grant from the American Heart Association-Ohio.

The purpose of the second project was to conduct pilot experiments designed to better understand the role of TRIP13 in cancer cell proliferation. Prior to this work, little was known about TRIP13 except that it interacts with the non-liganded nuclear thyroid hormone receptor TRβ1. The discoveries made under this project that TRIP13 also interacts with and modulates heterotrimeric Gβγ activity, as well as the discovery that TRIP13 expression is highly upregulated in cancer tissues, suggests that it may play an important role in signal transduction in cancer cells. Preliminary experiments also suggest that TRIP13 expression may negatively regulate growth of breast cancer cell lines. However, more work needs to be done to better understand the nature of this TRIP13-mediated growth regulation, as well as the extent to which TRIP13 impinges upon nuclear receptor and G-protein coupled receptor signaling pathways. As a result of this award, the PI was able to generate data which enabled her to gain funding though Cephalon, Inc. and secure a subaward from NIH through Louisiana State University.

Ohio State University

Programs supported by OSU under their Research Incentive funds included individual faculty research projects, multidisciplinary research projects, science/technology and economic development activities, matching equipment grants, and the funding of shared research facilities. Funded projects covered a broad cross sections of areas - from solar cells on the International Space Station to polar research, to heart and cancer research, to work on the Mars Rover project.

One RI supported project was a world leading program in ischemic heart disease research. This novel work includes development of new techniques to measure and image oxygenation in the ischemic heart (where blood flow is stopped or blocked). It also includes development of a way to image the viability of the heart during and after a heart attack through real time measurement and imaging of the heart's reduced oxygen state. The research

studies ways to protect the heart through hypoxic preconditioning and novel mechanisms of heart attack chemoprevention. In addition, the group performed the first OSU studies of the role of bone marrow derived stem cells for use in a damaged heart's regeneration and healing. During this period the research group produced 47 peer reviewed publications, had 72 abstracts published, supported 28 researchers (post doctoral researchers, research scientists and assistant professors). This support enabled exploration and development of research areas leading to industrial and NIH funding of $18 million --spanning the time frame.

Another RI funded project supported the development of high performance solar cells that are being tested for a year on the International Space Station. Due to their lighter weight and anticipated greater efficiency in converting sunlight into electricity, these cells hold potential for future aerospace missions, lower-cost energy for consumers and as an alternative to fossil fuel power generation. This project is in collaboration with researchers at the Massachusetts Institute of Technology and NASA Glenn Research Center. This research team has integrated a prime photosensitive electronic material, gallium arsenide, with lightweight, low-cost silicon wafers. External funding for the project now comes from NASA, the National Renewable Energy Laboratory, the Army Research Office, and the National Science Foundation.

An OSU team of researchers supported by RI funds have been creating synthesizing images of terrain on Mars. Their work is essential to constructing detailed topographical maps and three dimensional images of the planet's terrain required for rover navigation. When NASA launched the two Mars rovers, *Spirit and Opportunity,* they anticipated a useful rover lifetime of 90 days. More than two and a half years later (July 2006), the vehicles are still functioning. OSU became a national and international leader during the Mars rover localization and landing site mapping. In 2004 the NASA Director Sean O'Keefe presented the OSU research team with a Group Achievement Award for their excellent work on the Mars program.

Ohio University

The Research Incentive program allows OU researchers the latitude to carry out important preliminary studies that are later used to support larger projects and proposals. For 2004 and 2005 the Research Challenge Program directly supported over 158 publications/presentations, over 60 proposals to external agencies, and was integral in the filing of 8 patent applications. Although some metrics are more challenging to grasp they cannot be overlooked or discounted.

The RI program as administered at Ohio University provides an attraction for potential researchers considering Ohio University. Researchers know that resources available for bridge fund support for those between grants, and resources to collect pilot data in support of a new project or collaboration are often times hard to come by. The RI program fills that void. The resultant publications and presentations from the program also promote the quality and depth of research happening at Ohio's universities which help to attract quality students, faculty, and companies wanting to partner with those universities.

On one RI supported project, Ohio University, collaborating with Case Western Reserve and SOFCo-EFS, competed successfully for a role in the NASA Low Emissions Alternate Power (LEAP) project. The LEAP project identified solid oxide fuel cell (SOFCs) as a promising technology for aircraft and space propulsion and power sources. This collaborative effort brought all the essential capabilities together to conduct the experimental studies and computational modeling designed ultimately to optimize the performance of SOFCs operating on reformed aircraft fuels. A key element in the success of this $780,000 project was the synergy of combined expertise in fuel cell manufacturing; materials performance and characterization; and the thermodynamics of the combustion and reforming of sulfur-bearing hydrocarbon fuels.

The Voinovich Center at OU continues to expand its partnership with Battelle for Kids, the Ohio Department of Education, and faculty in our College of Education to collaborate on K-12 education research that examines links between educational leadership and student achievement. This initiative, combined with a science education partnership with the Physics department can address national competitiveness concerns such as those identified in the National Academy of Sciences Report, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. The Center recently completed research (funded by Battelle for Kids and the Appalachian New Economy Partnership) that investigated the impact of making value-added educational data available to a pilot group of Ohio public school districts. The Department of Education project will measure school leadership, implementation of the program statewide, and the impact on student achievement. This project also will provide graduate students with applied research opportunities. The research findings will have local, state, and national policy implications and contribute to the national prominence of the University. RI funds were used to pay for a portion of a high-end computer used to support the Center's K-12 education research initiatives. The dual

processor 64-bit computer was used to link, manipulate, and run statistics on very large data sets of student achievement scores. The statewide data sets were provided by the Ohio Department of Education as part of this joint project between the Voinovich Center and Battelle for Kids.

Shawnee State University

Shawnee State University has benefited in a number of ways from participation in the Research Incentive Program during the 2004 and 2005 fiscal years.

- Faculty have been involved in collaborative research and publication with colleagues at other Ohio institutions because of the funding.
- Ohio's international leadership in wetlands research has been enhanced through Shawnee's participation in the Olentangy River Wetland Research Park.
- Undergraduate students have been actively involved in research projects that would not have been available without the collaboration with other institutions.
- The attention to undergraduate research resulted in a fund raising effort by the President that yielded $25,000 to provide small grants to support student research projects.
- The availability of collaborative research funds was one factor in attracting a senior research faculty member to Shawnee State's new Occupational Therapy master's program.

A short summary and some highlights from two of the projects follow.

One SSU faculty member has worked with students collecting baseline data on the algae at the Olentangy River Wetland (ORW) Research Park at The Ohio State University. At this time, one student is working on a project to study the natural seed banks in the floodplains of the Olentangy River adjacent to ORW. Funding from Research Incentive has also allowed the faculty member to work with a student to study the effects of a major ice storm in 2003 on tree growth by examining tree ring patterns.

Another SSU faculty member has led a student research projects examining bacteria at ORW. Total bacteria and coliform levels have been measured and analyzed. The reduction of coliform bacteria as a result have water passing through the wetlands has also been examined. The results of this research have appeared in the annual report of the Olentangy River Wetland Research

Park and been presented at the annual meetings of the Ohio Academy of Science and Tri-Beta.

University of Toledo

During the 2004-06 biennium the University of Toledo used most of the Research Incentive funds to help attract new research oriented faculty who would strengthen the University's research focus, particularly those areas linked to the Third Frontier Program, and to fund multidisciplinary research.

One such example is Dr. Robert Collins, NEG Professor of Silicate and Materials Science, who was brought to UT in 2004 to build a nationally preeminent program in thin-film materials for photovoltaic electricity. In the relatively short time since his arrival, he has been involved in 33 pending or awarded grant submissions, which have resulted to date in 24 awards totaling $3,682,485 in sponsor awards. His research brings him into close collaboration with other universities and close collaboration with industry, as demonstrated by the strong industrial partners in the Wright Center of Innovation proposal he submitted (Pilkington, SSOE, Owens Corning, Solar Fields, Midwest Optoelectronics, Innovative Thin Films, Lake Shore Cryotronics, Decker Homes, Advanced Distributed Generation, Metamateria Partners, New Cyte, and Cornerstone Research Group). The primary focus of his research involves the development and application of polarized light spectroscopies based on ellipsometry and polarimetry to probe the optical properties of solids, surfaces, and thin films. Instrumentation development in his laboratory focuses on multichannel spectroscopic and imaging techniques that can be performed in real time during the fabrication and processing of materials. The material systems of interest include those used for thin film photovoltaics (such as amorphous and nano/microcrystalline silicon, transparent conductors, and polycrystalline CdTe) and those used for protective coatings (such as diamond, BN, and TiN). The goals of the research range from achieving a basic understanding of thin film growth and optical properties to improving industrial processes for photovoltaic thin films and other coatings.

Following an external review of proposals, a multidisciplinary award of $30,000 was awarded to a team of five investigators for "Design of Novel Nano- to Microscale Sensors for Biochemical Applications". Results from this seed grant led to the submission of the proposal to DARPA/DSO for $1,000,000. Word has been received from DARPA that the project will be funded. Positive outcomes to date include three publications, and a fourth

manuscript under review, as well as several presentations at international conferences. Scientific results:

- several new synthetic methods were investigated for immobilizing carbohydrates onto magnetic nanoparticles. The effects of linker length on immobilization efficiencies were also studied resulting in the discovery that a three carbon linker is sufficient to achieve high immobilization efficiency. This result forms the basis for the design of future studies.
- an electrochemical sensor that utilizes the enzyme methanol dehydrogenase was developed for the sensitive detection of trace levels of methanol.
- three new *o*-quinone electrocatalysts were evaluated for their ability to sensitively and selectively detect thiol containing compounds.

Wright State University

Sixty projects were awarded from Research Incentive funds during this biennium, totaling $1,492,521. Twenty of these were for promising new faculty hired in strategic areas for Wright State University. Awards averaged just under $24,000 and totaled $479,655, or 32% of the whole. Twenty-eight awards were made through the Early Start/Augmentation competition. This competition is conducted during the Fall Quarter and require investigators to have submitted a proposal for external funding with first year costs exceeding $40,000. Awards averaged over $18,000 and totaled $506,524, or 34% of the entire program. Six awards were made in the Major Collaboration competition. This competition is held in the Winter Quarter with the aim of helping teams of investigators (including investigators from other Ohio universities) to prepare significant external proposals on the order of NIH Program Project grants. Awards averaged just under $60,000, totaling $352,359 (24% of the whole). The Technology Commercialization competition is held in the Spring Quarter. This program is intended to expand the benefits of Wright State University research accomplishments through technology development leading to commercial application. Four awards were made, totaling almost $100,000 (7% of the whole).

One Research Incentive Program award supported a research project which generated preliminary results contributing to a successful application to the National Institutes of Health. The research proposal, *Regulation of Secretory Ion Channels in Colonic Crypts*, received 5 years of funding from the National Institute of Diabetes & Digestive & Kidney Diseases with an award totaling $1,227,000. Several reports of scientific findings have been published from research supported by the Research Challenge Program. The objective of this

research project is to determine the mechanisms regulating movements of chloride and potassium ions across the intestinal epithelium. Flow of these ions is central to the health of the intestine by driving the production of fluid that aids in digestion and in defense against invasion by microorganisms. By a regulated release of mucus, antibodies and other antibacterial agents the intestinal epithelium insures a continuity of operation during digestion. These epithelial flows can malfunction and contribute to serious symptoms and malignant outcomes in several diseases including cystic fibrosis, secretory diarrhea and inflammatory bowel diseases such as Crohn's disease and ulcerative colitis. This project will lead to greater insight into the regulatory controls for intestinal fluid and electrolyte flows that likely will aid development of therapeutic interventions for patients with life-threatening intestinal disease.

Youngstown State University

At Youngstown State University, during the '04-'05 Biennium, Research Incentive Funds were used to stimulate research activities in numerous ways. The major commitment was to continue support of the PACER (Presidential Academic Centers for Excellence in Research) Program. During this period six centers were supported:

- Center for Advanced Numerics, Complexity, and Networking
- Center for Biotechnology
- Center for Environmental Monitoring and Restoration
- Center for Hydraulics Research and Education
- Electromagnetic Field Research and Instrumentation Center (EFRIC)

These research centers are collaborative and interdisciplinary and focused on collaboration both within YSU and beyond, having received external grant support in most areas. Funding at these centers has been obtained from numerous sources both private and federal. Some of the funding (and supporting) agencies represented are: The American Chemical Society (Petroleum Research Fund), Research Corporation, the National Institutes of Health, Parker Hannifin Corporation, Advanced Imaging Research, Inc. of Cleveland, the EMC engineering team at Packard Electric Systems of Delphi Corporation, Internet provider cBoss, Inc., and the Youngstown Business Incubator The Hydraulics Lab is a collaboration between Youngstown State University and Parker Hannifin Corporation that aims to advance the study of hydraulics and pneumatics through interdisciplinary industrial research projects. The work to establish the EFRIC as part of the PACER Initiative also led to establishment an academic Partnership with Delphi Packard Electric

Systems and a Master Agreement which expedites research for the company through a purchase order process.

In all PACER centers, students are intimately involved in the research projects and these may be either graduate or undergraduate students depending upon the respective department. In many cases, students involved in industrial collaborations through PACER centers have been able to gain employment at the companies with who collaboration has taken place.

Finally, outside of these centers a number of general and specific projects have been undertaken in support of research development at YSU. Access to Internet 2 and provision of high end data bases for specific research groups are examples.