OHIO BOARD OF REGENTS

2003 HAYES INVESTMENT FUND COMPETITION

FINAL REPORT

Proposal Review Process

The process of soliciting and evaluating proposals for the Hayes Investment Fund Program was consistent with previous competitive review cycles for this research support program. Letters of intent to submit a preliminary proposal were requested to provide an assessment of the range of disciplinary areas that would be covered by the proposal submissions. Based upon that information, Regents' staff began the task of selecting external peer reviewers who could evaluate the preliminary proposals.

Forty-four preliminary proposals were received in response to the request for proposals issued on January 30, 2003. Owing to the wide range of science and technology disciplines represented by the proposals, a total of sixty-two external readers were engaged to review and evaluate these preliminary proposals. As in past years, each proposal was read by at least three external peer reviewers, who evaluated the proposals according to criteria that included the project's potential for achieving national excellence, the capabilities of the principal investigators, the potential for leveraging future support from federal and industrial sources, the potential to achieve the specified research goals, the advancement of basic research and education, and the demonstration of meaningful research collaboration among the partners. The detailed review criteria may be found in the request for proposals posted on the Regents' web page at:

http://www.regents.state.oh.us/rsch/03hayesrfp.pdf

Based upon the evaluations and rankings of the external readers, all of whom were leaders in their disciplinary areas who live and work outside of the State of Ohio, a total of thirty-two proposed projects were selected to move to the final proposal phase of the competition. An eight-person Hayes Investment Fund Review Panel, whose names and professional affiliations are given in the table below, was engaged to evaluate and rank the Hayes Investment Fund proposals. The members of the Panel were selected on the basis of their research expertise and their experience in directing diverse research programs that spanned multiple disciplines.

The Panel members were provided with copies of the final Hayes Investment Fund proposals, and they were also given the reviews from the disciplinary readers for the preliminary proposals. Each full proposal was read by all eight members of the Panel, and detailed written evaluations were provided by at least three of the Panel members. For this evaluation the Panel was instructed

to use not only the evaluation criteria employed by the readers of the preliminary proposals, but also to consider the relationship and consistency of each proposal with the goals and objectives of **The Third Frontier Project** including new and potential collaborations with the three newly funded **Wright Centers of Innovation** and, especially, using the new **Third Frontier Network**. As a result of this review and evaluation, a total of thirteen proposals were selected for the final phase of the competition, an oral presentation to the Hayes Investment Fund Review Panel in Columbus, Ohio on July 9, 2003. The questions and concerns of the Panel members were transmitted to the appropriate principal investigators to assist them in preparing for their oral presentations.

The Review Panel spent a full day, from 8:30 am until 5:45 pm, listening to and questioning the research teams of the thirteen finalists. They then met with Regents' staff to discuss each of the proposals in detail. After careful deliberation, the Panel recommended that each of the eight proposals listed in the table below be granted a 2003 Hayes Investment Fund award. The Board of Regents, at their meeting on July17, 2003 approved the recommendations of the Panel.

2003 Hayes Investment Fund Review Panel

Name	Discipline	Position	University
Robert Barnhill	Information Technology/Mathematics	Vice Chancellor for Research & Public Service	University of Kansas
Joan Lorden	Bioscience/Neuroscience	NSF-CGS Dean; Graduate Dean	University of Alabama, Birmingham
Daniel Masys	Information Technology/Medicine	Director, Biomedical Informatics	University of California, San Diego
Ronald Gibala	Materials Science & Engineering	Professor	University of Michigan
Ashok Saxena	Materials Science & Engineering	Regents Professor	Georgia Institute of Technology
Katherine Faber	Materials Science & Engineering	Professor and Chair	Northwestern University
David Walba	Chemistry	Professor	University of Colorado
Roger Chalkley	Bioscience/Molecular Physiology	Professor, School of Medicine	Vanderbilt University

2003 Hayes Investment Fund Awards

Research Consortium Members	Program	HIF Award
University of Cincinnati, Wright State University, Procter & Gamble Pharmaceuticals, Air Force Research Laboratory, and Acero.	Proteomics and Protein Characterization in the Post-Genome Era	**$1,000,000**
University of Cincinnati, Case Western Reserve University, University of Dayton, Air Force Research Laboratory, ThermoNicolet, First Nano, and Procter & Gamble	Nanoscale Hybrid Materials: Novel Synthesis, Characterization, and Applications	**$800,287**
Ohio State University, Ohio University, Wright State University, NASA Glenn Research Center, Air Force Research Laboratory, Battelle, and Lake Shore Cryotronics, Inc.	Ohio Nanoscale Patterning Consortium	**$2,000,000**
Ohio State University, University of Cincinnati, Wright State University, Air Force Research Laboratory, Knolls Atomic Power Laboratory, Alcan Technology & Management, Ford Motor Company, The Timken Company, and GE Aircraft Engines.	Center for the Accelerated Maturation of Materials	**$2,000,000**
Ohio State University, University of Akron, University of Dayton, Cleveland Clinic Foundation, Air Force Research Laboratory, Ashland Specialty Chemical Company,Applied Sciences, Inc., Owens Corning, Procter & Gamble, and Honda.	Consortium for Affordable Manufacturing of Polymers at the Nanoscale	**$2,000,000**
Ohio State University, Kent State University, University of Akron, University of Cincinnati, and NexTech Materials, Ltd.	Hydrogen Production and Storage Consortium	**$1,000,000**
Ohio State University, Kent State University, Case Western Reserve University, BTG International, Inc., DuPont Circleville, AlphaMicron, Inc., and Nanofilm.	Ohio Organic Semiconductor Consortium	**$1,000,000**
University of Toledo, Ohio State University, Case Western Reserve University, Cleveland State University, Cleveland Center for Structural Biology, Cleveland Clinic Foundation, and Anatrace.	Macromolecular Crystallography Consortium	**$1,181,600**
	HIF Award Total =	**$10,981,887**

Proteomics and Protein Characterization in the Post-Genome Era

Partners: ***University of Cincinnati,*** Wright State University, Procter & Gamble, Cincinnati Children's Hospital Research Foundation, WPAFB and Acero

Award Amount: $1,000,000

Project Summary

The recent completion of the Human Genome Project has forever changed the landscape for biomedical research. Information gleaned from the genome sequencing projects coupled with new technologies for studying global gene and protein expression profiles has empowered investigators with the tools that are needed for deciphering the fundamental genetic mechanisms that regulate normal physiological function and disease processes. UC has recently created a Genome Research Institute (GRI) for the purpose of establishing national leadership in post-genome research. The mission of the GRI is to establish a top-notch academic post-genome research program and in addition catalyze the state-wide initiative as delineated in the **Third Frontier Project** to develop a strong biotechnology industry in Ohio. However, the mass spectrometry instrumentation at the GRI is significantly below par for performing cutting-edge proteomics and protein characterization research; the current mass spectrometry capability being limited to a single instrument (MALDI) that is on loan from the College of Medicine at UC. The proposal requests funds from the Hayes program to purchase two complementary mass spectrometers (ELSI and MALDI) that will elevate their protein discovery and provide state-of-the-art protein characterization capabilities.

The review panel noted the following strengths of this proposal, based on review of submitted materials and the presentations made to the panel on July 9, 2003.

Strengths

- There was impressive demonstrated corporate involvement via an existing collaboration with Proctor & Gamble.
- It will be a major resource for the state, and will be freely available to other institutions.
- There is a well-trained individual to run the proposed facility.
- A forward-looking graduate training program was presented.
- The three areas of diabetes, obesity and atherosclerosis research are important life science areas.

Nanoscale Hybrid Materials: Novel Synthesis, Characterization, and Applications

Partners: ***University of Cincinnati***, Case Western Reserve University, University of Dayton, Procter & Gamble, FirstNano, Inc., ThermoNicolet Corp, and WPAFB

Award Amount: $800,287

Project Summary

Investment Funds will be used to acquire or construct five major instrument systems that will be used for the synthesis or characterization of nanoscale materials. They include a unique vertically-oriented nanofurnace for the preparation of single wall carbon nanotubes with much greater length than is currently possible, a novel nanomaterials synthesis system in which pulsed laser ablation and plasma polymerization are combined to prepare nanoparticles and incorporate them directly into plasma polymerized films, a unique scanning probe microscope/Fourier-transform infrared spectrometer that will be used to simultaneously determine the morphology, properties, and composition of materials on a nanometer scale, an electron paramagnetic spectrometer that will be used to determine the structure of channel proteins that provide a gating mechanism to active synthetic membranes that are supported by nanoporous films, and a Raman spectrometer that will be used in novel experiments to determine the structure of individual carbon nanotubes. An educational program that has student training as its main objective will complement the research efforts. Courses will be presented simultaneously at all three universities using video conferencing capability of the **Third Frontier Network.**

The review panel noted the following strengths of this proposal, based on review of submitted materials and the presentations made to the panel on July 9, 2003.

Strengths

- The collaborations discussed in the proposal among university and corporate partners already exist.
- A novel instrument design incorporating both atomic force spectroscopy and Fourier-transformed infrared (ATM/FTIR) was presented.
- The proposed educational program takes advantage of the high bandwidth of the **Third Frontier Network**, and the consortium members already have experience with remote experimentation control via the Internet for NMR instruments.
- Explicit benefits for the State of Ohio were presented.
- A large number of patents were described which demonstrated prior productivity.

Ohio Nanoscale Patterning Consortium

Partners: *Ohio State University*, Ohio University, Wright State University, WPAFB, NASA, Battelle, and Lake Shore Cryotronics Inc.

Award Amount: $2,000,000

Project Summary

In the words of the proposers, "the Ohio Nanoscale Patterning Consortium is an eclectic blend of academicians, corporate researchers and federal government laboratory personnel scattered around the State of Ohio with the unifying need for enhanced capability to pattern and therefore manipulate matter at the nanometer scale dimension."

The key equipment requested is an electron beam lithography (EBL) system capable of spot sizes down to 8 nanometers. The instrument can directly write patterns onto surfaces of a variety of specimens, or be used to create a master for replication later using any one of traditional patterning techniques, such as standard photolithography, stamping, molding etc., but with the aide of using a master that has nanometer resolution. The type of material that can be patterned is virtually material independent granted that it is compatible with a vacuum environment, and even then, encapsulation techniques could be employed to overcome this hurdle. Also, two scanning electron microscopes (SEM) are requested. One will be housed adjacent to the EBL system to facilitate easy inspection of the patterned materials. Ohio University will house the second SEM, also for inspections, but also for limited patterning capability with a relaxed parameter set. Renovation costs are also budgeted to ensure the proper environment for the EBL system. A full-time EBL engineer is cost shared by Ohio State in a graduated scale over the first 4 years of operation. Thereafter, it is proposed that the base of users and user fees will secure the Center's continued

The review panel noted the following strengths of this proposal, based on review of submitted materials and the presentations made to the panel on July 9, 2003.

Strengths

- The principal investigator and co-investigators have substantial federal funding, and the proposed project would further improve competitiveness for future research awards.
- Educational impact was demonstrated by the track record of the Semiconductor Epitaxy & Analysis Lab which included activities involving 36 students.
- Corporate endorsement of the proposal by LakeShore Cryotronics Inc. was demonstrated.
- The proposal included a viable cost-sharing plan using University contributions for a Ph.D. level engineer to serve as facility manager.

Center for the Accelerated Maturation of Materials

Partners: *Ohio State University,* University of Cincinnati, Wright State University, WPAFB, Knolls Atomic Power Laboratory, Alcan Technology & Management, Ford Motor Company, The Timken Company, and GE Aircraft Engines

Award Amount: $2,000,000

Summary

This proposal is for equipment for the implementation of the goals of the Center for the Accelerated Maturation of Materials (CAMM). The consortium consists of researchers from OSU, UC, and WSU. These researchers join a collaborative group of partners, including academics from five universities, which are the University of California (Berkeley), Northwestern University, Princeton University, Stanford University, and the University of Wisconsin (Madison). In addition, there is interaction with several national laboratories, including the Air Force Research Laboratory (AFRL) and Knolls Atomic Power Laboratory (KAPL), as well as a large group of partnering companies.

The equipment requested in this proposal consists of hardware and firmware required for a software engineering and remote access laboratory and classroom, software tools development, equipment for mechanistic determinations – nano-indentor/micro-scale deformation tester, equipment for a combinatorial methods laboratory (micro-scale thermo-mechanical simulator), equipment for, and renovations of, a mechanical testing suite, equipment for advanced materials characterization (UC), and software engineering and remote access module (WSU). The equipment requested is based on the need for better environmental control for materials testing and includes renovations

The review panel noted the following strengths of this proposal, based on review of submitted materials and the presentations made to the panel on July 9, 2003.

Strengths

- 20 current industrial partners were identified.
- The team includes computer science collaborators for visualization-related research and development
- There was demonstrated extraordinary leverage of prior Hayes funding
- The proposal has high relevance for Ohio-based industries.

Consortium for Affordable Manufacturing of Polymers and Composites at the Nanoscale

Partners: ***Ohio State University, University*** of Akron, University of Dayton, Cleveland Clinic Foundation, WPAFB, Ashland Specialty Chemical Company, Applied Sciences, Inc., Owens Corning, Procter & Gamble, and Honda.

Award Amount: $2,000,000

Summary

Nano-,bio-, and information technologies are the three major science and technology fields in the coming decades. Demand has been growing rapidly for products with nanoscale features and functions for industrial, information, biomedical, and environmental applications. However, the development of nanotechnology lags far behind bio- and information technologies. This proposal requests funds for an interdisciplinary consortium to address the problems of manufacturing affordable polymers and composites at the nanoscale. The consortium will have a broad-based research, education, and outreach programs, centered at OSU with satellite facilities at the University of Akron (synthesis of functional polymers) and University of Dayton (characterization of nanocomposites). Collaborators include more than ten companies, WPAFB, and the Cleveland Clinic Foundation.

The proposal requests equipment at OSU including an injection molding system for nanostructures, a nano-imprinting machine, super critical fluid based molding and a bonding system, laser/proximal probe enhanced solid freeform fabrication system, and micro-milling machine. Also requested are a nanocomposite synthesis and compounding system at UA, AFR-STM and thermal scanning microscope at UD.

The review panel noted the following strengths of this proposal, based on review of submitted materials and the presentations made to the panel on July 9, 2003.

Strengths

- This is an interdisciplinary and multisite project with several industrial collaborators
- The proposed project would further strengthen competitiveness for the pending application for an NSF Nano- Science and Engineering Center.
- The proposers have participated successfully in a NSF Integrative Graduate Education and Research Training (IGERT) award.
- The proposal includes a strong component of technology transfer.
- The equipment request was well justified.

Hydrogen Production and Storage Consortium

Partners: *Ohio State University,* Kent State University, University of Akron, University of Cincinnati and NexTech Materials, Ltd.

Award Amount: $1,000,000

Summary

Hydrogen economy for fueling sustainable development is beginning to emerge as the central theme for global energy needs in the 21st century. Concerns about urban air pollution, climate change, and dependable energy are responsible for the push towards a hydrogen economy. Hydrogen is the simplest and most abundant element in the universe, but deriving it as a fuel form from hydrogenous sources requires research and development. In addition, safe storage and transport of hydrogen is required to build the hydrogen infrastructure.

Colleagues from The Ohio State University, University of Cincinnati, Kent State University, University of Akron, and NexTech Materials, Ltd have formed the Hydrogen Production and Storage Consortium (HPSC) to address fundamental issues on production of H2 from coal with carbon sequestration, photochemical generation of H2 from water and development of novel materials for H2 storage.

Funding requested in this grant is to establish the infrastructure for making measurements that will facilitate a better understanding of issues related to H2 production and storage. The equipment can roughly be divided into four categories Materials Analysis, Catalysis studies, Membrane evaluation, and Spectroscopic Analysis. It includes a Gravimetric analyzer at Kent State University, a water gas shift reactor at the University of Cincinnati, a Porous Membrane Separator at Ohio State, and a Picosecond Spectrometer at Ohio State University and a Stepscan FTIR at the University of Akron.

The review panel noted the following strengths of this proposal, based on review of submitted materials and the presentations made to the panel on July 9, 2003.

Strengths

- The research area is an area of substantial government interest, suggesting that this award would leverage future research funding
- The proposal includes a relatively unique scientific approach in the use of membranes to facilitate key chemical reactions and the synthesis of catalysts.
- The proposal included multiple disciplines organized around a scientific challenge, where each group offers important and complementary expertise.
- A corporate partner (NexTech) was part of the proposal.

Ohio Organic Semiconductor Consortium (OOSC)

Award Amount: $ 1,000,000

Partners: *Ohio State University,* Case Western Reserve University, Kent State University, BTG International, Inc., DuPont Circleville, AlphaMicron, Inc., and Nanofilm.

Summary

The interdisciplinary OOSC, centered at OSU, KSU and CWRU, was assembled to exploit novel organic semiconductors/conductors for key scientific, educational and technology goals. OOSC builds on the successes of its prior Hayes award, recent federal awards for the study of novel organic semiconductors, and a recent organic semiconductor technology transfer activity. This award puts in place additional essential infrastructure for sustained future success. The new facilities will address needs for better materials synthesis, improved device structure fabrication, and quality materials/device characterization for education and organic semiconductor technology development. Specifically, facilities are sought to prepare state-of-the-art pure organic semiconductor materials, characterize them, and process the materials into multilayer films for scientific and device studies. The proposal requests a Chemical Vapor Deposition R&D System, sputtering system, confocal optical profilometer, SIMS, evaporator, gloveboxes, spin coater, spectrophotometer, semiconductor parameter analyzer, digital signal processing lock-in amplifier, impedance analyzer, microwave reactor, liquid and gas chromatographs, laser systems, digital refractometer/polarimeter, monochromator and source, potentiostat, UV-Vis-NIR spectrophotometer, thermogravimetric analyzer, and atomic force microscope.

The review panel noted the following strengths of this proposal, based on review of submitted materials and the presentations made to the panel on July 9, 2003.

Strengths

- Satisfactory progress was described for use of funds received in the last Hayes program
- The proposal was well written, from a strong group of principal investigators with a strong track record of intercampus collaborative work.
- Involvement by students in the project was demonstrated.
- Technology transfer was well demonstrated.

Macromolecular Crystallography Consortium

Partners: ***University of Toledo***, Ohio State University, Case Western Reserve University, Cleveland State University, Cleveland Center for Structural Biology, Cleveland Clinic Foundation, and Anatrace.

Project Award: $1,181,600

Summary

Completion of the human genome sequence presents the even more difficult challenge of assigning a function to each protein encoded by the genome. The function of each protein depends on its three dimensional structure, and X-ray diffraction is the most powerful method available to determine protein structures. This proposal seeks funding for the modernization and expansion of the X-ray facilities at participating Consortium Universities and for the development of a protein crystallization center. The proposers are establishing regional research facilities that will encourage access to investigators from Ohio universities and companies, and will make crystallography more accessible to the research community in the State of Ohio. The goal of the Consortium is to use the requested facilities to solve the structures of a diverse set of targeted proteins that will enable the investigators to understand their roles in metabolism, cellular signaling, and the transmission of genetic information. An equally important goal is the training of the next generation of macromolecular crystallographers who will shape the future of this scientific field.

The requested funds will be used to add a new port to existing diffractometer, and buy a new machine that includes a Home Lab Light Source equivalent to 2nd generation synchrotrons.

The review panel noted the following strengths of this proposal, based on review of submitted materials and the presentations made to the panel on July 9, 2003.

Strengths

- Examples of industrial collaborations were provided with Pfizer and Anatrace.
- The educational component was addressed by consortium crystallographers who have 44 current students, and more than 40 previous graduate and postdocs; there 4 courses on various aspects of crystallography at the University of Toledo.
- The proposed resource will be widely available within the state.
- Leverage of a 1995 Hayes award was demonstrated.
- The proposed equipment would eliminate the need for using the Advanced Photon Source for screening experiments.
- The University of Toledo matching funds were generous.