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News & Events

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R.I. Invests \$1.5M in Collaborative Research; 32 Scientists, 15 Institutions Receive Funding for Collaborative Projects

STAC Announces First Round Recipients for its Rhode Island Research Alliance Collaborative Research Award Program.

Rhode Island Steps Up R&D Game with Competitive Research Awards

The Rhode Island Science and Technology Advisory Council (STAC) today announced the first round of recipients for its Rhode Island Research Alliance Collaborative Research Award program. The awards will provide direct support to 32 scientists from 15 research organizations across Rhode Island. The program is part of a \$1.5 million effort to grow R&D capacity in the state, address critical problems of Rhode Islanders, and spur economic development.

Winners of this inaugural competitive award program include academic and industry scientists pursuing projects in medicine, engineering, chemistry, biology, oceanography and environmental science. Priority was given to high-impact projects that are collaborative across Rhode Island institutions and well positioned to receive follow-on funding, particularly from federal agencies. Those with significant technology development and commercialization potential were also encouraged.

Awardees include:

- A project to use virtual reality to improve the design of prosthetic limbs,
- An effort to understand how radiation therapy causes permanent injury in patients with testicular cancer and develop less harmful treatments,
- The development of high-tech toys to aid children with diseases like cerebral palsy,
- The acquisition of equipment that enables Rhode Island scientists to better study proteins and their role in disease,
- An effort to modify plant fibers to enhance their commercial value and use in products such as biofuels,
- The development of new marine-based drugs to fight a common and deadly hospital infection,
- A project to develop computer software to identify materials found in fire debris that can be used to improve forensic investigations,
- And, an academic-industry partnership to showcase how multiple types of robotic or autonomous underwater vehicles (AUVs) can be integrated for real-time ocean observation and analysis.

Winning teams include scientists from Afferent Corporation, Applied Science Associates, Inc., Bay Computer Associates, Brown University, Hasbro Children's Hospital, Ion Signature Technology, Providence VA Medical Center, Rhode Island College, Rhode Island Hospital, Rhode Island School of Design, Rhode Island State Crime Lab, Salve Regina University, SubChem Systems, WET Labs, Inc., and the University of Rhode Island.

“Whether it’s using virtual reality to improve the design of prosthetic limbs, whether it’s developing high-tech toys to assist children with diseases like diabetes, or whether it’s modifying plant fibers to enhance their use in products such as biofuels, these projects will enhance the quality of life in our state and in our nation,” stated Rhode Island Governor Donald L. Carcieri. “This is about supporting world-class research. It’s about investing in an innovation economy and growing higher wage jobs for Rhode Islanders.”

STAC has recommended that funding for the program be continued in 2007.

Background and Award Process

In 2006, STAC urged state lawmakers to advance the state’s research and development platform by promoting collaboration across the state’s research institutions. In response to this recommendation, Governor Carcieri recommended and the General Assembly approved \$1,500,000 in state funding to create the Rhode Island Research Alliance and directly fund collaborative research projects across the state’s academic and commercial research organizations.

“With the legislative action last year, we took a great step forward as a state, providing our leaders with an agenda for the 21st century workplace driven by science and technology,” stated House Majority Leader Gordon D. Fox. “With the award of these grants, we take another step forward. Rhode Island is helping to pave that path to a brighter future for all our citizens in the fields of science and technology.”

To administer the Collaborative Research Award program, STAC adopted a competitive application process similar to that used by the National Science Foundation. Applications were evaluated by peer reviewers—scientific experts familiar with a proposal’s area of focus—and a subcommittee of STAC members appointed by STAC co-chairs Jeff Seemann and Clyde Briant.

Rhode Island’s research community showed great enthusiasm for the program. STAC received 45 proposals requesting a total of more than \$7.1 million in support from researchers at eight Rhode Island higher education institutions, six hospitals and 17 private companies.

Senator William A. Walaska, Chairman of the Senate Corporations Committee and Senate sponsor of the package of STAC legislation promoting investments in research and development in the 2006 legislative session, observed, “Our investment in science and technology is becoming more and more important as we shift to a knowledge-based economy. It plays a critical role in our ability to attract good jobs to Rhode Island. By the same token, the availability of these job opportunities helps to keep an educated, talented workforce in the state.”

"The subcommittee making the awards selection reported that they found it very difficult to choose a small group of winners from such an extraordinary pool of applicants," says STAC co-chair and Brown University Vice President for Research Clyde Briant. "Although STAC could not fund every worthy project, the group succeeded in our goal to use this initial round of funding to support collaboration across Rhode Island’s institutions and across disciplines. The success of this award program represents an important step forward in Rhode Island’s effort to support world class research.”

About the Winners

Project 1: Virtual Immersive Environments and Motion Analysis for Advanced Rehabilitation

This project will apply virtual reality technology to improve the design of prosthetic limbs.

Collaborators:

Roy K. Aaron, Principal Investigator, Brown University

Deborah McK. Ciombor, Providence VA Medical Center,
Samuel Fulcomer, Brown University

Summary:

With Research Alliance support, this team will expand their work to understand human movement and the design of artificial limbs. The team will use Research Alliance funding to integrate virtual reality technology with existing methods of motion analysis to create prosthetic limbs that more closely simulate normal human movement.

To conduct this research, the team will use a specialized treadmill and motion platform and 3D video projection to create a virtual environment in which scientists can analyze the gait of amputees in a realistic movement scenario. The system places a patient on a hydraulic motion platform and projects a virtual environment on screens around the platform in which the patient “moves.” The team can then monitor exact body position and changes in limb articulations.

Insights gleaned from this process can be immediately applied to design artificial limbs that react to a person’s actual skeletal and muscular movements.

Project 2: In vivo and in vitro targeting of the Akt1 and p53 signaling networks in testicular cancer

This project will help doctors better understand how radiation therapy causes permanent damage in patients with testicular cancer.

Collaborators:

Dr. Mary Hixon, Principal Investigator, Brown University (RI-INBRE Investigator)
Dr. Eric Hall, Rhode Island College (RI-INBRE Investigator)
Dr. Sarah Spinette, Rhode Island College (RI-INBRE Investigator)

Summary:

Testicular cancer is the most common cancer affecting young males. Current treatments for testicular cancer include radiation and chemotherapy. These treatments are often very successful but lead to permanent testicular injury and infertility.

This team will use Research Alliance funding to advance their efforts to understand how these therapies cause permanent injury. The objective is to contribute to the development of new treatments which could protect such patients from lasting dysfunction while eliminating the cancer and allowing a full and productive life.

The team is currently investigating a set of genes and cell signaling molecules thought to play a role in radiation-induced damaged to a patient’s gonads. Funds will be used to support these investigations.

Project 3: Toys and Technologies for Rehabilitation

This project will develop high-tech toys to assist in the rehabilitation of children with diseases like cerebral palsy.

Collaborators:

Dr. Joseph Crisco, Principal Investigator, Brown University
Dr. Karen Kerman, Hasbro Children’s Hospital
Dr. Susan D’Andrea, Afferent Corporation
Dr. Khipra Nichols, Rhode Island School of Design
Dr. Dave Durfee, Bay Computer Associates, Inc.

Summary:

Brain injury, cerebral palsy and other neurological conditions create profound movement disorders in children, often leading to impaired use of arms. Rehabilitation with physical therapy is critical for recovery. Most current rehabilitation does not capitalize on the primary learning avenue for children: playing.

The premise of this project is that increased therapy in the form of play, targeted to the affected muscle groups, with the possibility of neurofeedback, will improve recovery in children with neuromuscular conditions.

Using Research Alliance funding, this team will design and develop toys that incorporate rehabilitation technologies to encourage the use of affected muscles. In addition these “toy-based technologies” will record play activity to allow clinicians and therapists to track a patient’s progress.

In year one of this project, the team will design and develop a prototype toy line that incorporates state of the art technologies, evaluate their use in clinical studies, and collect pilot data critical to obtaining federal funding.

Toy development will build upon work currently being done in the Toys for Rehabilitation Studio course at RISD and Brown taught by Drs. Nichols, Crisco and Dr. Kerman. Toy development includes collaboration with Meeting Street School, Hasbro Children's Hospital Physical Therapy (PT) and Occupational Therapy (OT) Departments, and potentially Hasbro Toy Company. The team will also incorporate Afferent Corporation’s neurotherapeutic sensory enhancement technology (SET) into the new line of toys. Afferent's technology dramatically increases the flow of sensory information traveling from muscles, joints, and skin to the body’s control centers.

The technologies developed through this project have the potential to substantially improve rehabilitation therapies in children and enhance the quality of life, self care, and independence of children with disabilities. The commercialization of these toys also has great commercialization potential.

Project 4: Acquisition of an electro-spray injected tandem mass spectrometer devoted to proteomics research support as a critical component of the Rhode Island Center for Proteomics

This award will fund the purchase of equipment to enable Rhode Island scientists to better study proteins and their role in disease.

Collaborators:

Dr. Edward Hawrot, Brown University

Dr. Wolfgang Peti, Brown University

Dr. David Rowley, University of Rhode Island (RI-INBRE Summer Undergraduate Research Program Coordinator)

Dr. Alison Shakarian, Salve Regina University (RI-INBRE Investigator)

Dr. Karen Almeida, Rhode Island College (RI-INBRE Investigator)

The NSF EPSCoR Rhode Island Center for Proteomics aims to support investigators pursuing proteomics research and provide them access to instrumentation required for the study of proteins, considered by biologists to be the building blocks of life.

In recent years, mass spectrometry has been the major workhorse for protein investigation, especially as it relates to disease. Today, Rhode Island researchers face great difficulty in accessing this critical equipment.

With this award, five researchers based in four EPSCoR-supported institutions of higher education will acquire an electrospray injected tandem mass spectrometer, a spectrometer ideally suited for protein identification and characterization. The equipment will be centrally housed and maintained within the NSF EPSCoR Rhode Island

Center for Proteomics at 70 Ship Street in Providence.

This core resource will play a key role in enhancing the research competitiveness of scientists across the state.

Project 5: Improving Cellulose Microfibril Properties in Plant Fibers through Genetic Engineering

This project will advance efforts to modify plant fibers and enhance their commercial value for use in products such as biofuels.

Collaborators:

Dr. Eric Roberts, Principal Investigator, Rhode Island College

Dr. Alison Roberts, University of Rhode Island

Summary:

This project lays the groundwork for modifying plant fibers, such as those produced by trees for pulp or cotton, to improve their physical properties and enhance their commercial value.

Cellulose is the fibrous component of plant cell walls and the major constituent of commercial plant fibers. The commercial uses of plant fibers depend on their physical properties, such as absorbency and tensile strength, factors that depend on the structure of their fibers. There is little natural variation in the structure of the cellulose fibers found in the plant species most commonly use for commercial purposes. Current efforts to modify the physical properties of plant fibers rely on chemical modification.

In contrast, the cellulose fibers found in species of algae vary widely in structure and physical properties. Work funded through this project will evaluate the genetic basis of fiber structure in pursuit of creating commercial fiber species that produce fibers with altered structure and commercially beneficial properties.

Because plant cell walls are an important potential source of biofuels, this project will also support statewide efforts to obtain federal funding for renewable energy-related research.

Project 6: Prevention of Bacterial Colonization and Virulence

This project seeks to develop new marine-based drugs to fight *Staphylococcus aureus*, a common and deadly hospital infection.

Collaborators:

Dr. Kerry LaPlante, Principal Investigator, Veterans Affairs Medical Center and University of Rhode Island (RI-INBRE Investigator)

Dr. Leonard Mermel, Rhode Island Hospital and Brown Medical School

Dr. David Rowley, University of Rhode Island (RI-INBRE Summer Undergraduate Research Program Coordinator)

Summary:

The bacterium *Staphylococcus aureus* is the leading cause of hospital infections in the United States. This pathogen is endemic to our hospitals and has developed resistance to nearly every clinical antibiotic. Hospitalized patients who have openings from intravenous catheters, ventilators and surgical wounds are extremely vulnerable to staphylococcal infections due to its ability to rapidly invade human tissue.

It is estimated that up to 20,000 deaths occur yearly in the United States due to infections, with associated hospital costs ranging from \$296 million to \$2.3 billion dollars annually. In response to the unmet need for new therapeutics to fight these infections, a unique collaboration will be established between Rhode Island biomedical scientists and clinical

researchers to discover molecules that attenuate virulence in *S. aureus*. The development of new drugs represents a novel strategy to halt bacterial colonization of medical devices and to treat systemic infections. No such agents are currently clinically available.

Research Alliance funds will be used to help the team test for marine products that fight *S. aureus*. Funding for this project will take a first step toward creating an “ocean-to-bedside” network of scientists in Rhode Island to develop unique marine molecules into novel therapeutics. Success in this venture will catalyze further interdisciplinary collaborations in drug discovery and development. This project, therefore, demonstrates significant potential to create new commercial opportunities.

Project 7: Development of novel computer software to analyze mass spectral output and identify target compounds used in forensic investigations

This project will work to develop computer software to identify materials found in fire debris that can be used to improve forensic investigations.

Collaborators:

Dr. Dennis Hilliard, Rhode Island State Crime Lab
Dr. Amy Duhaime, Rhode Island State Crime Lab
Dr. Robert Buco, Ion Signature Technology

Summary:

This team will use Research Alliance funding to design, develop, and prove that novel computer software can untangle the mass spectral output from a complex mixture of fire debris and unambiguously identify target compounds used in forensic investigations.

The ability to identify compounds with confidence is critical in identifying accelerants and the role they played in causing a fire. The proposed new data analysis software is based on mathematical algorithms that have been patented and proven for the analysis of environmental samples.

This team intends to create novel computer software to aid fire debris analysts in the forensic analysis of evidentiary material by gas chromatography with mass selective detection (GC/MS). The software will be designed in accordance with specifications set by analysts at the Rhode Island State Crime Lab, as well as verified and tested by analysts against samples in real-world cases analyzed by conventional data analysis software.

The team is also hopeful that the new software will also be used to detect hazardous compounds such as pesticides in food and beverage, toxins in pharmaceuticals, as well as key components in the manufacturing and quality control of chemical and petroleum samples.

When completed, the researchers intend to make the information generally available to the fire debris analysis and forensic science community by presentation of the work at major regional and national conferences as well as submitted publications to popular forensic journals. In addition, IST intends to market the software as a commercial product to crime laboratories at the private, state and federal level across the country and, develop industry-specific applications for other markets as well.

Project 8: An Undersea Sensor and Communication Network for Real-Time Coastal Observation and Analysis

This academic-industry partnership will demonstrate how multiple types of robotic or autonomous underwater vehicles (AUVs) can be integrated for real-time ocean observation and analysis.

Collaborators:

Dr. Alfred Hanson, Principal Investigator, SubChem Systems, Inc.

Dr. Andrew Barnard, WET Labs, Inc.
Dr. Matt Ward, Applied Science Associates, Inc.
Dr. Scott Veitch, SubChem Systems, Inc.
Dr. Eugene Morin, SubChem Systems, Inc.
Dr. Casey Moore, WET Labs, Inc.
Dr. Eoin Howlett, Applied Science Associates, Inc.
Dr. Percy Donaghay, University of Rhode Island

Summary:

This project will use a joint academic-industry partnership to demonstrate how multiple types of robotic or autonomous underwater vehicles (AUVs) with multi-sensor payloads and smart sampling systems can be integrated in use for real-time coastal observations and analysis.

This partnership combines key commercial systems providers located in Rhode Island with academic researchers at the University of Rhode Island's Graduate School of Oceanography in a collaborative partnership to demonstrate the utility and feasibility of operating a fully distributed, real-time ocean observation system within Narragansett Bay.

This network will allow the team to access data from these systems in real-time, modify sampling and operating instructions in real-time, and allow different types of autonomous systems to communicate with each other. The real-time wireless underwater sensor network will be interfaced with COASTMAP, a globally re-locatable, integrated system for real time monitoring, modeling and data distribution for shelf, coastal sea and estuarine waters, for rapid data processing, display, analysis, archiving and distribution to end users.

With Research Alliance funding, the collaborators will extend the application of COASTMAP to allow for the collection, fusion, display, and analysis of data from underwater sensing systems including both stationary and those mounted on a wide variety of oceanographic sampling platforms. The real-time coastal observation system and integrated technologies will be demonstrated in Narragansett Bay and used to investigate recurrent oxygen-depletion events that have resulted in fish and shellfish kills during the summer months.

This proposed project will also allow the industry partners to effectively collaborate on the integration of their respective commercial products into a new commercial system for continuous real-time coastal ocean observation. The project will allow URI to continue to provide unique opportunities for researchers and students in the oceanography and ocean engineering disciplines to conduct research with contemporary autonomous sampling platforms, sensors, networking and data management and informational technologies.

Next Steps

Rhode Island is especially well positioned to capitalize on research endeavors that build on current momentum and create stronger connections across the state's public and private research institutions.

STAC's Rhode Island Research Alliance is well positioned to continue this important work. A strong collaborative research alliance will create a powerful platform for consolidating limited resources towards a common agenda, maximizing the effect of the state's research investment, strengthening Rhode Island's ability to compete for additional federal research dollars, and creating opportunities for new companies and jobs.

STAC recommends that Rhode Island's leadership support STAC's Research Alliance and its direct investment in collaborative research by renewing the Alliance's \$1.5 million in funding in FY08.

The Research Alliance will again award these funds through a competitive review process to projects that are of

significant scientific merit, highly collaborative across institutional boundaries, well positioned to secure additional funding, and have significant technology development and/or commercialization potential.