2009-2010 Annual Report to the
Alabama Commission on
Higher Education

Alabama EPSCoR
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Alabama EPSCoR was very successful in the last year, and secured more than $12 million dollars in new federal research funding during CY 2009. Federally funded research expenditures for the same period exceeded $17 million. Awards were received from the National Science Foundation, U.S. Department of Energy, National Aeronautics and Space Administration, and the U.S. Department of Agriculture. These awards range in duration from one to six years and employ numerous researchers, graduate students, and undergraduate students. In addition, large numbers of K-12 teachers and students are involved in Alabama EPSCoR K-12 outreach activities. A special emphasis is placed on outreach and collaborations with underrepresented groups to encourage involvement and knowledge in STEM (Science, Technology, Engineering and Mathematics) fields.

The Alabama EPSCoR (Experimental Program to Stimulate Competitive Research) program is dedicated to the advancement of economic development via scientific and engineering research through a collaborative effort among the State’s research universities. The focus of activities is designed to attract and retain distinguished scientists and researchers for Alabama; to develop new cutting-edge technologies and high-tech industry; and to stimulate state competitiveness in medicine, biotechnology, engineering, and other applied sciences.

The Alabama EPSCoR Steering Committee (AESC) was saddened at the loss of one of our members in April 2010. Mr. Dave Echols was the Senior Project Manager for the Alabama Development Office and served as Chair of the Alabama EPSCoR Steering Committee from April 2004 to March 2006. During his tenure, the AESC and Alabama Commission on Higher Education became more attuned to the imperative for collaboration between research and business. His commitment to this purpose led to the appointment to the AESC of a representative from the Alabama State Senate, Senator Steve French. This appointment had a profound and long term impact, the establishment of the Graduate Research Scholars Program, which has funded more than 130 exceptional Alabama graduate students as of November 2010.

The Alabama EPSCoR program continues to be a valuable contributor to scientific and engineering infrastructure, research capabilities, education, and economic development across the state. We look forward to continued investment for a stronger, more prosperous Alabama.

Respectfully submitted by,

Alabama EPSCoR

Richard Marchase, Ph.D.  Chris Lawson, Ph.D.
Chair, Alabama EPSCoR Steering Committee  Executive Director, Alabama EPSCoR
Activities sponsored by the Alabama EPSCoR affect, in some manner, the economy of every county in Alabama and the lives of Alabama citizens in many ways including: education, health care, and employment.

Current activity details can be found in the following report.

To build, maintain, and grow Alabama EPSCoR is to build, maintain, and grow Alabama’s future.

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2009 Notable Achievements

- new federal awards exceeded $12 million in CY 2009;
- active EPSCoR related grants totaled $17M in expenditures in CY 2009;
- continuation of the Graduate Research Scholars Program (GRSP); support of 39 graduate students during Round 5
- the graduation of a NASA Seed Grant researcher to recipient of a NASA Cooperative Agreement Notice (CAN Award);
- two NASA CAN awards received by Alabama NASA EPSCoR;
- Alabama DOE EPSCoR awarded an Implementation Award;
- submission of two large NSF proposals to enhance Alabama’s cyberinfrastructure.
2.1 Experimental Program to Stimulate Competitive Research

EPSCoR Mission, Goals and Objectives

EPSCoR began at NSF in 1978, when Congress authorized the agency to create EPSCoR in response to broad public concerns about the extent of geographical concentration of federal funding of research and development (R&D). Eligibility for EPSCoR participation was limited to those jurisdictions that have historically received lesser amounts of federal R&D funding and have demonstrated a commitment to develop their research bases and to improve the quality of science, technology, and engineering research conducted at their universities and colleges.

The success of the NSF EPSCoR programs during the 1980s subsequently prompted the creation of EPSCoR and EPSCoR-like programs in six other federal agencies: the Department of Energy (DOE), the Department of Defense (DOD), the U.S. Department of Agriculture (USDA), the National Aeronautics and Space Administration (NASA), the National Institutes of Health (NIH), and the Environmental Protection Agency (EPA).

The mission of EPSCoR was originally designed to meet the NSF’s statutory function “to strengthen research and education in science and engineering throughout the United States and to avoid undue concentration of such research and education”. Since that time, EPSCoR has evolved to serve other federal agency programs including those listed herein. Alabama EPSCoR is currently eligible to participate in EPSCoR programs associated with NSF, DOE, NASA, USDA, and EPA. Alabama EPSCoR is currently ineligible for participation in the EPSCoR programs associated with the NIH and the DOD because state funding from these agencies exceeds the required minimum for qualification.

EPSCoR goals: to provide strategic programs and opportunities for EPSCoR participants that stimulate sustainable improvements in their R&D capacity and competitiveness; and to advance science and engineering capabilities in EPSCoR jurisdictions for discovery, innovation, and overall knowledge-based prosperity.

EPSCoR objectives:

- to catalyze key research themes and related activities within and among EPSCoR jurisdictions that empower knowledge generation, dissemination, and application;
- to activate effective jurisdictional and regional collaborations among academic, government, and private sector stakeholders that advance scientific research, promote innovation, and provide multiple societal benefits;
- to broaden participation in science and engineering by institutions, organizations, and people within and among EPSCoR jurisdictions;
- to use EPSCoR for development, implementation, and evaluation of future programmatic experiments that motivate positive change and progression.

2009 Program Status

NSF EPSCoR: During 2009, proposals for two major cyberinfrastructure proposals were submitted to NSF, and these proposals were awarded in 2010 for a total of $2.9M. NSF EPSCoR involved over 233 core participants and NSF EPSCoR outreach programs reached another 1300 participants, which surpassed our diversity involvement goals. NSF EPSCoR Co-funding in 2009 led to a total of $8M of new awards being brought into the state.

DOE EPSCoR: Alabama was awarded a $ 1.9M DOE EPSCoR Implementation Award for an initial three years, renewable for another three years. The Implementation Award consists of two components: a research cluster and a human resource component.

NASA EPSCoR: two Cooperative Agreement Notice (CAN) awards at $ 750K each were funded. A UA researcher graduated from a NASA RID (Research Infrastructure Development) Seed grant which are smaller grants for junior faculty to a larger CAN award.

ALABAMA EPSCoR OVERVIEW AND HIGHLIGHTS
USDA EPSCoR: Alabama EPSCoR received $1M in CY 2009 research expenditures while $735K in new grants were funded.

EPA EPSCoR: The EPA EPSCoR was not funded in 2009.

DoD EPSCoR: Alabama is not currently eligible for DoD EPSCoR.

NIH EPSCoR: Alabama is not currently eligible for Institutional Development Award (IDeA) Program through NIH.

USDA EPSCoR works to increase the amount of agricultural research at academic institutions in the state through identification of critical issues facing agriculture today, stimulating the development of collaborative networks across the state, and providing resources and funding.

EPA EPSCoR provides support for state priority research areas, removes barriers to strengthening statewide research infrastructure development, and improves human resource base for environmental science, engineering, and education.

NIH EPSCoR works to increase the amount of agricultural research at academic institutions in the state through identification of critical issues facing agriculture today, stimulating the development of collaborative networks across the state, and providing resources and funding.

The NIH Institutional Development Award (IDeA) program broadens the geographic distribution of NIH funding for biomedical research. Alabama is currently ineligible for IDeA funding.

The Department of Defense EPSCoR (DEPSCoR) funds states to perform research in science and engineering fields important to national defense. Alabama is currently ineligible for DEPSCoR funding.
2.2 ALEPSCOR Overview

The Alabama EPSCoR (ALEPSCOR) program is dedicated to the advancement of economic development via scientific and engineering research through a collaborative effort among the State’s research universities. The focus of activities is designed to attract and retain distinguished scientists and researchers for Alabama; to develop new cutting-edge technologies, companies and opportunities; and to stimulate state competitiveness in medicine, biotechnology, engineering, mathematics and other applied sciences.

ALEPSCoR is a consortium of academic, government, and industrial organizations established in 1985. The core ALEPSCoR academic institutions in Alabama include the seven Ph.D. granting research universities: Alabama A&M University (AAMU), Auburn University (AU), The University of Alabama (UA), University of Alabama at Birmingham (UAB), University of Alabama in Huntsville (UAH), Tuskegee University (TU), and University of South Alabama (USA). Other academic institutions participate in and benefit from program activities through satellite or outreach efforts and Co-funding. The primary goal of the consortium is to establish the infrastructure needed to increase sustained national science and technology research competitiveness. This goal is accomplished by:

1. Supporting research clusters based on current Alabama research strengths;
2. Carefully planning major equipment purchases that significantly increase state capabilities;
3. Supporting the hire of new faculty and research personnel in targeted areas;
4. Broadening participation of students in research cluster-related science and engineering fields; and
5. Linking these clusters with higher education, government agencies, and the private sector.

| Funding Rates by EPSCoR Jurisdiction |
|---|---|---|---|---|---|---|---|---|---|
|   | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| All NSF | Awards | 10,339 | 10,798 | 10,367 | 9,772 | 10,450 | 11,478 | 11,162 | 14,641 |
|   | Proposals | 35,082 | 40,084 | 43,816 | 41,723 | 42,374 | 44,593 | 44,438 | 45,181 |
|   | Funding Rate | 29% | 27% | 24% | 23% | 25% | 26% | 25% | 32% |
| ALL EPSCoR Jurisdictions | Awards | 1,511 | 1,567 | 1,454 | 1,433 | 1,489 | 1,653 | 1,564 | 2,474 |
|   | Proposals | 5,595 | 6,418 | 6,815 | 6,802 | 7,037 | 7,392 | 7,349 | 8,476 |
|   | Funding Rate | 27% | 24% | 21% | 21% | 21% | 22% | 21% | 29% |
| Alabama | Awards | 82 | 81 | 99 | 78 | 84 | 86 | 85 | 148 |
|   | Proposals | 385 | 443 | 488 | 483 | 530 | 508 | 489 | 606 |
|   | Funding Rate | 21% | 18% | 20% | 16% | 16% | 17% | 17% | 24% |

Source: NSF Budget Internet Information System (BIIS)
2.3 ALEPSCOR Investment Update

Alabama’s investment in the ALEPSCoR program led to $17M in federally funded research expenditures during CY 2009. New federal awards received in CY 2009 exceeded $12M.

Since 2002, Alabama has increased the number of proposals submitted and the percentage of proposals funded. In 2002, Alabama submitted 385 proposals, with a success rate of 21%. In 2009, Alabama researchers submitted over 600 proposals with a success rate of 24%.

New EPSCoR awards include:

- Twenty-two new NSF Co-funded Awards to eight institutions totalling $7,955,891 ($3,354,142 in EPSCoR funds, $4,601,749 from non-EPSCoR NSF Directorates). The duration of these awards range from two to five years.
- A new DOE Implementation Award for $1.9M was awarded in August 2009 for a period of three years with a possible renewal of three additional years. Alabama had three ongoing State Lab Partnership Awards.
- Two NASA EPSCoR Cooperative Agreement Notice (CAN) Awards totalling $1.5M along with one new $10,000 NASA Research Infrastructure Development (RID) Seed Grant were awarded in 2009.
- Two new USDA EPSCoR Awards totaling $735K, one award for $10K and the other for $725K.
- There was no funding for EPA EPSCoR Programs in 2009.

Over the duration of these grants, impacts will continue to be made. See agency sections for additional details.

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<tr>
<th>Agency</th>
<th>Total Amount of New Funding Awarded in 2009</th>
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<td>NSF Co-funding</td>
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<tr>
<td>DOE</td>
<td>1,905,001</td>
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<tr>
<td>NASA</td>
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<td>USDA</td>
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<tr>
<td>Subtotal</td>
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<td>Balance of NSF Co-funding (non-EPSCoR Directorates)</td>
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<td><strong>TOTAL</strong></td>
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<table>
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<tr>
<th>Agency</th>
<th>Expenditures from ongoing grants</th>
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<td>NASA</td>
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<td>USDA</td>
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<tr>
<td>Subtotal</td>
<td>8,767,214</td>
</tr>
<tr>
<td>Balance of NSF Co-funding (non-EPSCoR Directorates)</td>
<td>8,570,242</td>
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<td><strong>TOTAL</strong></td>
<td><strong>$17,337,456</strong></td>
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As a member of the EPSCoR Program, Alabama receives support to stimulate nationally competitive research and to increase the ability of its scientists to compete successfully for research funds from NSF and other federal agencies.
2.4 How Does EPSCoR Make a Difference?

As a member of the EPSCoR program, Alabama receives federal funds to stimulate nationally competitive research and to increase the ability of its scientists to compete successfully for research funds from NSF and other federal agencies. The ALEPSCoR consortium of academic, government, and industrial organizations supports projects that establish an infrastructure within the state capable of developing and sustaining high-quality science and engineering research and education that can potentially contribute to statewide national competitiveness.

Over the long term, ALEPSCoR is enhancing valuable resources that can influence Alabama’s research capacity in the 21st Century. Alabama depends on its colleges and universities to provide the well educated workers that leading companies require if they are to compete in a knowledge-based global economy. A highly educated work force is the most critical factor in attracting and retaining the kind of leading companies that bring 21st century jobs to the state. Increasing Alabama’s scientific and technology research competitiveness is critical for the long term economic health of the state.

Specifically, Alabama EPSCoR makes a difference to Alabama in the following ways: education, outreach and increased diversity, partnerships, infrastructure building, economic benefit/jobs, business opportunities, and a system that encourages graduation and self-sustainability.

**Alabama EPSCoR makes a difference in Alabama education:**
- Alabama EPSCoR makes a difference through the state’s colleges and universities, their science and engineering faculty, and students. A primary focus of the team is preparing students for careers in fields including: biotechnology, nanotechnology, biological sciences, engineering, optics and lasers, phase change energy, etc.
- Through mandates by NSF and other EPSCoR agencies, a portion of the agency investment goes to promote programs for K-12. Citizens of the state benefit by outreach efforts which includes basic community math programs, teacher education opportunities, and development of new science-based curricula. These efforts improve K-12 education without significant investments from the state.

**Alabama EPSCoR helps to encourage partnerships in the state:**
- Alabama EPSCoR cooperates with state leaders in government, higher education, and business to establish productive, long-term partnerships between different universities and colleges, K-12 educational institutions, Alabama businesses, and other government agencies. These partnerships are designed to stimulate local action resulting in lasting improvements to the state’s academic research infrastructure and increased national research and development (R&D) competitiveness.

**Alabama EPSCoR enhances infrastructure in the state in targeted areas:**
- Human infrastructure is enriched by opportunities to establish relationships with national laboratories, to use equipment and collaborate with federal researchers, and hiring new faculty in targeted research “growth” areas which enables Alabama to achieve “critical mass” in these high growth research areas.
- Equipment infrastructure is improved by targeted equipment purchases which enable Alabama researchers to perform research in new cutting-edge technologies.
2.0 OVERVIEW AND PROGRAM HIGHLIGHTS

Alabama EPSCoR provides an economic benefit to Alabama and brings jobs to the State:

- External EPSCoR funded grants support new faculty hires which provide salary for new research assistant professors, post-doctoral research associates, graduate student stipends and tuition, as well as undergraduate student support. These external grant funds provide jobs for hundreds of people in the state, helping to stimulate the state’s economy.
- By establishing the research infrastructure in the state’s targeted areas, Alabama researchers become competitive in obtaining federal non-EPSCoR grant funding. New external grant funds provide an additional economic benefit to the state by providing support for faculty and graduate students.

Alabama EPSCoR creates new high tech business opportunities and future jobs for the state:

- Alabama EPSCoR funded research leads to intellectual property that can serve as a catalyst for the creation of high technology companies in the State of Alabama. Alabama EPSCoR funded research has led to numerous patents, licensing agreements, and small business start-ups. These new companies will provide additional long-term jobs for Alabama residents.

Alabama EPSCoR provides an engine to “graduate” Centers, research programs, and other programs to non-EPSCoR funding self-sufficiency:

- There are a number of Alabama EPSCoR funded programs which are now major success stories for the state. These programs listed at right no longer require EPSCoR funding.

Graduated Programs

Extended Alabama Structural Biology Consortium was instrumental in bringing the newest biotechnology center, Hudson-Alpha Institute for Biotechnology (HAIB) to Alabama, spin off 3 companies and is partnered with 11 more that are pursuing new drug designs serving the world. Two NSF RII Investigators have opened offices at Hudson-Alpha.

Materials for Information Technology which received continuous NSF MRSEC funding starting in 1994 and will continue through 2013.

Coastal Marine Sciences that later became part of the Southeastern Research Alliance;

A Material Science Collaborative that received a Whitaker Foundation award for development of its BioMedical Implant Center;

A Mathematics Research Center developed at Auburn and continues to sponsor course development as part of the Alabama Math Science Technology Initiative;

Interactions Between Galaxies and Their Environments, now a part of the International Partnership with the Hubble Program;

The Land-water Interfaces Program which received NSF IGERT funding and is considered a major contributor to the National Ecological Observatory Network;

Integrated Micro-Electromechanical Systems;

Large-Scale Electromechanical Systems which was integrated into the Alabama Transportation Center and is an Engineering Academies sponsor;

Internet 2 assisting with development of the Alabama Research and Education Network and Alabama Supercomputer.

Centers and clusters are supported to permit “Graduation” from the EPSCoR program after having achieved national recognition and awareness. The list above highlights only a few of the collaborative programs that have graduated to date.
2.5 State Steering Committee Vision

The Alabama EPSCoR Steering Committee (AESC) is responsible for fiscal and programmatic aspects of EPSCoR activities. Members include representatives from the seven research institutions (AAMU, AU, TU, UA, UAB, UAH, and USA), and the Alabama Commission on Higher Education (ACHE).

Dr. Richard (Dick) Marchase has served as Chair of the Alabama EPSCoR Steering Committee since February 2009. Dr. Marchase is the Vice President for Research and Economic Development at the University of Alabama at Birmingham. Dr. Elizabeth French, the Director of ACHE’s Office of Institutional Effectiveness and Planning, remains as Vice-Chair.

The Alabama EPSCoR Steering Committee was saddened at the loss of Mr. Dave Echols in April 2010. Mr. Echols served as Chair of the Alabama EPSCoR Steering Committee from April 2004 to March 2006 and was the Senior Project Manager for the Alabama Development Office.

Dr. Keith Harrison (left) former ALEPSCoR Steering Committee Chair presenting then outgoing Chair Dave Echols with an appreciation plaque for his service to the ALEPSCoR Steering Committee, March 2006.
Alabama EPSCoR Executive Director

In September 2010, the Alabama EPSCoR Steering Committee elected a new Alabama EPSCoR Executive Director, Dr. Chris Lawson, University of Alabama at Birmingham Physics Professor and Director of the NSF RII funded Center for Sensors and Spectroscopies (COSS). State Agency Directors and the GRSP Director report to the Alabama Executive Director.

Alabama EPSCoR Executive Director’s Challenge

The Alabama EPSCoR Executive Director is tasked with setting in motion elements needed to build state research infrastructure capabilities and capabilities. A few of the tasks are:

- **Provide a common vision for programs, and assist with development of the State Strategic Plan with respect to changing goals and objectives.**
- **Mediate the conflicting desires of the research institutions/organizations and limited availability of state and federal funds to address the extensive needs and interests of researchers at each institution.**
- **Generate awareness and interest in the need for an effective statewide effort to develop and promote research and development activities in Alabama.**
- **Establish policies and guidelines for program activities in Alabama.**
- **Provide general oversight and coordination of program projects, where applicable.**
- **Disseminate information regarding program opportunities and selecting participants for proposals.**
- **Monitor the progress of funded programs and research in Alabama.**
- **Attend required ALEPSCoR meetings to provide program overview and status.**
- **Conduct strategic planning related to the program.**
- **Provide visibility and public relations on behalf of the program.**
- **Where possible, select projects that will be of the greatest benefit to the State’s success in science and engineering research and will have the greatest impact on attaining the goals of the ALEPSCoR.**

In September 2010, the Alabama EPSCoR Steering Committee elected a new Alabama EPSCoR Executive Director, Dr. Chris Lawson, University of Alabama at Birmingham Physics Professor and Director of the NSF RII funded Center for Sensors and Spectroscopies (COSS). State Agency Directors and the GRSP Director report to the Alabama Executive Director.

State Agency Directors

**Alabama EPA EPSCoR Agency Director**

Dr. William Deutsch
Auburn University
deutswg@auburn.edu
334-844-9119

**Alabama DOE EPSCoR Agency Director**

Dr. John Steadman
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jsteadman@usouthal.edu
251-460-6140

**Alabama DOD EPSCoR Agency Director**

Dr. John Wiest
The University of Alabama
jwiest@eng.ua.edu
205-348-1727

**Alabama NASA Program Director**

Dr. John Gregory
University of Alabama in Huntsville
gregoryj@uah.edu
256-824-6028

**Alabama USDA EPSCoR Agency Director**

Dr. Frank (Skip) Bartol
Auburn University
bartoff@auburn.edu
334-844-3700
2.6 Agency Directors

The Alabama EPSCoR Agency Directors provide oversight responsibility for the day-to-day operations of federal EPSCoR research programs in Alabama, including responsibility for coordination, notification and supervision of all EPSCoR announcements and awards issued by the federal government. An Alabama EPSCoR Agency Director is the administrative officer for a designated EPSCoR program in Alabama. He or she is appointed by the Alabama EPSCoR Steering Committee and is responsible for carrying out the administrative functions of the Alabama EPSCoR Steering Committee (AESC), providing management, coordination and direction of the EPSCoR program in Alabama and for such other duties as assigned by the Executive Director and AESC. Alabama EPSCoR currently has an EPSCoR Agency Director for DOE, EPA, NASA, USDA, NIH and DOD. In previous years, the Alabama EPSCoR Executive Director served a dual role as the NSF Agency Director. In September 2010, the ALEPSCoR Steering Committee amended the ALEPSCoR bylaws to separate the ALEPSCoR Executive Director position from that of NSF Agency Director. The Alabama NSF EPSCoR Agency Director will be selected at an upcoming Steering Committee meeting.

The Agency Directors are accountable to the Executive Director of the Alabama EPSCoR Program (State Executive Director) and to the AESC for providing direction of the Alabama EPSCoR Program.

Alabama EPA EPSCoR Agency Director
Dr. William Deutsch was appointed in March 2008 as the Alabama EPA EPSCoR Agency Director. Dr. Deutsch is a faculty member in the Department of Fisheries and Allied Aquacultures at Auburn University. Dr. Deutsch’s specialty is in Environmental Assessment and Training, Aquatic Ecology, and Community-based Watershed Stewardship.

Alabama DoE EPSCoR Agency Director
Dr. John Steadman was appointed as the Alabama DOE EPSCoR Agency Director in March 2008 by the Alabama EPSCoR Steering Committee. Dr. Steadman is currently the Dean of the University of South Alabama’s College of Engineering. Before moving to Alabama, Dr. Steadman was the Project Director for five different DOE EPSCoR grants totaling more than $10M over a period of fifteen years.

Alabama NASA EPSCoR Agency Director
Dr. John Gregory has served as the Alabama Space Grant Consortium Director and Alabama NASA EPSCoR Program Director since 1991. In addition, Dr. Gregory has served as the Director of the Laboratory for Materials and Surface Science (LMaSS) at the University of Alabama in Huntsville since 1986.
Overall ALEPSCoR goals that apply to all programs include:

Goal 1: To increase R&D funding in Alabama to the national level.

Goal 2: To increase competitiveness of all research institutions in the state by measured publications, patents, research faculty, research equipment, etc.

Goal 3: To increase minority and under-represented group participation.

Goal 4: To develop industry-government-university partnerships to contribute to technology development and economic growth in Alabama.

With respect to those programs with traditionally low success rates for the State of Alabama, the ultimate goal is to increase effectiveness of EPSCoR programs. Specific tasks to be completed include:

Develop a coordinated plan for research within the state and aid in the development of consistent plans for each agency.

Provide guidance in conducting competitions, where possible. Select programs which have the greatest potential for achieving national competitiveness and determine the resources required to reach that potential. Use strengths and focus areas identified in the review and selection process.

Function as a liaison with the Alabama Commission on Higher Education.

Participate in EPSCoR Foundation and Coalition activities, as well as other groups that have an impact on federal funding agencies.
2.7 ALEPSCoR Graduate Research Scholars Program

Graduate students who represent the next generation of researchers and innovators are critical to the advancement of Alabama’s high-tech human resource capacity. To assist our institutions of higher education in training this next generation of scientists and engineers, investments are required to attract the brightest and best scholars who will contribute to the state’s vision of economic growth and prosperity.

In 2009, the Alabama Legislature continued the line item appropriation to EPSCoR through the Alabama Commission on Higher Education for the purpose of funding the Graduate Research Scholars Program (GRSP). Since its inception in 2006, through Round Six, the program has funded more than 130 exceptional graduate students. Students are selected competitively by a team consisting of one campus coordinator from each Ph.D. granting institution in the ALEPSCoR Program.

Renewals will be granted subject to satisfactory progress in a given year and available funding. The goal of the ALEPSCoR GRSP is to invest in Alabama universities to expand research output and attract eminent senior faculty and quality graduate students. The program objective is to provide a highly trained workforce to fuel the growth of high technology companies in Alabama.

The quality of work generated as part of the first five funding rounds was both cutting-edge and novel. Encouraged by the success of the program, researchers have leveraged state funds with other research-based resources to supplement the GRSP Program and increase participation in the program.

Students at all Alabama EPSCoR universities are eligible to apply whose proposed research, or field of study and career interests are congruent with the funded science and technology programs of the NSF, DOE, NASA, USDA, EPA, DOD and NIH. The Request for Proposal for Round Six was announced in March 2010 with applications due to the institution’s Campus Coordinator in April 2010. The GRSP’s period of performance was adjusted to coincide with the academic year, candidates are chosen in the spring to facilitate funding programs for students.

The Alabama EPSCoR Steering Committee’s GRSP Subcommittee monitors and continually makes revisions to improve the program.

GRSP Round Five supported thirty-nine graduate students, thirty-six working on their Ph.D. while three worked on their M.S. All students completed reporting requirements. (Round 5 students are listed at right).

Forty-three candidates for GRSP Round Six (listed in the Appendix) were selected by the GRSP Campus Coordinators in May 2010. More information regarding the GRSP Program is available in the recently published GRSP Volume Four Booklet.
## Round 5 Scholars

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<th>Inst.</th>
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<th>Research Area</th>
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<tr>
<td>AAMU</td>
<td>Malek Abunaemeh</td>
<td>Material Sciences, Physics</td>
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<tr>
<td>AU</td>
<td>Sudhir Ahluwalia</td>
<td>Veterinary Biomedical Sciences</td>
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<td>TU</td>
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<td>USA</td>
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2.8 Major Infrastructure Awards

In 2009, Alabama EPSCoR received new awards totaling more than $12M. EPSCoR Programs within NSF, DOE, NASA, and USDA awarded more than $7.5M while the balance of NSF Co-funding brought in an additional $4.6M to the state.

National Science Foundation (NSF) EPSCoR

NSF EPSCoR provided federal funding for ALEPSCoR programs through Research Infrastructure Improvement (RII) grants and EPSCoR Co-Funding. Each of those is summarized below with additional details in Section 3.0.

In 2009, Alabama EPSCoR submitted two cyberinfrastructure proposals to NSF. The first is to upgrade Alabama Cyber connections in nano technology, biosciences, and sensors. In 2010, the proposal was awarded in the amount of $1,176K. A joint Track-II Cyberinfrastructure proposal between Alabama, Louisiana, and Mississippi was submitted to coordinate and upgrade cyberinfrastructure, across the region, this was also awarded in 2010. Abstracts for these proposals can be found in Section 2.9.

NSF Research Infrastructure Improvement Cooperative Agreement

Alabama EPSCoR was awarded a $15M NSF Research Infrastructure Improvement Cooperative Agreement from September 1, 2008 to August 31, 2013 entitled, “ Enhancing Alabama’s Research Capacity in Nano/Bio Science and Sensors.” In 2009 Alabama EPSCoR received year 2 of this funding which provides support for five Research Centers for Excellence in Alabama:

- Alabama Center for Nanotechnology Materials (ACNM), Tuskegee University (plus USA, AU, UAB, UA, and AAMU) is developing new nanostructured materials with enhanced thermal, physical, mechanical, and biodegradable properties.
- Center for Environmental Cellular Signal Transduction (CECST), Auburn University (plus AAMU, TU, and UAB) is developing model biosystems to facilitate the development of nanomaterials and nanoscale devices.
- Center of Optical Sensors and Spectroscopies (COSS), UAB (plus UA and UAH) is developing new optical and molecular sensing technologies for applications in environmental monitoring, counter-terrorism, industrial process control, and medical diagnosis.
- Center for Interdisciplinary Discovery via Engineered Nanofabrication (CIDEN), AAMU (plus UAB, UA, UAH, and TU) is applying cutting-edge nanoengineering to develop molecular sensors, regimented nanomaterials and nanostructures with applications in chemical, biological, and thermoelectric devices.
- ALEPSCoR Education Outreach Initiative (AEOI), UA (plus AAMU, TU, and USA) is coordinating EPSCoR K-12 educational outreach efforts across the state.

NSF Co-Funding Awards

NSF EPSCoR Co-funding awards provide Alabama researchers and institutions another opportunity to obtain federal NSF EPSCoR funds. When a proposal is sent to a NSF Directorate and found meritorious, opportunities within NSF exist for support of the project to be jointly funded by the specific NSF Directorate and the NSF EPSCoR office.

In the past few years, Alabama EPSCoR has been very successful with these awards. In 2009, new direct Co-funding awards totaled $3.3M with a balance of $4.6 from other NSF Directorates bringing a future $8M into the state. New awards were received by six EPSCoR institutions, (AAMU, AU, TU, UA, UAB and USA), as well as Alabama State University and Alabama Southern Community College.
DOE EPSCoR Awards

DOE Implementation Award

Alabama DOE EPSCoR was awarded a $1.9 M three-year Implementation Award which includes two components: a research component and a human resource development program. The Research Cluster is headquartered at Auburn University and includes researchers at UA, USA, AU, AUM, and TU. The Human Resource Development component assists researchers with travel support to establish a relationship with a DOE national laboratory.

State Laboratory Partnership Program

DOE EPSCoR State Laboratory Partnership Awards encourage collaborations between researchers at any DOE federal laboratory and ALEPSCoR research institutions. Alabama currently has three State Laboratory Partnership Awards. Additional information on the Alabama DOE EPSCoR Program can be found in Section 4.0.

NASA EPSCoR Awards

The goal of NASA EPSCoR is to develop academic research activities that are long-term, self-sustaining, and nationally competitive for non-EPSCoR funding. The Alabama NASA EPSCoR program is a full research initiative, competively selected in a field of interest to both NASA and the State of Alabama. In 2009, Alabama NASA EPSCoR was awarded one NASA Research Infrastructure Development (RID) Seed Grant and two NASA Cooperative Agreement Notice (CAN) awards. RID Seed Grants are intended for junior faculty. One recipient of a RID Seed grant graduated and became a CAN Award recipient. Additional information on NASA EPSCoR Awards can be found in Section 5.0.

USDA EPSCoR Awards

On October 1, 2009, the National Institute of Food and Agriculture (NIFA) was established, replacing the Cooperative State Education and Extension Service (CSREES). Under the new USDA-NIFA format, the USDA EPSCoR program is “designed to help institutions develop competitive research, education and extension/outreach programs in high-priority areas of national need in agriculture, food, and environmental sciences.”

In CY 2009, two new awards were brought in to the state totaling $735K. Total USDA federally funded research expenditures for USDA exceed $1M in 2009. USDA EPSCoR awards that began in 2007 will bring revenue into the state until 2011. For additional information about these awards, see Section 6.0.
In 2009, major research infrastructure improvement proposals were submitted to the NSF Track II and NSF CyberInfrastructure Programs.

**NSF Track II Proposal**

Research Infrastructure Improvement Program: Track-2 (RII Track-2) awards provide up to $2 million per year for up to 3 years to consortia of EPSCoR jurisdictions to support innovation-enabling cyberinfrastructure of regional, thematic, or technological importance. A successful RII Track-2 proposal must describe a clear, comprehensive, and integrated cyberinfrastructure vision to drive discovery, and provide collective solutions to cyberinfrastructure challenges of regional and national importance. The proposal must also describe how robust, reliable environments, capabilities, and capacities will be provided to deliver long term value across science and engineering disciplines. These awards will enhance discovery, learning, and economic development through the use of cyberinfrastructure.

Alabama EPSCoR collaborated with Mississippi and Louisiana EPSCoR Programs to submit, *Research and Education Cyberinfrastructure Investments to Develop the Coastal Hazards Collaboratory in the Northern Gulf Coast* in 2009. Dr. Michael Khonsari, Louisiana Board of Regents, will serve as the lead on the project. Dr. Sandra Harpole, Mississippi State University, and Dr. Sara Graves, University of Alabama in Huntsville are Co-Investigators. The total request for the tri-state proposal is $1,749,999. This proposal was awarded in October 2010.

The Northern Gulf Coast is essential to the sustainability of economically important coastal fisheries, marine transportation, energy development and strategic national defense. The project supported by this EPSCoR Research Infrastructure Improvement (RII) Track-2 award establishes the Northern Gulf Coastal Hazards Collaboratory (NG-CHC) to: 1) enhance the research competitiveness of the region, 2) advance economic opportunities for citizens by reducing risks to coastal vulnerabilities, and 3) catalyze collaborative research via enhanced cyberinfrastructure (CI) that addresses problems of major national importance, viz., engineering design, coastal system response, and risk management of coastal hazards. The three states in the consortium, Louisiana (LA), Mississippi (MS), and Alabama (AL), are leveraging their partnerships, proximity, and significant prior investments in CI to advance science and engineering of coastal hazards across the region.

The NG-CHC has the opportunity to capitalize upon strong CI and coastal hazards research infrastructure to address issues of national importance. The challenge is to develop a framework and strategies for organizing the resources in the region in a manner that transcends boundaries among state lines. The principal barrier to date has been the lack of CI that enables rapid sharing of available data resources and tools and advance new discoveries in geosciences and engineering associated with coastal hazards in this vulnerable coastal region. The Research Infrastructure Improvement Track-2 cyberinfrastructure (CI) investments will focus on enhancement of the data storage, sensor network, computing and instrumentation systems that are essential for addressing the challenges of a distributed Coastal Hazard Collaboratory.
CyberInfrastructure Proposal

The Research Infrastructure Improvement Program: Inter-Campus and Intra-Campus Cyber Connectivity (RII C2). Awards made under this program will provide up to $1 million for up to 2 years to support the enhancement of inter-campus and intra-campus cyber connectivity within an EPSCoR jurisdiction. These awards are intended to enhance broadband access for academic research and the utilization of cyberinfrastructure consistent with the jurisdiction's Science and Technology (S&T) plan. The inter-campus and intra-campus connectivity targeted by these awards is expected to broaden individual and institutional participation in STEM research and education activities within and among jurisdictions and to facilitate synergy among NSF EPSCoR Research Infrastructure Improvement activities.

Dr. Sara Graves, University of Alabama in Huntsville Director of the Information, Technology and Systems Center along with University of Alabama at Birmingham Physics Professor Dr. Chris Lawson and University of Alabama Environmental Engineering Professor Dr. Karen Boykin submitted the proposal entitled, Alabama Cyber Connections in Nanotechnology, Bioscience, and Sensors. This proposal was awarded in September 2010 in the amount of $1,176,470 from funds made available by the American Recovery and Reinvestment Act of 2009.

This Inter-campus and Intra-campus Cyber Connectivity (RII C2) project will further the goals of Connecting Alabama and will support upgrades to existing networks as well as the development of new cyber connectivity components to better realize research potential and improve competitiveness within the state. Specific RII C2 objectives are:

- Establish the ALEPSCoR RII-Industry State Nano-Bio-Sensors Database Initiative to connect the HudsonAlpha Institute of Biotechnology (HudsonAlpha), Alabama A&M University (AAMU) and Alabama State University (ASU) via dark fiber to the Alabama Research and Education Network (AREN) backbone for improved connectivity with schools throughout the state and to national and international research and education networks.
- Establish Interactive Digital Centers at the EPSCoR RII Track-1 research Centers of Excellence to improve computational modeling capabilities, facilitate dissemination of research results, support remote Center-related virtual seminars and classes to enable non-local students to participate, allow remote access to Center instrumentation for long-distance education and research, and promote the Centers to attract the best and brightest students to Alabama for Center-related research. The proposed upgrades to the video-conferencing services and desktop video-conferencing services seek to broaden participation with other universities, government laboratories, and high technology companies.
2.10 Workshops, Meetings, and Conferences

Small Business Technology Transfer and Small Business Innovative Research (STTR/SBIR) Conference

The purpose of the 9th Annual STTR/SBIR Small Business Conference at Alabama A&M University Research Institute January 26-28, 2009 was to provide valuable information to small business and university personnel seeking funding for exploratory projects. The presentations by small business specialists and Federal Agency Program Managers provided information on how to initiate projects and build partnerships. A special training session for small businesses provided valuable information on costing, writing winning contracts, and business development. This conference also served as a platform for networking opportunities and future collaborations among participants.

Sponsors include Alabama EPSCoR, the U.S. Small Business Association, Science Applications International Corporation (SAIC), AMCOM Contracting Center, and Boeing. Speakers included: Dr. Ian Bennett, NSF SBIR-STTR; Mary Ann Beyster, Foundation for Enterprise Development; David Brock, MSFC; Dorothy Huston, TMT Group, Inc.; George Otchere, Bill Derrick, Mark McConnell, Dan Harrison, and Tony Sacco from SAIC; Susan Nichols, DARPA; Lynn Garrison, MSFC; Buddy Thomas, AMCON; Stan Stanford, Charter; Tizoc Loza Northrup Grumman Systems; Oliver Leslie, Boeing; Gless Kinstler, Alabama Launchpad; Chris O’Qwin, DOE; James Johnson, AAMURI; George Kobler, from Lanier, Ford, Shaver, and Payne Law Firm.

ADVANCED GREEN COMPOSITES WORKSHOP

An Advanced Green Composites Workshop sponsored by the NSF RII Alabama Center for Nanostructured Materials was held at the University of Alabama at Birmingham School of Engineering, June 28-29, 2009. The workshop featured topics including: Reinforcements using synthetic and natural fibers, bioresin, moisture and durability of Green Composites, processing Green Composites, design issues and integration into applications, Green Building Technology, international trends, and laboratory/demonstration time.

A number of sectors such as automotive, transportation, buildings and infrastructure are shifting to a ‘green’ outlook as manufacturers are increasingly introducing environmentally friendly structural and functional themes to their design. For example, automotive floor panels, interior trim, horizontal and vertical panels, bumper beams and trunk inserts feature advanced natural fiber composites. However, science and engineering graduates have a limited understanding of integrated design, processing, performance and long-term durability of ‘green’ plastics and composites.

Natural fibers and bio-based resins are derived from agricultural products. They are environmentally friendly, biodegradable and compared to synthetic
glass and carbon fibers, the energy consumption to produce them is very small. The density of natural fibers is in the range of 1.2 to 1.5 g/cm³, which is lower than glass and carbon fibers. The modulus-to-density ratio of many natural fibers is higher than that of glass fibers. Natural fiber composites can provide comparable impact resistance to glass or carbon fiber composites and increased vibration damping. The price of natural fibers is also less than glass and carbon fibers.

There is a range of natural fibers that can be utilized with thermoplastic or thermoset polymer matrices including wheat straw, kenaf, jute, flax, hemp, wood flour, coconut, sisal and banana. The surface treatment, surface adhesion and interface compatibility of natural fibers to polymers such as polypropylene, polyamides and polyurethanes influence the end properties of natural fiber composites, also referred to as biocomposites. Some of the overall limitations of natural fibers are: (a) lower modulus than synthetic fibers; (b) susceptibility to moisture uptake; (c) weak surface adhesion to hydrophobic non polar polymers; and (d) lack of availability as broad goods.

Biocomposites are not limited to the use of natural fiber reinforcements. Biobased resins when combined with natural fibers can result in 60-100% biocomposites. Bio-based resins or bio-blends are obtained by combining unsaturated polyester (UPE) with epoxidized soybean oil (EMS), power plant derived fly ash foam (for energy absorption) and regrind from plastic waste.

The emerging workforce of scientists and researchers needs to be educated in the utilization of green materials in their thinking in terms of engineering design, processing and integration for technology insertion.

Southern Regional Water Policy and Economics Conference

The 2009 Southern Regional Water Policy and Economics Conference: 21st Century Water Issues in the Southern States brought together extension and research professionals working on water economics, engineering, law, and other related fields. It was hosted by the Southern Region Water Policy and Economics Team which functions to promote and facilitate delivery of multi-state research and extension programming to address regional and/or multiregional water quality and availability concerns.

The conference provided an opportunity for team members, collaborators, and others interested in water issues to: 1) share cutting edge research and extension information on water quality, conservation, law and resource management issues in their states; 2) learn about projects and interests in other institutions; and 3) identify opportunities for regional collaboration and funding.

Conference participants included approximately thirty researchers, extension experts, and agency personnel from the thirteen southern states. These include Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, New Mexico, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas.
In summary, The Alabama EPSCoR (Experimental Program to Stimulate Competitive Research) is dedicated to the development of scientific and engineering capabilities through state research university collaboration. Research performed by our universities represents a substantial industry in Alabama. Activities are designed to attract distinguished scientists, young investigators, and researchers from various fields, fostering economic development through investments that result in cutting-edge technologies and stimulate competitiveness in medicine, biotechnology, engineering, mathematics, and other applied sciences.

Alabama EPSCoR was very successful in securing new funding during 2009 from the NSF, DOE, NASA, and the USDA. New awards totaled more than $12M while CY 2009 research expenditures totaled more than $17M. Significant state commitment is necessary to sustain the ALEPSCoR activities and to provide concrete evidence to NSF and the other agencies that the State is willing to partially match the large federal research investment in these activities. Continued state support ensures EPSCoR federal funding will continue to be available for our scientists and demonstrates a willingness on the part of the State of Alabama to make a full commitment to building research capabilities to support state economic development.

The ALEPSCoR has been recognized by the sponsoring Federal agencies as one of the best programs of its kind in the United States. Funding received will allow the program to implement its expanded core program to continue building our infrastructure and expertise in areas of scientific importance to the state and the nation. A strong commitment for EPSCoR is a sound investment for our State’s future.
SUPPLEMENTAL DOCUMENTATION PROGRAM DETAILS

Alabama EPSCoR Research Programs:

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3.0 Alabama NSF EPSCoR

The NSF EPSCoR program began in 1978 and is a federal-state partnership designed to help America maintain its global leadership by capitalizing on talents and resources available in all states of the union. The program promotes the intellectual and human development missions of NSF by supporting basic research activities which span a broad range of science, engineering and technology and by supporting training of future scientists and engineers. NSF EPSCoR program manages a research portfolio that that is crucial to the research and economic development of EPSCoR states and territories. All EPSCoR awards are made through NSF’s rigorous merit review process. The NSF EPSCoR Office is currently located in the Office of the NSF Director.

Alabama first became eligible for EPSCoR funding in 1985. In 2009, a total of twenty-five states and two territories were eligible for NSF EPSCoR funding.

EPSCoR’s mission is to help moderate the unequal allocation of NSF and other federal R&D funding. The colleges and universities in all the 25 EPSCoR states plus Puerto Rico and the Virgin Islands receive only about 10 percent of the $6 billion NSF budget. The remaining ninety percent of NSF funding goes to 25 non-EPSCoR states. At a time when the NSF budget is expanding (projected to double by 2017), special attention should be given to improving the research capacity and competitiveness of states that still need to build and enhance research capacity.

Funding Opportunities

NSF EPSCoR provides funding support through the following types of awards:
- Research Infrastructure Improvement (RII) Track 1
- EPSCoR Co-Funding
- Workshops and Outreach
- Research Infrastructure Improvement Track 2 and CyberInfrastructure Awards

RII Track 1 (Alabama’s RII-3)

In 2009, Alabama EPSCoR was awarded a $15M NSF EPSCoR Research Infrastructure Improvement Cooperative Agreement from September 1, 2008 to August 31, 2013 entitled, “Enhancing Alabama’s Research Capacity in Nano/Bio Science and Sensors.” This award provides funding for five Research Centers for Excellence in Alabama:
- Alabama Center for Nanotechnology Materials (ACNM), is developing new nanostructured materials with enhanced thermal, physical, mechanical, and biodegradable properties.
- Center for Environmental Cellular Signal Transduction (CECST), is developing model biosystems to facilitate the development of nanomaterials and nanoscale devices.
- Center of Optical Sensors and Spectroscopies (COSS), is developing new optical and molecular sensing technologies for applications in environmental monitoring, counter-terrorism, and industrial process control, and medical diagnosis.
- Center for Interdisciplinary Discovery via Engineered Nanofabrication (CIDEN), is applying cutting-edge nanoengineering to develop molecular sensors, regimented nanomaterials and nanostructures with applications in chemical, biological, and thermo-electric devices.
ALEPSCoR Education Outreach Initiative (AEOI), is coordinating EPSCoR K-12 educational outreach efforts across the state.

This program brings together biologists, optical scientists, environmental scientists, material scientists, chemists, biochemists, physicists and many others in an exciting environment of interdisciplinary research and education for revolutionary new discoveries in biotechnology, nanotechnology, and sensing. This unique RII program and effort introduces new equipment and highly capable faculty to each center, extending opportunities for research, education, and collaborations. RII awards distributed for 2009 and after required a 50% cost share by participating institutions. The Track 1 Cooperative Agreement Alabama received in September 2008 for $15M required no cost share.

The mission of the NSF RII-3 is to establish a self sustaining multi-campus consortium for nanobiological sensor research and education for the State of Alabama, with an infrastructure of nationally competitive research centers. A statewide partnership implemented an integrated, statewide partnership among the core ALEPSCoR academic institutions: Alabama A&M University (AAMU) (an HBCU), Auburn University (AU), Tuskegee University (TU) (an HBCU), the University of Alabama (UA), the University of Alabama at Birmingham (UAB), the University of Alabama in Huntsville (UAH), and the University of South Alabama (USA) has been implemented. Several centers have initiated the ALEPSCoR plan with the RII program, a coordinated cross discipline effort to enhance competitiveness in the emerging area of nanobiological science and sensors at the interface of molecular biology, molecular sensors and detection technology, nanomaterials, and nanoscale engineering. A summary of each of the NSF Centers is described on the following pages.
ALABAMA CENTER FOR NANOSTRUCTURED MATERIALS

ACNM comprises Tuskegee University (TU), Alabama A&M University (AAMU), Auburn University (AU), University of Alabama Huntsville (UAH), and University of South Alabama (USA). ACNM seeks fundamental understanding of nanocomposites at the molecular level. Research will: (i) determine the effects of chemical bonding between particles and polymers; (ii) investigate structure property relationships through atomistic and rheological studies; (iii) develop nanophased carbon/carbon composites; and (iv) evaluate the durability and characterize the dynamic behavior of nanophased composites.

Researchers of ACNM are involved with three main focus areas which include polymeric nanocomposites, synthesis of nanoparticles for drug delivery applications and advanced green composites. In the current year, we have utilized carbon nanotubes, nanoclay and fabricated fiber reinforced polymeric nanocomposites and characterized their mechanical, thermal and morphological properties. There has been a significant increase in the properties of these materials. The studies on the environmental effect have been extended to include the effect of ultraviolet radiation. It has been seen that nanophased composites improve resistance to degradation to UV effects. Studies on the functionalization of nanotubes showed that there is significant improvement in nanotube dispersion by the creation of steric hindrance between nanotubes and also improved interfacial interaction between the nanomaterials and polymer. In order to improve the directional properties of nanocomposites, it is essential that nanotubes or nanofibers are properly aligned. Toward this goal, an experimental setting for aligning CNF/epoxy under a 3000X optical microscope was accomplished which allows us to control the electrical strength and frequency.

Rheological characterization of nanophased polymers is in progress. This study will give important feedback on the processing aspects of nanocomposites. Nanomagnetite (NM) was successfully used as an additive in cellulose fibers with the purpose to reinforce the fibers and add magnetic properties. These fibers can be used in medical applications such as drug delivery systems. Cellulose/conductive polymers are applicable for smart textile and sensor applications. Kenaf fiber reinforced biopolymeric nanocomposites were fabricated and characterized for their mechanical and thermal properties. Polyester based biopolymers were utilized and optimized. Surface modification of jute fibers was accomplished by performing subsequent chemical treatments such as detergent washing, dewaxing, alkali, and acetic acid treatment. Magnetic nanoparticles that can be loaded with cancer therapy drugs such as Doxorubicin and Taxol and directed to the desired site with an external magnetic field were synthesized. Current studies have focused on the toxicity of these nanoparticles.

We have organized symposia and international conferences. TU and UAB faculty hosted an Advanced Green Composites Workshop in June 2009 attended by over 50 participants. Through partnership building activities, Tuskegee invited four eminent international researchers from Bangladesh, China, India and UK to present seminars to encourage student participation in research across continents as well as establish long term collaborative relations. Other outreach activities organized with AEOI included Nanobio Science Academy for Teachers (NBSAT) in June 2009, Research Experience for Teachers (RET), Research Experience for Undergraduate (REU), mentoring workshops for graduate and undergraduate students, Science and Technology Open House, visitation for highschoolers, and Science Olympiad. In all these activities, graduate students were involved.

For more information, see http://www.tuskegee.edu/Global.story.asp?S=3612502.
CENTER FOR ENVIRONMENTAL AND CELLULAR SIGNAL TRANSDUCTION

The CECST is a multi-institutional center involving AU, AAMU, TU and UAB. The CECST concept evolved from and is built upon the foundation of the AU Cellular and Molecular Biosciences (AU-CMB) ‘Peak of Excellence’ program, which provides administrative structure for the center and represents a commitment by AU to move both the institution and the State forward in this new ‘century of biology.’ Goals of the AU-CMB program, which complement those of ALEPSCoR, are to foster innovative interdisciplinary research and educational efforts in the cellular and molecular biosciences by developing human and technical resources necessary to achieve, sustain and enhance national competitiveness in bioscience disciplines, with an emphasis on discovery.

The CECST continues to evolve towards a greater degree of integration between the fields of Molecular Biology and NanoScience, particularly in the area of Bio-Nano Materials. With the addition of two new investigators from the Department of Chemical Engineering, Drs. Elizabeth Lipke and Virginia Davis, the CECST continues to expand outward from the core discipline of Molecular Biology to the interface between biomolecules and cells and nano-particles. The CECST is directing more resources to projects such as the manufacturing and characterization of nano-materials for use as scaffolds for directed stem cell development and tissue repair in organ systems (heart and major blood vessels: Lipke), and the characterization and effectiveness of metallo-nanoparticles in large molecular polymers (nucleic acids) for use in antimicrobial films (Davis). Other areas of research on the interface between molecular biology and nano-science continue to be strengthened: the development of RNA-based gels for the delivery of biologically active compounds (Wower), and the engineering of the mammalian (murine) mitochondrial genome for expression by the nuclear genome for the study of mitochondrial dysfunction and disease (Pinkert). The Center has also maintained its focus on certain areas of molecular bioscience, specifically 1) gene flow and transfer at the ecosystem level through funding of faculty and graduate students on a research cruise in the Gulf of Mexico to study large-scale phylogenetic relationships of deep-sea methane seep symbiotic associations, 2) hormonal regulation of mammalian development, 3) the characterization of potential model systems of study through the development of molecular tools (cDNA libraries and microarrays) in vertebrate and invertebrate systems, and 4) the regulation of environmentally mediated gene expression in microbes, plants, and animals.

In the areas of education outreach, the CECST is channeling more resources to its most successful endeavor, the Teaching Enhancement Award (TEA) program. In year 2, all faculty mentors will receive $5,000, either in the form of one month summer salary or supplies. This will serve as an incentive to retain our most successful faculty and attract new faculty mentors to the program. With regard to our undergraduate summer research program (USRS – Undergraduate Summer Research Scholars), another highly successful program, we have expanded the number of students supported from 6 to 10. Also, to allow for a smoother transition in our graduate student training program (GRSP), we are now calling for applications in early spring, and making awards in June for the upcoming academic year. This will avoid the previously existing conflict between assigning students to either Research Fellowships or Teaching Assistantships.

For more information, see http://www.auburn.edu/cmb/.
Center for Optical Sensors and Spectroscopies (COSS)

The Center for Optical Sensors and Spectroscopies (COSS) is a multi-institutional Center consisting of researchers and facilities from UAB, UA, and UAH. The mission of the COSS is to promote optical sensing and spectroscopy research on environmental, biomedical, and national security issues through collaborative use of resources and expertise among the member universities, government and industrial laboratories, and improve sensor techniques using recently developed revolutionary laser and spectroscopic technologies. The recent oil spill off of the southeast coast affecting LA, MS, and AL has highlighted the critical need for rapid environmental monitoring of hazardous wastes and other pollutants. In the last year, COSS environmental researchers have been developing and testing methods to rapidly detect the extent of contamination of spills and discharges of hazardous organic compounds. This work is also investigating the problems associated with the aftermath of these accidents such as determining the potential hazards to responders and residents of the affected areas. Long-term potential contamination of aquatic organisms and the food supply is also of concern and can be better examined using the newly developed methods. The intellectual merit of the COSS laser based “optical nose” being developed will enable rapid and sensitive measurements of these compounds during, and after, these environmental disasters. Other applications of these technologies include biomedical applications such as the development of new non-invasive medical diagnostic methods via the analysis of the breath of patients and industrial process control. COSS is involved in the protection of optical sensors in addition to the development of optical sensors.

Recent COSS research accomplishments of the last year include the following:

- COSS researchers developed a new approach for Mid-IR fiber laser material fabrication based on transition metal doped ZnSe/As2S3:As2Se3 composite materials, and we have reported on the first room-temperature laser oscillation of these materials at 2.4 µm. This result opens a new pathway for development of a completely new class of middle-infrared fiber lasers.
- COSS researchers have reported on the first mid-IR lasing in Cr:ZnSe waveguide structures, which are attractive for chip-integrated optical laser design with diode laser excitation and electronic control of tenability. These new technologies are required for highly sensitive and portable opto-chemical sensors.
- COSS researchers have generated nanocrystals by nanoparticle beam pulsed laser deposition (NBPLD) of Cr-doped ZnSe materials for investigations as gain media for electrically-pumped mid-IR laser sources. This can lead to new battery powered, miniaturized, sensors for on-site, instant analysis of toxins (for example, at environmental spills).
- COSS researchers have developed unsymmetrical phosphine-substituted bithiophenes that can be incorporated into polymer films and attached to nanoparticles. These materials have exhibited the highest solubility and best blue sensor protection of any material to date, which can lead to new types of sensor protection methods.

The broader impact of this work is that COSS collaborative research includes partners from other Alabama EPSCoR Centers, Alabama universities, national research labs, international educational and research institutions and industrial partners.

For more information, see http://www.coss.phy.uab.edu/COSShome.html
CIDEN (Center for Interdisciplinary Discovery via Engineered Nanofabrication)

The Center for Interdisciplinary Discovery via Engineered Nanofabrication (CIDEN) is one of the newest of the Alabama Experimental Program to Stimulate Competitive Research (AL-EPSCoR) centers funded by the National Science Foundation Research Infrastructure Improvement (NSF RII-3) Grant Program. CIDEN's focus is on nanofabrication, specifically ion, photon, and electron writing and lithography, in order to support research using nanopatterning and nanostructuring on modifying materials properties to be tailored to specific applications. The research conducted at CIDEN is directed toward molecular sensors, regimented nanomaterials and nanostructures with applications in chemical, biological, and thermoelectric devices. Advances in nanoscale detection and manipulation will open new frontiers in the sciences and technology.

In line with the CIDEN’s research objective, ongoing efforts aimed at tailoring materials at the nanoscale are in progress to enhance energy conversion, sensing, and biological properties of novel nanostructures. We produced a large number of publications in peer-reviewed journals. In the maturing research areas we are seeking patentable material and possible commercialization. Experimental evidence of surface plasmon resonance of nanometric metallic layers was obtained. This opens the possibility of developing optically interrogated hazardous gas sensors. Technological advances and new designs have been made in developing liquid crystal based chemical sensors that can give a quick visual feedback. Nanoporous ceramic membranes for SERS studies have been successfully developed. Carbon nanotube functional devices were demonstrated. Current efforts are in developing technological processes for wafer-scale fabrication. Phosphine functionalized nonlinear optical absorber materials have been successfully synthesized and their optical response is currently being tested in the blue spectral region. Biological tissue growth on biocompatible (carbon based) materials has been successfully controlled. Durability for extended periods of time is currently investigated. Most Year 2 goals have been reached, including previously stated scientific milestones on existing projects, organizing annual meetings, purchase/ordering of major equipment (PBW system), and the recruiting of new students at all levels. Progress is being made in new projects and by recruiting junior faculty.

This year’s activities have more than doubled from last (first) year, as teams from all campuses presented at common conferences, workshops, and open houses. Collaborative external funding seeking (proposal writing) also increased as new partnerships evolved. CIDEN organized and co-sponsored the STTR/SBIR meeting at AAMU. Three students (2 graduate, 1 undergraduate) were provided financial support to attend and present at MRS-09. One graduate student was provided financial support to attend and present two oral contributions at TMS-2010. Four graduate students were provided financial support to attend and present two oral contributions at TMS-2010. Four graduate students were provided financial support to attend the MRS-S10 meeting and present their contributions. CIDEN organized and co-sponsored the 2009 Huntsville Ion Beam Institute (HIBI) meeting. Summer 09 REU (6), REH (1), RET (1) projects were hosted at AAMU and UA. Summer workshops with undergraduate and high school involvement were carried out at all four campuses. All students involved in research activities were required to submit abstracts for the MRS and TMS meetings (7/8 accepted, 3 to print). Also, 15 student abstracts were submitted to the CAARI 2010 meeting. This process exposes them to the larger scientific community while also maintaining a relationship and involvement with CIDEN beyond the summer internship. CIDEN held an S&T workshop in December 2009.

For more information, see http://www2.aamu.edu/alepscor/centers.html.
AEOI RII-3 Center

The cross cutting ALEPSCoR Outreach Initiative (AEOI) coordinates, and collects data on, education, diversity, outreach/partnering and workforce development efforts. The AEOI was included in ALEPSCoR’s RII-3 to serve the research centers and workforce development pipeline relevant to the nanotechnology, biotechnology, sensors science and technology foci. As part of the RII-3, the AEOI mission is to: 1) enhance the nanobiosensor educational infrastructure in both formal and informal settings across all learning levels, and 2) increase the diversity of people engaged in nanobiosensor education and research. Overarching AEOI goals with respect to the RII are to: 1) develop a database/clearinghouse of existing education/outreach efforts across the state, 2) develop a coordinated suite of educational materials in nanobiosensors, 3) implement nanobiosensor outreach activities for teachers, students, and others, and 4) develop collaborations to encourage participation of minorities in nanobiosensors at the college level.

The AEOI’s research component investigates and evaluates the effectiveness of education outreach initiatives to generate K-16, governmental and private sector center collaborations. The research is identifying key issues from leaders in STEM education, and developing K-12 and higher education research partnership models. The primary goal of this activity is to draw the best ideas into the ALEPSCoR outreach initiative while casting off those that do not yield acceptable results. Research focuses on understanding and overcoming key problems that prevent or impede building bridges between primary, secondary, and higher education. Since construction of such bridges is the motivation behind the AEOI, understanding known or perceived structural problems is paramount.

In FY 2009, AEOI supported a number of components including: The Educational Component which involved: (a) the Math Advancement Programs (MAP) at Alabama A&M University (AAMU) and University of Alabama (UA) introducing nano-bio-sensor theory through hands-on learning experiences, (b) the training of graduate and undergraduate students as mentors for education, outreach and diversity programs, (c) the donation of inquiry based learning modules introducing basic RII Nano-Bio-Sensor concepts to the Alabama Engineering Academy, Science in Motion, and for undergraduate laboratory usage; and (d) assisting RII Centers with plan development and to examine the feasibility for introducing new joint courses. The Outreach Component included (a) an RII Open House held at Tuskegee University (TU) with more than 200 attendees, (b) a High School S&T Workshop at AAMU exceeding 150 attendees, (c) a Graduate Student Workshop at TU and one planned for UA, (d) training and awareness activities for faculty related to Nano-Bio-Sensors EOD, (e) a Boys State Introduction to Sustainability and RII Research, (f) identifying experienced EOD groups as potential collaborators for centers; and (g) a new experimental outreach program to address Advisory Board recommendations for developing and testing RII focused traveling demonstrations, working with nationally recognized NISE-Net and EOD Programs, and for initiating a Competitive EOD Program to serve as a platform for new ideas. The Diversity Component primarily involved (a) an Introduction to Research Experiences for more 60 Students and 17 institutions led by TU and UA for “Developing Skill Sets in STEM” and “Introducing Nano-Bio-Sensor Content”, and (b) a Nano-Bio Science Academy for 29 plus Teachers that may be expanded as part of a Black Belt Regional Minority Teacher Led Math Science Partnership activity. The Educational Research Component led by AEOI staff at the UA that supported (a) general human resources data collection and assessment for the RII, (b) development of metrics for both component activity and longitudinal tracking, (c) development of an on-line evaluation system available to program participants including nationally recognized motivation assessments and nationally recognized surveys for capturing participant motivation for assessing “impact”, (d) development of an experimental outreach program to address Advisory Board recommendations for developing and testing RII focused traveling demonstrations, working with nationally recognized NISE-Net and EOD Programs, and for initiating a Competitive EOD Program to serve as a platform for new ideas. The Diversity Component primarily involved (a) an Introduction to Research Experiences for more 60 Students and 17 institutions led by TU and UA for “Developing Skill Sets in STEM” and “Introducing Nano-Bio-Sensor Content”, and (b) a Nano-Bio Science Academy for 29 plus Teachers that may be expanded as part of a Black Belt Regional Minority Teacher Led Math Science Partnership activity. The Educational Research Component led by AEOI staff at the UA that supported (a) general human resources data collection and assessment for the RII, (b) development of metrics for both component activity and longitudinal tracking, (c) development of an on-line evaluation system available to program participants including nationally recognized motivation assessments and nationally recognized surveys for capturing participant motivation for assessing “impact”, (d) the development of an Alabama RII Nano-Bio Sensors clearinghouse to generate awareness of programs and identify priority areas for pipeline development activity opportunities, and (e) a national cross jurisdictional EPSCoR EOD clearinghouse to support and advance all EPSCoR EOD programs.

In addition, the AEOI assists the research centers and
ALEPSCoR Program in addressing a number of the objectives listed in the ALEPSCoR RII-3 Strategic Plan, supports continued development of the AEOI Strategic Plan, and assists AAMU as directed with coordination of the RII Partnership Building Program.

During FY 2009, more than 1,300 education, outreach, diversity participants were involved in the ALEPSCoR RII. Participants came from over 67 counties within Alabama, 28 jurisdictions, and 11 countries. As part of activities to assess minimum criteria for nano-bio-sensor pipeline programs, data indicates 30 disciplines and 24 sub-disciplines were represented in expanding science areas, arts, mathematics, education, and engineering. The expanded network contributed to a growing connectivity of the research centers and the synergistic nature of research performed. More than $4 million was leveraged for AEOI RII EOD activities. Five proposals were submitted through AEOI support, two funded, and three journal articles generated to assist in the area of human resource development.

For more information, log onto http://aeoi.eng.ua.edu.

GRADUATE STUDENT WORKSHOP 2009

A half day Graduate Student Workshop was conducted on November 21, 2009 at Tuskegee University’s Kellogg Conference Center. The event was sponsored by the Alabama Experimental Program to Stimulate Competitive Research (ALEPSCoR), a statewide program funded through the National Science Foundation to build infrastructure, including human infrastructure, essential to making Alabama globally competitive in science and technology. Students in attendance were from Alabama A&M University, Tuskegee University, and the University of Alabama either pursuing or desiring to pursue degrees in the fields of biology, chemistry, physics and engineering.

The format of the Graduate Student Workshop allows for the host university to both encourage and assist undergraduate students to consider graduate school by providing tools needed for them to be successful candidates for enrollment at any graduate institution, to build an intellectual community among the next generation of engineers and scientists, to foster collegial networks, to promote constructive dialogue between undergraduate and graduate students in science and technology fields, and to discuss exciting concepts of student research projects.

This year’s program consisted of panel presentations by Ph.D. candidates: Cydale Smith, Alabama A&M University; Mary Ellen Moore and Tarig Hassan, Tuskegee University; and Brad Wilson, The University of Alabama. There were also poster sessions, and informal discussions over shared meals.

Science and Technology Open House

The Science and Technology Open House was held on October 24, 2009 at Tuskegee University’s Kellogg Conference Center. The theme of the Science and Technology Open House was “Advancing Science and Technology in Alabama”. The purpose of the Open House was to share with the community (K-12 students, teachers and parents from selected schools), activities at the four EPSCoR Centers and provided the opportunity for EPSCoR (Experimental Programs to Stimulate Competitive Research) Centers to highlight work on campuses throughout Alabama in nano/bio. The Open House was an excellent opportunity for students and teachers to meet with researchers from various universities, and created an opportunity for networking, collaboration, sharing of information and the building of trust relationships.

Along with Dr. Shaik Jeelani, TU Vice President of Research and Sponsored Programs, and Dr. Daryush Ila, then Alabama EPSCoR Executive Director, two elected officials from the Alabama House of Representatives, Representative Pebblin Warren, 82nd District and Representative and Thad McClammy, 76th District gave the purpose and welcome to an audience of 150 scientists, students, and teachers from across Alabama. The presenters included the Center Directors: Dr. Mahesh Hosur, Alabama Center for Nanostructured Materials (ACNM) of Tuskegee University; Dr. Christopher Lawson, Center for Optical Sensors and Spectroscopies (COSS) of University of Alabama Birmingham; Dr. Frank Bartol, Center for Environmental and Cellular Signal Transduction (CECST) of Auburn University; and Dr. Claudiu I. Muntele, Center for Interdisciplinary Discovery via Engineered Nano-fabrication (CIDEN) of Alabama A&M University. The featured speaker for the Science and Technology Open House was Dr. Wade Adams, Director of the Richard E. Smalley Institute for Nanoscale Science and Technology of Rice University.

Institutions represented were Auburn University, Alabama A&M University, Calhoun Community College, Tuskegee University, University of Alabama, University of Alabama at Birmingham, University of Alabama in Huntsville and University of South Alabama. Representation from AMSTI (Alabama Math & Science Technology Initiative), McWane Science Center, SECME, VivoB BioSciences who provided exhibits and hands on activities for the students. School districts in Bullock, Lee, Macon, and Montgomery counties were also well represented.
NSF Co-funded awards provide Alabama researchers and institutions another opportunity to obtain federal NSF EPSCoR funds. When a proposal is sent to a NSF Directorate and found meritorious, opportunities within NSF exist for support of the project to be jointly funded by the specific NSF Directorate and the NSF EPSCoR office. In 2009, new direct co-funding awards totaled $3.4M with a balance of $3.3M from other NSF Directorates. A total of 22 funded projects were awarded to six of the seven EPSCoR institutions, (AAMU, AU, TU, UA, UAB, and USA), as well as Alabama State University and Alabama Southern Community College, these include: two GOALI awards, three Faculty Early Career Development (CAREER) awards; one Research Experience for Undergraduates (REU) award; one Research in Undergraduate Institutions (RUI), and three awards to encourage students with disabilities to enter STEM (Science Technology, Engineering and Mathematics) fields.

Grant Opportunities for Academic Liaison with Industry (GOALI) promotes university-industry partnerships by making project funds or fellowships/traineeships available to support an eclectic mix of industry-university linkages. Special interest is focused on affording the opportunity for: 1) faculty, postdoctoral fellows, and students to conduct research and gain experience in an industrial setting; 2) industrial scientists and engineers to bring industry’s perspective and integrative skills to academe; and 3) interdisciplinary university-industry teams to conduct research projects. This program targets high-risk/high-gain research with a focus on fundamental research, new approaches to solving generic problems, development of innovative collaborative industry-university educational programs, and direct transfer of new knowledge between academe and industry. GOALI seeks to fund transformative research that lies beyond that which industry would normally fund.

CAREER awards are NSF’s most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research within their organizations. These activities start the foundation for a lifetime of leadership in education and research.

REUs support research participation by undergraduate students in any of the research areas supported by NSF. A REU Site may be either an independent project that engages a large number of undergraduate students with a single discipline or academic department with a single theme; or as an REU Supplement that includes an undergraduate research component to a new or already existing NSF grant or cooperative agreement.

The Research in Undergraduate Institutions (RUI) activity supports research by faculty members of predominantly undergraduate institutions through the funding of: 1) individual and collaborative research projects, 2) the purchase of shared-use research instrumentation, and 3) Research Opportunity Awards for work with NSF-supported investigators at other institutions. Eligible “predominantly undergraduate” institutions include U.S. two-year, four-year, masters-level, and small doctoral colleges and universities that (1) grant baccalaureate degrees in NSF-supported fields, or provide programs of instruction for students pursuing such degrees with institutional transfers (e.g., two-year schools), (2) have undergraduate enrollment exceeding graduate enrollment, and (3) award an average of no more than 10 Ph.D. or D.Sc. degrees per year in all NSF-supportable disciplines.

A brief description of a few NSF Co-funded projects listed at right are included in this section.
### New NSF Co-funding Awards in 2009

<table>
<thead>
<tr>
<th>Inst.</th>
<th>PI</th>
<th>EPScOR CF</th>
<th>Total NSF Award</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAMU</td>
<td>Okafor, Florence</td>
<td>74,710</td>
<td>149,420</td>
<td>Targeted Infusion: Acquisition of a 90-MHz FT-NMR Spectrometer to Enhance Current Curriculum and Research in Order to Achieve ACS Accreditation in the Chemistry Program at AAMU</td>
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<td>ASU</td>
<td>Pettis</td>
<td>164,000</td>
<td>203,499</td>
<td>Collaborative Research: Alabama Alliance for Students with Disabilities in STEM</td>
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<tr>
<td>AU</td>
<td>Jenda</td>
<td>442,946</td>
<td>1,310,207</td>
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<td>AU</td>
<td>Qin</td>
<td>100,000</td>
<td>200,000</td>
<td>CSR: Small: Collaborative Research: FastStor: Data-Mining-Based Multilayer Prefetching for Hybrid Storage Systems</td>
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<td>AU</td>
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<td>200,000</td>
<td>400,000</td>
<td>CAREER: Multicore-Based Parallel Disk Systems for Large-Scale Data-Intensive Computing</td>
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<td>AU</td>
<td>Wang</td>
<td>75,000</td>
<td>182,025</td>
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<td>TU</td>
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<td>230,263</td>
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<td>TU</td>
<td>Gray-Singh</td>
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<td>161,510</td>
<td>Targeted Infusion Project: Building a Biology Genomics Concentration at Tuskegee University</td>
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<td>TU</td>
<td>He</td>
<td>49,000</td>
<td>98,000</td>
<td>Collaborative Research: GOALI: A New Advanced Process Control Framework for Next-Generation High-Mix Semiconductor</td>
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<td>TU</td>
<td>Bolden-Tiller</td>
<td>118,270</td>
<td>236,359</td>
<td>REU Site: Tuskegee University Integrative Biosciences Research Experience for Undergraduates (IBS REU) Site</td>
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<tr>
<td>UA</td>
<td>Clark</td>
<td>93,838</td>
<td>199,717</td>
<td>Phylogenetics and taxonomic revision of the neotropical genus Drymonia (Gesneriaceae, tribe Episcieae)</td>
</tr>
<tr>
<td>UA</td>
<td>Jennings</td>
<td>275,000</td>
<td>275,000</td>
<td>CAREER: Novel diastereoselective bond forming reactions via silicate intermediates</td>
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<td>UA</td>
<td>Snowden</td>
<td>275,000</td>
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<td>CAREER: New Synthetic Applications of Trichloromethyl Carbinols</td>
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<td>UA</td>
<td>Schwartz</td>
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<td>282,157</td>
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<td>UA</td>
<td>Masterlark</td>
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<td>Collaborative research: Unraveling coseismic and postseismic deformation: A prerequisite for analyses of stress-coupling and</td>
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<td>UA</td>
<td>LeCount</td>
<td>112,989</td>
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<td>Households and the Institutionalization of Ancient Maya Kingship at Actuncan, Belize</td>
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<td>UA</td>
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<td>Magnetic-Fluorescent Bifunctional Nanoparticles for Biomedical</td>
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<td>UA</td>
<td>Kung</td>
<td>171,774</td>
<td>408,871</td>
<td>Investigation of the Metalorganic Vapor Phase Epitaxy of AlInN</td>
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<td>UAB</td>
<td>Jones, Sharyn</td>
<td>160,846</td>
<td>346,132</td>
<td>A long-term perspective on marine biodiversity and conservation: Interdisciplinary fieldschool in the Lau Group, Fiji</td>
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<td>USA</td>
<td>Coym</td>
<td>82,456</td>
<td>82,456</td>
<td>RUI: Novel Mobile Phase Additives for Reversed-phase Liquid</td>
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<td>USA</td>
<td>Stenson, Alexandra</td>
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<td>103,000</td>
<td>RUI: Analytical Method Development for MSn Characterization of Humic Substances</td>
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<td>3,354,142</td>
<td>7,955,891</td>
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Alabama A&M University seeks to acquire a 90-MHz Fourier Transform Nuclear Magnetic Resonance (FT-NMR) Spectrometer for the program in Chemistry to develop and enhance undergraduate student research, as well as develop and disseminate NMR modules to enhance chemistry program curricula. The chemistry program seeks to gain approval from the American Chemical Society-Committee on Professional Training (ACS-CPT). To gain ACS-CPT approval, university chemistry programs must have a functioning NMR spectrometer that undergraduates use in instruction and research. With this instrumentation, STEM students at Alabama A&M will have hands-on experience with a powerful research instrument and will be better equipped to matriculate to graduate school or to enter the scientific and technological workforce. This project seeks to increase the number of minority Chemistry graduates and thus will be an asset to the surrounding scientific and research communities in Huntsville and northern Alabama.

The proposed activity will improve the undergraduate research program, and offer course enhancements and laboratory experiments that previously were not available. These efforts will result in contributions to biodiesel analysis, and the structure and reactivity of ozonized unsaturated fatty acids. Additionally, new teaching paradigms will be developed that can be applied to all academic STEM programs.

A large number of existing parallel storage systems consist of hybrid storage components, including solid-state drives (SSD), hard disks (HDD), and tapes. Compared with high-speed storage components (e.g. SSD and HDD), tapes inevitably become an I/O (interoperability) performance bottleneck. Prefetching and caching are commonly employed techniques to boost I/O performance by increasing the data hitting rate of high-end storage components. However, prefetching in the context of hybrid storage systems is technically challenging due to an interesting dilemma: aggressive prefetching schemes can efficiently reduce I/O latency, whereas overaggressive schemes may waste I/O bandwidth by transferring useless data from HDDs to SSDs or from tapes to HDDs. In this research project, called FastStor, we investigate new data-mining-based multilayer prefetching techniques to improve performance of hybrid storage systems. The goals of this research are to (1) design data-mining algorithms for multilayer prefetching; (2) develop predictive parallel prefetching mechanism for SSD-based storage systems; (3) implement parallel data transfer among SSDs, HDDs, and tapes; (4) develop meta-data management schemes; and (5) implement a simulation framework named FastStor-SIM. The developed tool kit can be used to improve the I/O performance of data centers with hybrid storage systems. The research findings of this project are published in conferences or journals for public knowledge. Through the collaboration of Auburn University, South Dakota School of Mines and Technology, and the University of Southern Mississippi, PIs promote learning and training by exposing graduate and undergraduate students to technological underpinnings in the fields of storage systems.
(NPT)²--BUILDING A TECHNOLOGICALLY ADVANCED PULP, PAPER, AND ALLIED INDUSTRIES WORKFORCE AND CONTRIBUTING TO THE DEVELOPMENT OF THE NATION’S RENEWABLE ENERGY CAPACITY

Charles Shepherd
Alabama Southern Community College

The National Network for Pulp and Paper Technology Training (NPT)², with four regional nodes and 15 community colleges, provides the pulp and paper sector of the U.S. forest products industry with a globally competitive, technologically advanced workforce through recruiting, retaining and placing students; developing and implementing standards, certificates, curriculum and professional development; and disseminating products to other community colleges. The National Network increases outreach to employers, professional organizations, colleges and high schools including the development and approval of standards and certifications. The curriculum is expanded to include standards, curriculum materials and professional development that emphasize the wood-based renewable energy used in pulp and paper mills that can be used nationally to reduce dependence on petroleum. Goals for recruitment and professional development workshops for high school faculty and include at least 200 new students per year with 35% being from underrepresented groups and 40% from rural areas and with 70% completing the program. The goal of 70% of the graduates being employed within six months of graduation is implemented through research on the return on investment by companies from hiring graduates of the program.

COLLABORATIVE RESEARCH: ALABAMA ALLIANCE FOR STUDENTS WITH DISABILITIES IN STEM

Dr. Overtoun Jenda, Associate Provost for Diversity and Multicultural Affairs, Auburn University

Dr. Carl Pettis
Mathematics, ASU

Dr. Mohammed Qazi
Mathematics, TU

The “Alabama Alliance for Students with Disabilities in STEM” is a collaborative effort involving Auburn University, Tuskegee University, Alabama State University, and Auburn University at Montgomery, Central Alabama Community College, Southern Union Community College, the Alabama Institute for the Deaf and Blind, and six school districts in East-Central Alabama: Lee, Chambers, Elmore, Montgomery, Macon, and Tallapoosa County school systems. The Alliance has the following four major goals: 1) Increase the quality of students with disabilities completing Associate and Baccalaureate degrees in STEM Disciplines; 2) Increase the number of students with disabilities completing Associate and Baccalaureate Degrees in STEM disciplines and entering STEM graduate degrees or the STEM workforce; 3) Increase the number of students with disabilities completing Graduate Degrees in STEM disciplines; and 4) Increase the number of high school students with disabilities going to college.

This unique Alliance, which includes two HBCUs, Tuskegee University and Alabama State University, builds upon established STEM bridge programs to include female and minority students with disabilities. The Alabama Alliance has an internal evaluation team and an external evaluator who will lead the independent formative and summative project evaluations, Dr. Abbot Packard, from the University of West Georgia.
To improve disk interoperability (I/O) performance, one may integrate multicore processors with parallel disk systems. Unfortunately, architectures and data processing algorithms for multicore-based parallel disk systems are still in their infancy. This motivates us to develop novel architectures for parallel disk systems, where significant multicore processing power and memory are integrated into parallel disk drives. This CAREER project provides the first parallel disk system in which large parts of data and I/O processing are offloaded to multicore processors, embedded in disk drives. The proposed techniques and mechanisms are highly adaptive to dynamic workloads with both large and small disk requests, making modern parallel disk systems leverage multicore processors for better performance and scalability.

The overall objective of this CAREER Development project is to build hardware and software parallel disk architectures that put substantial multicore computing power on disks. The research consists of three basic tasks: (1) designing hardware and software architectures storage systems laboratory; (2) developing new courses; (3) multicore-based data processing techniques, and (3) building software performance models and an analysis tool kit. The educational plan includes: (1) establishing a storage systems laboratory; (2) developing new courses; (3) implementing the concept of a mini-conference to educate students; and (4) increasing underrepresented student involvement in research activities. In addition, the project would benefit society by developing hardware and software modules for next-generation parallel disk systems, where multicore processors and disk drives are tightly integrated to boost disk I/O performance.

The primary goal of this collaborative GOALI (Grant Opportunities for Academic Liaison) research is to develop and validate a novel non-threaded advanced process control (APC) framework for next-generation high-mix semiconductor manufacturing. Semiconductor technology lies at the heart of the revolution in computing, communications, consumer electronics, transportation and health care. In the last decade, diversified demand from consumers has been pushing the semiconductor industry to produce many differentiated products. As a result, multi-product-multi-tool (‘high-mix’) manufacturing has become increasingly the standard manufacturing model, which poses many challenges that the current APC framework cannot address. The PIs plan is to research the fields of run-to-run (RtR) control, control performance assessment (CPA), and statistical process monitoring (SPM) to meet the emerging needs in high-mix production.

The research will create a non-threaded paradigm for high-mix semiconductor manufacturing by breaking from the current tradition of threaded APC, and provide new theories and techniques to address the challenges posed by high-mix production. By sharing information among different threads and different APC components, monitoring and control performance will be greatly improved and the number of required models will be significantly reduced. Because few restrictions were posed during the framework development, the proposed framework is not limited to the semiconductor processes, instead, it can also be applied to the batch-oriented pharmaceutical, specialty chemical, and polymer industries and could inspire new solutions and research directions in general batch process monitoring and control.
TARGETED INFUSION PROJECT: BUILDING A BIOLOGY GENOMICS CONCENTRATION AT TUSKEEGERE UNIVERSITY
Dr. Danielle Gray-Singh
Biology Department Head, TU

The Tuskegee University (TU) HBCU-UP Targeted Infusion Project (TIP) will infuse genomics into the undergraduate curriculum of the Biology Department. This TIP will provide highly interactive, inquiry-based approaches to acquaint students with the emerging field of genomics. To accomplish this goal, one introductory course and two advanced level genomics courses will be developed and newly designed genomics modules will be incorporated into existing courses including: Advanced Genetics, Advanced Biotechnology, Molecular and Cell Biology, Botany, Microbiology, and Research Methodology. In parallel, a series of complementary project laboratories will be developed to provide students hands-on, minds-on experience with genomics research and facilitate current research activities of faculty and students at TU. Students enrolled in these courses will be better prepared to enter the 21st century scientific workforce, particularly in the emerging fields of genomics. The teaching materials (including hypertexted laboratory manuals) developed at TU will be disseminated via open access courses, presentations, publications, and workshops for faculty members. The TU-TIP project will provide educational innovations for universities and colleges nationwide.

REU SITE: TUSKEEGERE UNIVERSITY INTEGRATIVE BIOSCIENCE RESEARCH EXPERIENCE FOR UNDERGRADUATES (IBS) SITE
Dr. Olga Bolden-Tiller
Animal and Poultry Sciences, TU

The TU-REU Site will provide a research program for undergraduates during the summers of 2009-11. Eight students will be selected each year to participate in a 10-week research program in the area of integrative biosciences. Students who are rising juniors or seniors are eligible to apply. Students who do not have research programs at their institutions or are from underrepresented minority groups are especially encouraged to apply. Participants can select from a number of research projects on plant genomics, biocomplexity in the environment, computational biology and bioinformatics, animal sciences and cell/molecular biology. Aside from an intensive mentored research experience in integrative biosciences research, which is defined as involving the integration of two or more science disciplines, students will be able to participate in an orientation session, an Introduction to Research course, an Ethics in Science component, a Research Certification and Safety Training program, a GRE preparation workshop, and seminars in professional development skills. A field trip will also occur during the course of the program. At the completion of the summer, the participants will write and present a report of their research projects. Research stipends, housing and travel will be provided.

PHYLOGENETICS AND TAXONOMIC REVISION OF THE NEOTROPICAL GENUS DRYMONIA (GESNERIACEAE, TRIBE EPISCIEAE)
Dr. John Clark
Biology, UA

This project will produce a framework for studying a fascinating example of flower and fruit diversification in a poorly studied plant group from the tropical rainforests of Central and South America. Most species in the target group (genus Drymonia in the flowering plant family Gesneriaceae) are rarely collected and inadequately known. Many of the species that will be studied have never been photographed and at least ten species are new to science. Molecular data will be generated to assess recently diversified lineages to answer questions on the origins of fruit and flower morphologies.

Results from this project will document plant diversity from ecosystems that are critically endangered. Exploratory collecting expeditions will be conducted in Panama, Costa Rica, Peru, and French Guiana where targeted areas represent significant gaps in our knowledge of plant diversity. Training opportunities will be given to one doctoral candidate in field and lab-oriented research and undergraduate students at the University of Alabama. Teachers from the Tuscaloosa City/County Schools will be exposed to a variety of experiences including assisting on field expeditions to the tropics. A live collection will be developed for conservation of rare and endangered species as well as for assessing floral features.
CAREER: NEW SYNTHETIC APPLICATIONS FOR TRICHLOROMETHYL CARBINOLS
Dr. Timothy Snowden
Chemistry, UA

This project will continue the development of methods involving gem-dichloroepoxide intermediates for the safe and economical preparation of substituted carbonyl compounds and biomolecule analogs. Established routes to such materials generally require inefficient reaction steps, expensive reagents, or dangerous reaction conditions. Studies to establish safer and shorter methods for homologating carboxylic acids and preparing beta-amino acids, deoxy-C-glycosides and amino-C-glycosides from readily available trichloromethyl carbinols will be explored. The resultant products will be evaluated in terms of yield, preparation cost, and the stereo- and regioselectivities of devised reaction steps. Structure-reactivity analyses and product analyses under carefully adjusted reaction conditions will also demonstrate how specific parameters affect the formation and reactivity of the transient gem-dichloroepoxide intermediates involved in each method.

COLLABORATIVE RESEARCH: INVESTIGATION OF THE LATE JURASSIC PAIRED MAGMATIC BELT (BLUE MOUNTAINS, NE OREGON): EVALUATION OF MAGMATIC GROWTH DURING CONTRACTIONAL OROGENY
Dr. Joshua Schwartz
Geology, UA

The main goal of this research project is to understand the origin of plutons and batholiths in the Blue Mountains province of northeastern Oregon with important chemical characteristics (low Sr/Y, Na, Al, Sr, and high Y, in contrast to high Sr/Y, Na, Al, Sr, and low Y). In addition, the group study the significance of crustal deformation events involving arc-arc and arc-continent collision. High and low Sr/Y plutons occupy large areas in ancient and modern orogenic belts, such as in the Appalachian Mountains, New Zealand, and the Sierra Nevada, yet considerable controversy exists regarding mechanisms of their generation, the tectonic settings in which they form, and their role in the evolution of continental crust through time. Previous models have proposed that partial melting of subducting oceanic crust or lower continental crust may generate high Sr/Y magmas. This project uses structural geology, geochronology, and igneous and metamorphic petrology to test these pre-existing models, and proposes a new model in which lateral tectonic collisions of island arcs played an important role in controlling the onset and distribution of high Sr/Y magmatism. This study, if successful, will provide new insights into the mechanisms of high and low Sr/Y magma generation, their spatial and temporal distribution in orogenic belts, and their relationship to mineralization in the Blue Mountains province. This study also has broader implications for understanding changes in the Mesozoic crustal structure of the Blue Mountains province through lateral tectonic collisions.
The December 26, 2004 M9.2 Sumatra-Andaman Earthquake (SAE), the third largest earthquake ever recorded, ruptured the boundary separating the subducting Indo-Australian Plate from the overriding Burma Plate and triggered a devastating tsunami that significantly impacted 9 countries bordering the Indian Ocean. Near the epicenter, the tsunami caused over 30 meters of run-up in some coastal areas of Northern Sumatra, almost instantly killing over 200,000 people. The rupture of the SAE included more than 20 meters of fault-slip, based on associated seismologic data and GPS measurements of seafloor and ground deformation. This magnitude of deformation provides a rare opportunity to conduct a regional-scale in-situ rheological experiment, in which the coseismic fault-slip is the impulse and the subsequent deformation is the response. Modeling these measured perturbations can test hypotheses of coseismic (including tsunami-genesis) and post-seismic (including earthquake-coupling and tsunami run-up) behavior. Specifically, Finite Element Models (FEMs) of the subduction zone near the epicenter allow for a quantitative evaluation of the role of rheologic partitioning and processes, on the stress, strain, and pore pressure that govern coseismic and post-seismic behavior. Tsunami propagation models can then use FEM-generated seafloor deformations to predict coastal run-up. This modeling and interpretive study of the SAE will address the following scientific questions: 1) How does the distribution of material properties (i.e., structure, density, porosity, and stiffness of rock formations in the subduction zone) affect fault-slip estimations? 2) How does this distribution influence seafloor deformation, tsunami genesis, and run-up predictions? 3) What is the timing and distribution of poroelastic and viscoelastic post-seismic deformation? 4) What afterslip is required? 5) Do Coulomb stress and pore pressure transients correlate to aftershock occurrence? These questions are underpinned by a more fundamental question: How do we construct and constrain models of coseismic and post-seismic behavior as a synthesis of processes, all of which contribute to the deformational system? Accordingly, the primary goal of the proposed research is to determine the distribution and calibration of rheologic properties that describe coseismic and post-seismic behavior of the SAE. More specifically, FEM simulations will address aftershock occurrence in both space and time (including stress-coupling between the SAE and the March 25, 2005 M8.7 Nias earthquake that occurred 350 km away from the SAE epicenter). FEM-generated seafloor deformation predictions will drive tsunami propagation simulations. Because we expect that variations in material properties (and possibly secondary splay faulting) will cause both long and shorter scale seafloor deformations, tsunami generation and propagation simulations will be performed with the dispersive long wave model FUNWAVE. Tsunami hazards will be expressed in terms of simulated run-up and inundation for the most affected areas of the Indian Ocean (e.g., Northern Sumatra), and compared to the observed impact of the 12/26/04 tsunami. This synoptic approach to simulating coseismic and post-seismic deformational systems may significantly advance tectonic and tsunami coastal hazard assessment capabilities for the SAE and impact future assessments of similar mega-thrust earthquakes for other subduction zones hosting high population densities, such as the upper U.S. West Coast (Cascadia) and Japan. Techniques for designing and implementing FEMs will be disseminated to the scientific community during a workshop in the latter stages of this project. Students will use Abaqus software to construct FEMs that simulate fault-slip, which can be used in forward and inverse models of deformation and drive of post-seismic processes, including poroelastic and viscoelastic deformation.
Dr. Lisa LeCount and a team of international colleagues and students will conduct three field seasons of archaeological research at the ancient Maya site of Actuncan, Belize. The Actuncan Archaeological Project will examine the rise of hereditary kingship and how processes that led to centralized authority affected households during the Preclassic to Classic transition (B.C. 400 to A.D. 600). During this little known time span, many Maya sites became sufficiently large and complex to be considered archaic states. The first royal dynasties were recorded in hieroglyphic texts at the large sites such as Tikal and Copan, and rulers at smaller centers, such as Actuncan, actively commissioned the building of palaces, courts, temples, and elaborate tombs. Although most archaeologists acknowledge that a suite of causal factors led to centralized authority among the ancient Maya, the intellectual debate is polarized between materialistic approaches that view elite control over the production and distribution of resources as the source of paramount power and ideational approaches that emphasize moral and religious constructs and knowledge as the source of centralized authority. To move beyond this impasse, the project will investigate organizational changes in households as rulers increasingly centralized their authority during the Preclassic to Classic transition. A household approach to understanding the rise of Maya kingship is rarely explored, since most researchers investigating this question focus predominately on the monuments and tombs of rulers. The actions of rulers, however, cannot be fully understood without investigating households that held kin-based power through their control of land, labor and ancestral sources of religious authority. As independent sources of power, households are significant indicators of the successes and failures of political strategies to consolidate kingly authority.

While in situ siliconate formation followed by hydride reduction of an oxocarbenium cation is a synthetically very valuable tool, expansion of this initial observation to include carbon based transfers are highly desirable to the synthetic community. Thus, the possibility of siliconate formation, carbon based nucleophilic shift to an oxocarbenium cation affording new diastereoselective carbon-carbon bonds, and concomitant silylation of the initial hydroxyl ‘directing’ group is a tremendous goal that this award addresses with respect to cyclic and acyclic stereocontrol. This project will further investigate the inclusion of carbon based nucleophiles which would greatly expand the reaction sequence beyond that of a hydride reduction of the oxocarbenium cation. This type of carbon group transfer should allow for the formation of quaternary or tertiary carbons dependent of the oxocarbenium substitution pattern and will make a tremendous impact on stereocontrolled carbon-carbon bond formation. In addition, the education portion of this CAREER award will provide a ‘real world’ research experience for highly motivated, underrepresented minority high school students from rural Alabama. This award will bring these young adults into the laboratory for their first encounter with scientific research. This exposure will help foster and promote interests in future careers within the physical sciences.
Magnetic nanoparticles have significantly advanced cancer treatments through targeted drug delivery and localized therapy and further make simultaneous therapy and diagnosis possible as magnetic resonant imaging (MRI) contrast agents. Unfortunately, these applications are limited by the expensive MRI equipments, which are not available to common research laboratories. Currently, fluorescence imaging remains the primary choice for bio-imaging because of its high sensitivity. This proposal will develop magnetic-fluorescent nanoparticles which provide a single platform with therapeutic and diagnostic functions. Beyond the new possibilities of this nanostructure in biomedical fields, further findings on the photophysics of Ag nanoclusters on nanoparticle surfaces may provide valuable information to physicists and spectroscopists. The integrated nanostructures may be used for monitored magnetic removal of the contaminants from the environment. Part of the research project will be incorporated in the junior summer laboratory course (ChBE320), a five hour laboratory operation class, promoting students learning through hands-on experience, such as building alternating current (AC) magnetic coils to study the heat generation from magnetic nanoparticles and creating magnetic-fluorescent nanoparticle arrays on a chip to demonstrate the bio-sensing capability.

INVESTIGATION OF THE METALORGANIC VAPOR PHASE EPITAXY OF AlInN SEMICONDUCTORS
Dr. Patrick Kung
Electrical and Computer Engineering, UA

The project addresses fundamental research issues in a topical area of electronic/photonic materials science having technological relevance. Societal benefits of the proposed research on AlInN materials can be very broad since the specific materials being studied could support applications such as all-weather radar, surveillance, reconnaissance, high speed wireless telecommunications and automotive radar for collision warning sensors. Students will acquire fundamental research and education skills as part of this project. Additionally, the scientific concepts underlying this project will be integrated into new courses that the PI and Co-PI are developing at both undergraduate and graduate levels. In order to broaden the participation from underrepresented groups, the University proposed activity will benefit from an HBCU Workshop at The University of Alabama to reach science faculty members and educators from HBCUs, as well as a project entitled, “Broadening Participation Research Initiation Grants in Engineering” (BRIGE) program. Outreach activities to local schools and the general public will be carried out in conjunction with existing activities within The University of Alabama Center for Materials for Information Technology (MINT).

For more information regarding NSF Awards
log on to:
http://nsf.gov/awardsearch/
The Analytical and Surface Chemistry Program supports Professor Jason Coym of the University of South Alabama to explore novel additives (e.g. cholesterol) for varying selectivity and retention in reversed-phase liquid chromatography (RPLC). Perhaps the most commonly used form of liquid chromatography, RPLC is a key method for separating analytes in solution, and is used heavily in pharmaceutical and biochemical settings. The work entails dynamically coating cholesterol onto the stationary phase, as a simpler and more flexible alternative to typical covalent linkage. A parallel aim is to use cholesterol-enhanced and lipid-coated phases as membrane mimics for studies of biopartitioning.

The development of unique chromatographic selectivities, and the ability to easily modulate selectivity, is of broad interest to analytical and bioanalytical chemists. Students working on this project will gain knowledge and practice working with chromatography, physical chemistry, and biochemistry, thereby coming to realize the interdependence of the various disciplines of chemistry.

RIU- ANALYTICAL METHOD DEVELOPMENT FOR MSn CHARACTERIZATION OF HUMIC SUBSTANCES
Dr. Alexandra Stenson
Chemistry, USA

With Co-funding from the Hydrologic Sciences Program in the Division of Earth Sciences, the Analytical and Surface Chemistry Program supports Dr. Alexandra Stenson of the University of South Alabama to investigate development and use of micro-preparative chromatography followed by ultra-high resolution multi-dimensional mass spectrometry for elucidating the structural composition of humic substances of environmental importance. The most immediate stumbling block to molecular characterization of humic substances is the immense complexity of such samples. Fourier Transform-Ion Cyclotron Resonance Mass Spectrometry (FT-ICR MS) has been demonstrated to resolve individual humic ions and to provide information on the molecular level (e.g. molecular formulae). More detailed structural (vs. merely compositional) data will require multidimensional MS experiments on individual ions, an approach that is currently hindered by sample complexity. Thus, the first goal of this research is to reduce sample complexity through tailored “micro-preparative” chromatography. Metal-complexation and in-cell reactions are employed to garner further functional group information.

The lack of structural information on humic substances is presently an issue for such important environmental considerations as solid and liquid waste-management (including radioactive waste), as well as the precise detailing of metal, carbon, and nutrient-cycles. This work promises to lay the groundwork for complete structural characterization, which, once achieved, would be transforming to a plethora of environmentally important fields. Undergraduates are thoroughly involved in the work, providing extraordinary research opportunities.
Using the excitement of scientific discovery, the experience of hands-on research in a foreign setting, and the power of the Internet, the proposed project aims to enhance understanding of global culture, biological diversity, and effective strategies in science education. Over 2 summers undergraduate students will engage in interdisciplinary problem based research that is expected to generate a model of long-term dynamics in human exploitation of marine biological communities, emphasizing interactions between humans and the environment. A diverse group of undergraduates from the University of Alabama at Birmingham (UAB; a Minority Serving Institution and the lead institution for NSF’s Alabama AMP or Alliance for Minority Participation Program) and elsewhere in the U.S., will spend 6 weeks in the field and 3 weeks in the classroom and lab at UAB each summer. The team will recruit minorities to fill a significant proportion of the available positions by tapping into the diversity in student participation already present in UAB’s AMP and the McNair Scholars Program. Students’ activities and projects will include: archaeological surveys, mapping, and excavations; collecting and analyzing ethnographic data on resource exploitation and foodways; conducting lab analysis of archaeological materials; working with database systems and computer software; and interpreting data in written, digital, and oral presentations for the academic and general public. An External Advisory Committee of senior scholars will guide and monitor the progress of this REU site.

This innovative project will produce a model describing millennia of human-environmental interactions. An evolutionary perspective is afforded by our team’s expertise in ethnography, archaeology, and historical ecology, providing for the evaluation of changes in marine diversity and exploitation through time. A fundamental part of the proposed research is the collaboration of students and faculty from North America, Fiji-based collaborators, and Fijian villagers. These interactions will serve to stimulate interest in the understanding and preservation of cultural and natural resources. This site will provide a model of innovative strategies for teaching field-based sciences, for disseminating research to educators, and for evaluating the educational effectiveness of our approach. The team will develop visual digital media and contribute to technologically savvy curriculum for use in K-16 classrooms throughout the state of Alabama. Data gathered by REU students will be used in displays and presentations to the general public in collaboration with UAB, the McWane Science Center, University of the South Pacific, the Fiji Museum, and Alabama Public Television.

During a cyclone some Fijians weather the storm from their homes, often with several families clustering together in one house. Others move up the hill to a school or church. Some villagers take refuge in the caves (shown above) along the side of the collapsed volcanic cone in the center of the island, which have been used as shelters for hundreds of years.
4.0 Alabama DOE EPSCoR 2009 Update

The Alabama DOE EPSCoR program is the central coordinating unit responsible for energy-related research and human resources development issues for the state. Dr. John Steadman, Dean of the University of South Alabama's College of Engineering, serves as the program's Agency Director.

It is critical that we address energy issues in Alabama's economic development efforts. Alabama's rich energy diversity attracts industrial development and improves economic growth necessary to achieve a national competitive posture. The growth of our energy resources are based on its wise and profitable use.

Alabama universities strive to provide the educational, research and development leadership necessary to broaden the state's economic base. Significant levels of research and educational opportunities in all energy areas are found at the state's seven major Ph.D. granting universities.

Funding Opportunities

DOE EPSCoR provides funding support through the following types of awards:
- Implementation Grants are for a maximum period of six years with an initial period of three years. Maximum funding for Implementation Grants is $750,000 per year. Only one active implementation grant per state or territory is permitted at a time. Only one submission per state per notice is permitted and all Implementation Awards must be submitted through the State DOE office. There is one EPSCoR Implementation Grant Financial Assistance Notice (grant solicitation) from the Office of Science per year. Alabama was awarded a DOE Implementation Award in August 2009. Continuation funding for the awards will be contingent upon the availability of appropriated funds, progress of the research, and continuing program need. Minimum cost sharing in the amount of 50% of the DOE share of the total budget is required from non-Federal sources.

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EPSCoR-State/National Laboratory Partnership Grants are for a maximum period of three years. Maximum funding for these grants is $150,000, with ten percent required in matching funds, and only one active grant per individual investigator is permitted at a time. Multiple submissions per state and laboratory are permitted and expected. There is no limit to the number of state or laboratory submissions per year. All funding resides within the EPSCoR state and no EPSCoR funds are permitted to support DOE National Laboratory activities.

Alabama DOE EPSCoR Implementation Grant

In August 2009, Alabama DOE EPSCoR was awarded a DOE EPSCoR Implementation Award entitled, Nanostructure-Enhanced Phase Change Materials (NEPCM) Tailored for Energy Efficiency, High-Power Electronics, Thermal Storage/Comfort and Building Materials Applications, for an initial three years for $1,905,000 with a matching commitment of $1,006,859. The award is located at The University of Alabama, the institution where the proposal was submitted. Dr. John Steadman, USA, serves as the Project Director and is responsible for the Human Resource Development component. Dr. Jay Khodadadi, Mechanical Engineering Professor at Auburn University serves as the Research Cluster’s Principal Investigator. The Research Cluster collaborators include: Drs. German Mills and R.L. Jackson, Auburn University; Dr. M.A.R Sharif, The University of Alabama; Dr. Tamara Floyd-Smith, Tuskegee University; Dr. L.A. Cueva-Parra, Auburn University Montgomery; and Dr. K-T Hsiao, University of South Alabama.

The Human Resource Development component provides support for researchers to visit a DOE National Laboratory either for a brief or extended visit. This encourages researchers to establish and develop relationships with researchers at DOE National Laboratories.

Development of stable and functionality-proven NEPCM and its utilization in a wide range of energy-related applications within the framework of an inter-disciplinary DOE Research Cluster is planned. Exploiting the enhanced thermal conductivity of dilute nanoparticle suspensions is the key element to the development of this class of NEPCM. The target NEPCM will be obtained through dispersion of copper-based nanoparticles within paraffins (a group of alkane hydrocarbons). Various preparation schemes for realizing stable suspensions of copper and copper-oxide nanoparticles in paraffins are outlined. Through a series of logical chemical preparation steps, stabilized suspensions will be prepared. Thermal conductivity, viscosity, latent heat, melting temperature and specific heat measurements will be collected for the prepared suspensions. These measurements will be used to establish the stability of the prepared suspensions upon subjecting them to consecutive melting-convection-solidification cycles. In addition to the fabrication and characterization issues, closely-coordinated projects on five campuses will address challenging problems in relation to multi-scale/multi-physics noncontinuum modeling, separation/reclamation, enhancement of tribological properties of nanoparticle-laden paraffinic oils and heat dispersion properties. Particular attention will be placed on tailoring of appropriate NEPCM to diverse applications such as high-power electronics, machine efficiency, thermal storage/comfort and building materials. The multi-campus Research Cluster will complement the existing energy research in Alabama through initiating a unique high-tech energy research program, training of scientists/engineers and laying the groundwork for a variety of high-volume new products. The immediate applications of the NEPCM technology can lead to partnerships with collaborating multinationals, thus contributing to Alabama’s economic development.

October 13, 2009 NEPCM Kick-off Meeting
DOE EPSCoR State/Laboratory Partnership Awards

Alabama had three ongoing DOE State Laboratory Partnership projects, one awarded in 2007 and two awarded in 2008. These include Dr. Allen L. Landers, Auburn University; Dr. Jeffrey Fergus, Auburn University; and Dr. Patrick LeClair, The University of Alabama.

EFFECT OF SOFC INTERCONNECT-COATING INTERACTIONS ON COATING PROPERTIES AND PERFORMANCE

Dr. Jeffrey Fergus, Associate Professor of Materials Engineering at Auburn University was awarded a DOE State Laboratory Partnership award in May 2008. The project is a collaborative effort between Auburn University and Pacific Northwest National Laboratory (PNNL). Solid oxide fuel cells (SOFCs) are a promising technology for high-efficiency, low-emission energy conversion. The high operating temperature of SOFCs improves the tolerance to fuel type and purity, so that SOFCs can be used with a wide variety of fuels, including gasified coal, methane and fuels derived from renewable biological sources, such as switchgrass. The high temperature, however, also accelerates unwanted reactions, which places stringent requirements on the materials used. This project addresses one of these high temperature materials challenges – specifically, protective ceramic coatings for metallic interconnects.

INTERMETALLIC SYSTEMS

Drs. Patrick LeClair and Gary Mankey (UA) were awarded a DOE-EPSCoR State-National Laboratory partnership grant in the amount of $450,000 in June 2008 for a three year study of exchange interactions in intermetallic systems. The goal of this research is to develop a fundamental understanding of the exchange interactions in epitaxial intermetallic alloy thin films and multilayers.

The materials under study - intermetallic alloys of Fe, Pt, and Rh have a rich variety of ferromagnetic, paramagnetic and antiferromagnetic phases which are sensitive functions of composition, substrate symmetry and layer thickness. The aim is to formulate a complete understanding of the magnetic ordering in these materials, particularly in ultrathin films and multilayers, with an ultimate goal of producing layered structures with tunable magnetic properties. The alloy systems to be studied have a degree of complexity and richness of magnetic phases that requires the use of the advanced tools offered by the DOE-operated national laboratory facilities, such as neutron and x-ray scattering to measure spin ordering, spin orientations, and element-specific magnetic moments. This project will contribute to DOE’s mission...
of producing “Materials by Design” with properties determined by alloy composition and crystal structure. Advanced characterization techniques at DOE national laboratories will be applied to understand the materials fabricated at UA, and a tight feedback loop will be used to tailor the magnetic properties on demand. Developing the ability to control magnetic anisotropy, for instance, is essential for creating the next generation of magnetic storage media (such as hard disks), where individual bit sizes have already become smaller than 100nm in the largest dimension. Still smaller bits and higher storage density will require the ability to exquisitely tailor magnetic media properties at the atomic level, the ultimate goal of this study.

Alabama is rich in energy resources. The State has considerable conventional and unconventional natural gas reserves, substantial deposits of coal, and numerous rivers capable of hydroelectric generation. Several regions of Alabama are well suited for growing switchgrass, making the State a potential site for the installation of bioenergy plants. With a strong manufacturing base in paper products, chemicals, and textiles, Alabama’s industrial sector leads State energy consumption, accounting for nearly one-half of total energy use.

DOE’s EPSCoR supports the program’s overarching mission to advance the national, economic, and energy security of the United States; to promote scientific and technological innovation in support of that mission; and to ensure the environmental cleanup of the national nuclear weapons complex.
5.0 Alabama NASA EPSCoR 2009 Update

The NASA Experimental Program to Stimulate Competitive Research, or EPSCoR, strengthens the research capabilities of jurisdictions that have not in the past participated equably in competitive aerospace and aerospace-related research activities. EPSCoR provides eligible jurisdictions with funding to develop a more competitive research base within their jurisdiction and member academic institutions. The NASA EPSCoR mission is:

• To increase the understanding, assessment, development and utilization of space resources and provide a strong education base.
• To promote partnerships and cooperation among universities, federal, state, and local governments, and aerospace related industries.
• To provide a university based network responsive to the nation’s aerospace needs.

The Alabama NASA EPSCoR program builds upon existing strengths within the State, using facilities and personnel at the Space Grant Universities and at NASA, Marshall Space Flight Center (MSFC) but extending these to a new set of teachers, researchers, students, and industrial collaborators. The Alabama NASA EPSCoR Program Director also serves as the Alabama Space Grant Consortium Director.

The goals of Alabama NASA EPSCoR are:

• To effect a permanent increase in the national competitiveness of Alabama’s basic research programs in targeted areas.
• To enhance research areas which already have strength and which are closely related to special needs of Alabama.
• To provide the basis for continuing expansion of basic research in Alabama in the post-EPSCoR era.

Funding Mechanisms

NASA EPSCoR uses two primary funding mechanisms, both types require cost-sharing of 1:1, they are:

• The Research Infrastructure Development, or RID, component enables jurisdictions to build and strengthen relationships with NASA researchers and are awarded to junior faculty. The RID has a three-year base period of performance with a potential single, two-year renewable period of performance. Currently awards are $125,000 per year. A one-to-one match (cash or in-kind) is required for every NASA dollar awarded. The most recent RID was announced and awarded in 2009. NASA intends to announce the RID opportunity every three to five years, pending funding availability.

Alabama NASA EPSCoR RID award recipient, Dr. Greg Thompson, Associate Professor of Metallurgical and Materials Engineering at The University of Alabama graduated from a RID grant and was successful in winning a CAN award in 2009.

• Research Awards- Cooperative Agreement Notice (CAN) solicits topic-specific proposals addressing high-priority NASA research and technology development needs. Awards are up to $750,000 for a three-year performance period. Of that, $75,000 is awarded to UAH’s Dr. John Gregory, the Alabama NASA EPSCoR Program Director, while $675K is awarded to the researcher. A one-to-one match (cash or in-kind) is required for every NASA dollar awarded. NASA intends to announce the EPSCoR CAN for Research Awards yearly, pending funding availability.

A few NASA EPSCoR projects are described in this section.
<table>
<thead>
<tr>
<th>Type of Award</th>
<th>PI</th>
<th>Title</th>
<th>Inst.</th>
<th>Discipline</th>
<th>Award Amt</th>
<th>POP</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA Research Infrastructure Development (RID)</td>
<td>Dr. Tianxi Zhang</td>
<td>&quot;MHD Simulation of Non-Flux-Rope CMEs Associated with Impulsive SEP Events.&quot;</td>
<td>AAMU</td>
<td>Physics</td>
<td>30,000</td>
<td>6/1/08-5/31/10</td>
</tr>
<tr>
<td>NASA Research Infrastructure Development (RID)</td>
<td>Dr. Greg Thomspen</td>
<td>&quot;Elucidation of Macro-alloy Treatments in High Temperature Shape Memory Alloys.&quot;</td>
<td>UA</td>
<td>Materials Engineering</td>
<td>30,000</td>
<td>6/1/08-5/31/10</td>
</tr>
<tr>
<td>NASA Research Infrastructure Development (RID)</td>
<td>Dr. Amy Lang</td>
<td>&quot;Microgeometries for Boundary Layer Control.&quot;</td>
<td>UA</td>
<td>Aerospace Engineering</td>
<td>40,000</td>
<td>6/1/08-5/31/10</td>
</tr>
<tr>
<td>NASA Research Infrastructure Development (RID)</td>
<td>Dr. Patrick Kung</td>
<td>&quot;High Efficiency Photovoltaics Using III-Nitride Materials for Space Applications.&quot;</td>
<td>UA</td>
<td>Electrical and Computer Engineering</td>
<td>40,000</td>
<td>6/1/08-5/31/10</td>
</tr>
<tr>
<td>NASA Research Infrastructure Development (RID)</td>
<td>Dr. Gang Li</td>
<td>Modelling Particle Acceleration and Transport in the Inner Heliosphere</td>
<td>UAH</td>
<td>Physics</td>
<td>30,000</td>
<td>6/1/08-5/31/10</td>
</tr>
<tr>
<td>Cooperative Agreement Notice FY 09 (CAN)</td>
<td>John Gregory (UAH) and Gary Zank</td>
<td>High Temperature Shape Memory Alloys for Improved Efficiency in Aeronautic Turbomachinery</td>
<td>UAH</td>
<td>Physics</td>
<td>750,000</td>
<td>9/12/09-9/11/12/10</td>
</tr>
<tr>
<td>Cooperative Agreement Notice FY 09 (CAN)</td>
<td>John Gregory (UAH) and Gary Zank</td>
<td>The Dynamical Inner HelioSheath and the Space Radiation Environment</td>
<td>UAH</td>
<td>Materials Engineering</td>
<td>750,000</td>
<td>10/1/09-9/30/12</td>
</tr>
<tr>
<td>Cooperative Agreement Notice FY 07 (CAN)</td>
<td>John Gregory and Robert Lindquist</td>
<td>Device Realization for Sensor and Health Monitoring of Space Transportation Systems</td>
<td>UAH</td>
<td>Electrical and Computer Engineering</td>
<td>750,000</td>
<td>9/1/07-8/31/10</td>
</tr>
<tr>
<td>NASA Research Infrastructure Development (RID)</td>
<td>Dr. Junpeng Guo</td>
<td>&quot;Nano-Plasmonic Sensors for Space Exploration.&quot;</td>
<td>UAH</td>
<td>Electrical and Computer Engineering</td>
<td>30,000</td>
<td>6/1/08-5/31/10</td>
</tr>
</tbody>
</table>

Total: $2,460,000
NASA EPSCoR Projects

THE DYNAMICAL INNER HELIOSHEATH AND THE SPACE RADIATION ENVIRONMENT
Dr. Gary Zank
Materials Engineering, UAH

By combining the collective expertise of the University of Alabama in Huntsville (UAH), NASA Marshall Space Center (MSFC), Alabama A&M University (AAMU), and an industrial partner, Exploration Physics International Incorporated (EXPI), all located in Huntsville, Alabama, we propose to initiate the development of a physics based predictive model to describe the interplanetary radiation environment throughout the inner heliosphere, including at the Earth. To forecast and “nowcast” the radiation environment throughout the inner heliosphere, from the solar corona to ~10 AU, requires the fusing of three components: 1) the need to provide probabilities for incipient solar activity (both “all clear forecasts” and the “when, where, and how strong” for outbursts); 2) the ability to use these probabilities and daily solar coronal and solar wind observations to continuously model the 3D time-dependent heliosphere, including magnetic field structure, within 10 AU; and 3) the ability to model the acceleration and transport of energetic protons, electrons, and heavy ions based on current heliospheric conditions. The team members assembled for this proposal are world leaders in each of these three areas. By developing a physics based radiation model, we will be in a position to transition it to an operational forecast and “nowcast” tool, positioning us to support 1) NASA’s human health radiation research program, which is critical to reduce uncertainties in radiation effects and to better define radiation limits on future space flights; 2) The NOAA Space Weather Prediction Center (SWPC), which monitors and forecasts the space weather environment and works closely with the JSC Space Radiation Analysis Group (SRAG) and other operational NASA missions; 3) the NASA JSC SRAG which provides and coordinates operational support to human space flight; 4) Robotic missions, where the focus is on designing spacecraft to survive the space radiation environment, and for which operational support varies widely from project to project, and 5) ongoing defense needs. A successful outcome to this project will therefore significantly increase future research opportunities by opening up a large and varied potential customer base, both in research and in applications to government/federal, defense, and aerospace industrial needs.

Four key elements make this proposal possible: 1) the enormous commitment and investment to computational space physics made by the UAH. In hiring Science PI Zank as the UAH Chan Chair of Physics and Director of the Center of Space Plasma and Aeronomic Research (CSPAR), 6 new 50% faculty lines were provided with the expectation that these faculty lines would become 100% state supported once CSPAR meets certain grant and contract goals, and that the new faculty are able to achieve tenure. 2) the physics department at AAMU, an historically black university, has been building a space science program since 2001, which culminated in the hiring of two junior space science professors in 2006, both of whom are integral parts of this proposal, 3) the immediate proximity of the science PI and his research group with the NASA MSFC solar and space physicists is allowing us to develop important
collaborative efforts in understanding the variable inner heliosphere and its radiation environment. The integral role of NASA MSFC personnel in developing solar coronal forecast tools and relating radiation models to space weather prediction are key elements of this proposal, and 4) EXPI, classified as an Alabama Service Disabled Veteran-Owned small business has developed the first and only solar wind forecast models based on real-time space weather events.

**HIGH TEMPERATURE SHAPE MEMORY ALLOYS FOR IMPROVED EFFICIENCY IN AERONAUTIC TURBOMACHINERY**

Dr. Greg Thompson
Metallurgical and Materials Engineering, UA

Shape memory alloys (SMA) are a unique class of materials which can recover deformation induced at some lower temperature by heating through a given transformation temperature. This deformation recovery can act as a source of work by having the material recover against an applied load and act as a compact, low profile, solid-state actuator. To date, the exploitation of SMA is limited because the recovery phenomenon occurs at low temperatures (<100 deg. C). By increasing the transformation temperature, SMA would have immediate usage in several higher temperature service aerospace applications. This research program brings together Professors Gregory Thompson and Mark Weaver at the University of Alabama (UA) and Dr. Ronald Noebe at NASA’s Glenn Research Center (GRC) in developing a new class of NiTi high temperature SMA.

By macro-alloying NiTi with Pt, Pd, Hf, Zr and Au, the transformation temperature has been shown to increase upwards of 1000 deg. C for particular elements and amounts. This macroalloying facilitates the precipitation of several nanometer-sized secondary phases. The influence of these macroalloy elements and the thermomechanical fabrication process of the alloys on the elevated temperature shape memory effect are not well understood and focus of this research. This program provides unprecedented 3D atomic level imaging of these materials using Transmission Electron Microscopy and Atom Probe Tomography to understand how these precipitates form and alter the SMA properties. The results of this research will bring to fruition optimal materials engineering necessary for the development and application of high temperature SMA in aerospace and related technologies. The program currently supports the post doctoral research of Dr. Taisuke Sasaki and the Ph.D. studies of B. Chad Hornbuckle and Anne Coppa as well as current and former undergraduate researcher experiences for Hunter Spurgeon, Morgan Blouin, and Austin Finnen. The research was presented at the International Field Emission Society meeting Sydney, Australia in July 2010 and during the upcoming Minerals, Metals and Materials Meeting in San Diego, California in March 2011.

Professors Thompson (far left) and Weaver (far right) with undergraduate researchers Morgan Blouin and Austin Finnen conducting a X-ray Diffraction experiment to determine the phases in the SMA alloys.

Dr. Greg Thompson demonstrates a shape memory alloy for students at Hillcrest Middle School, part of UA’s Society of Women Engineers’ program to engage students into science and engineering careers. The shape memory alloys are materials being studied for aerospace applications in the NASA grant.
6.0 Alabama USDA EPSCoR 2009 Update

The National Research Initiative (NRI) Competitive Grants Program was established in 1991 at the Cooperative State Research, Education and Extension Service (CSREES) and served as the USDA EPSCoR Program until it was superseded by the Agriculture and Food Research Initiative (AFRI) in 2008.

The ARFI Food and Agricultural Science Enhancement (FASE) and EPSCoR program is designed to help institutions develop competitive research, education and extension/outreach programs in high-priority areas of national need in agriculture, food, and environmental sciences. Strengthening awards consist of Sabbatical Grants, Equipment Grants, Seed Grants, and Strengthening Standard Project Awards. Ten percent of the AFRI budget will be set aside for strengthening awards and post doctoral fellowships.

Sabbatical Grants, Equipment Grants, Seed Grants, and Strengthening Standard Project Awards will be available during each funding cycle to ensure that researchers at institutions and states that are underrepresented in terms of federal research, education, and extension/outreach funding receive a portion of AFRI funds. Eligibility for all strengthening categories except equipment grants includes: (a) faculties of small and mid-sized academic institutions (total enrollment of 17,500 or less), that are not among the most successful universities and colleges for receiving federal funds for science and engineering research (b) Project Directors at degree-granting institutions in USDA EPSCoR states, and (c) minority serving institutions. All degree-granting institutions that are not among the most successful in receiving federal science and engineering research funds are eligible for Equipment grants. When determining eligibility for these grant types, the following definitions apply:

• Every 3 years the NRI determines which states are eligible for USDA EPSCoR funding by determining those that have had a funding level from the NRI no higher than the 38th percentile of all states, based on total funding for the previous 3-year period (excluding strengthening set-aside funds). The following insert lists the states that fall into this category for FY 2009-FY 2011.

USDA EPSCoR Eligible Jurisdictions

Alabama  New Hampshire
Alaska    North Dakota
Connecticut Rhode Island
Delaware   South Carolina
Idaho      South Dakota
Hawaii     Vermont
Kentucky   West Virginia
Louisiana  Wyoming
Maine      
Mississippi
Nevada     
District of Columbia
Micronesia
Puerto Rico
Guam       
American Samoa
Northern Mariana Islands
U.S. Virgin Islands
<table>
<thead>
<tr>
<th>PI</th>
<th>Institution</th>
<th>Amount</th>
<th>Period</th>
<th>Title</th>
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<tbody>
<tr>
<td>Zachary Senwo</td>
<td>AAMU</td>
<td>10,000</td>
<td>09/01/09-08/31/10</td>
<td>Strengthening Soil Science Research and Training at 1890 Land Grant Universities</td>
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<tr>
<td>Nyakatawa, E.</td>
<td>AAMU</td>
<td>396,109</td>
<td>8/1/06-7/31/10</td>
<td>Silvopastoral Systems for Pine Sawlog, Goat, and Forage Production on Small and Medium-sized Farms in the Black Belt Region of the Southeast</td>
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<tr>
<td>Bailey, C</td>
<td>Auburn University</td>
<td>460,000</td>
<td>June 2005-June 2009</td>
<td>Forestry and Community: Creating Local Markets for Local Resources</td>
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<tr>
<td>Ewald, S.J.</td>
<td>Auburn University</td>
<td>480,834</td>
<td>1/15/2006-1/14/2009</td>
<td>Reducing Risk of Avian Influenza Outbreaks in Commercial Chickens by Genetic Resistance</td>
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<tr>
<td>Liu, Z.J</td>
<td>Auburn University</td>
<td>690,000</td>
<td>Feb 2006-Jan 2009</td>
<td>Mapping the Catfish Genome: Bac Contigs, End Sequencing, and Marker Development for Map Integration</td>
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<tr>
<td>Price, S.; Toro, H.; McKee, S.; Hoerr, F.</td>
<td>Auburn University</td>
<td>298,271</td>
<td>9/15/06 -9/14/09</td>
<td>Control of Salmonella in Infected Chickens by Combining Application of Bacteriophages, Competitive Exclusion, and Maternal Immunity</td>
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<td>Bartol, F.F.; Bagnell, C.A.</td>
<td>Auburn University</td>
<td>343,912</td>
<td>9/1/2007-8/31/2010</td>
<td>Molecular Markers and Mediators of Porcine Reproductive Tract Development</td>
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<tr>
<td>van Santen, V. L.; Toro, H.; Hoerr, F. J.</td>
<td>Auburn University</td>
<td>359,000</td>
<td>9/15/2007-9/14/2011</td>
<td>Effects of Viral Immunosuppression on Disease in Vaccinated Chickens</td>
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<tr>
<td>Rashotte, A. M.</td>
<td>Auburn University</td>
<td>382,828</td>
<td>9/1/08-8/31/2011</td>
<td>The Role of Cytokinin Regulated Transcription Factors in the Development of Leaf Structure</td>
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<td>Ramonell, K.M.</td>
<td>Univ. of Alabama</td>
<td>100,000</td>
<td>9/1/07-8/31/09</td>
<td>The Role of Receptor Kinases in the Recognition of Fungal Elicitors</td>
</tr>
<tr>
<td>Vincent, J. B.</td>
<td>Univ. of Alabama</td>
<td>482,090</td>
<td>12/1/2008-11/30/2011</td>
<td>Establishing Whether Chromium is an Essential Element: Absorption, Transport, and Mode of Action</td>
</tr>
<tr>
<td>Scholz, Carmen</td>
<td>UAH</td>
<td>100,000</td>
<td>9/1/07-8/31/2010, ext till Nov.</td>
<td>Biological Conversion of Biodiesel-Derived Crude Glycerol to Produce Value-Added Industrial Products</td>
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<tr>
<td></td>
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USDA EPSCoR Projects

SOIL SCIENCE RESEARCH AND TRAINING AT 1890 LAND-GRANT UNIVERSITIES: SUCCESSES AND FUTURE CHALLENGES
Dr. Zachary Senwo
Natural Resource and Environmental Studies, AAMU

While minorities are seriously underrepresented in the professional fields of agricultural sciences, 1890 land-grant institutions continue to be at the forefront of training this group in this and related sciences. Historically, agriculture as a profession and discipline has been perceived poorly by minority students, despite its overwhelming contributions in improving our economic growth, assurance of food security, peace, and our wellbeing throughout history. While there is critical need to diversify the workforce in food, agriculture, natural resource and environmental sciences, our 1890 institutions continue to experience declining enrollments in these fields. The declining enrollment threatens viability and, sustainability of academic programs, the mission to serve society and particularly the underserved communities. Alabama A&M University is among several colleges and universities in the nation to have broadened the scope of its various agricultural disciplines to attract underrepresented minorities.

We planned a workshop to strengthen soil science research and training at 1890 Land-Grant institutions. The specific objectives were to: (1) share concerns, ideas, resources, capacities and capabilities, and develop a national strategy and agenda to strengthen soil science research and training at 1890 institutions; (2) develop a consortium of 1890 soil scientists, identify soil science research areas and critical issues facing soil science programs at 1890 institutions; (3) address the lack of serious participation in soil research funding opportunities by 1890 institutions; and (4) develop networks and linkages with 1860s and USDA-ARS scientists to strengthen soil science training at 1890 institutions.

DEVELOPMENT OF THE SNP PLATFORM AND ITS APPLICATION FOR GENETIC MAPPING IN CATFISH
Dr. Z. J. Liu
Fisheries and Allied Aquaculture, AU

Aquaculture must be developed and made sustainable in the face of the declining natural fisheries and increasing human population. Genome-based selection approaches need to be developed to deal with the major problems in aquaculture such as diseases that cause an annual loss of almost $100 million. The major factor limiting selection using genome-based technologies is the lack of tightly linked markers. To circumvent this problem, innovative and efficient marker platforms must be developed. This project intends to develop the high-throughput SNP platform. We have identified over 128,000 putative single nucleotide polymorphism markers (SNPs), from which 43,717 high-quality SNPs has been identified. In this project we will validate these EST/BAC end sequence-derived SNPs and identify additional SNPs using deep sequencing of reduced representation libraries. Informative SNPs will be mapped using both intraspecific and interspecific resource families.
ESTABLISHING WHETHER CHROMIUM IS AN ESSENTIAL ELEMENT: ABSORPTION, TRANSPORT, AND MODE OF ACTION

Dr. John Vincent, Professor and Interim Chair of the Chemistry Department and Dr. Jane Rasco, Assistant Professor of Biological Sciences at The University of Alabama were awarded a $ 482,090 U.S. Department of Agriculture award from December 1, 2008 to Nov. 30, 2011.

For approximately 50 years, chromium has been proposed to be an essential trace element in the diet for humans and other mammals. However, the evidence for this assertion is ambiguous. Nutritional studies on chromium are difficult to perform and interpret as chromium is present in small concentrations in essentially all foods and humans require very little chromium (if any at all). Additionally, an unambiguous test to determine whether an individual suffers from chromium deficiency does not exist. Chromium may be associated with the action of the hormone insulin. The levels of chromium in urine increase, for example, when the concentration of insulin in the blood increases. The magnitude of this increase, most notably of a particular form of chromium in the blood (chromodulin), may correlate with the levels of chromium in the body available for use. We will test whether the increases in levels of chromium and chromodulin in response to sugar (and insulin) can be used as a marker for chromium nutritional status. We will also test recent proposals for how chromium might affect how insulin works in the body at a molecular level. This will involve looking at the effects of chromium on the steps of the pathway by which insulin signals the cell to metabolize glucose and to turn on or off other metabolic and cellular processes. Finally, how chromium is moved from the bloodstream (after being absorbed by the gastrointestinal tract) to tissues has been established; however, how chromium subsequently moves within the cell is not understood. We will examine the potential for a class of proteins called monocarboxylate transporters to move chromium across membranes within cells.

Mapping several thousands of gene-associated SNPs will allow construction of high density SNP linkage and comparative maps. Such maps will facilitate whole genome QTL analysis and identification of candidate genes underlining important performance traits. This project will deliver several additional “by-products”: integration of linkage maps, integration (at least partially) of linkage and physical maps, and provide information concerning genome-scale gene duplications in catfish. It is likely that linkage disequilibrium will also be detected with traits under selection, providing information of marker-phenotype associations. We have generated all the necessary elements for this project, and assembled a strong and synergistic team for successful execution of the project.
EPA’s EPSCoR, created in 1991, uses the model developed by the NSF to assist researchers in less-intensive research. States participate in the EPA National Center for Environmental Research (NCER) Science to Achieve Results (STAR) program. EPA’s STAR program funds research grants and graduate fellowships in numerous environmental science and engineering disciplines and periodically establishes large research centers in specific areas of national concern. At present, these centers focus on children’s health, hazardous substances, particulate matter, drinking water, water quality, global change, ecosystem assessment and restoration, human health risk assessment, endocrine disrupting chemicals, pollution prevention, and socio-economic research. The EPA STAR is a merit-based program where all awards are based on a competitive, peer-review process. The funding mechanism operates internally within EPA and does not require any action on the part of the applicant. The EPA EPSCoR Program has received no federal funding since 2007.

The Alabama EPA EPSCoR mission statement includes the following: Alabama EPA EPSCoR is committed to fostering interdisciplinary and collaborative environmental research clusters across departments, colleges, and institutions that can synergistically enhance the research, infrastructure, economic development, and human resource development in the state. The primary goals of the Alabama EPA EPSCoR program are: 1) to develop environmental science and engineering components by strengthening the statewide infrastructure needed to remove barriers, 2) to provide support for selected environmental research areas and programs, and 3) to improve the state’s human resource base for environmental science, engineering, and education.

EPA STAR Future

EPSCoR states are requesting a $25 million increase in funds provided for the EPA STAR program. The focus of this research should be clean water research and ecosystem adaptation and restoration under climate change.

The EPSCoR states propose restructuring the STAR program’s EPSCoR activities into a new program. The restructured program would involve researchers from the eligible states invited through their state EPSCoR Committee to participate as individuals or groups of individuals to conduct interdisciplinary projects to compete for research awards through the EPA STAR program. The environmental research would be in mission-oriented interdisciplinary areas responding to one of the Agency’s “theme” areas. In any given year, EPA would select the environmental “theme(s)” to be funded based on Agency needs. In order to ensure the broadest possible participation of EPSCoR states, 40 percent of the funding would be for individual awards and 60 percent for collaborative awards.

To achieve important EPA research objectives, it is recommended the program be funded at $25 million with approximately $10 million obligated to the individual investigator awards and $15 million for collaborative awards. This approach will significantly enhance EPA’s ability to tap into the best ideas the EPSCoR states have to offer in support of the Nation’s environmental research needs.
8.0 Alabama DEPSCoR 2009 Update

Currently Alabama is ineligible to compete for Alabama Department of Defense EPSCoR (AL DEPSCoR) funding but has an appointed DEPSCoR Agency Director for the purpose of securing eligibility for the state not supported by DEPSCoR.

Eligibility is based on the amount of Department of Defense (DoD) funding received by a state. State DEPSCoR eligibility criteria is based on the following:

- Eligible states are EPSCoR States meeting the NSF established State Committee Formula
- The Formula Used is: \( Sa < (Na/50)*.6 \)
- A state’s average DoD R&D obligations for last three data years = \( Sa \)
- The National average DoD R&D obligations to IHE for last three data years = \( Na \)

A state applying for DEPSCoR funding, must also demonstrate their commitment to developing DoD research base and improving science and engineering research and education programs at institutions of higher education by providing a 50% cost match on all proposals.

The Defense EPSCoR program was first authorized in the FY 1995 Defense Department Authorization Act. DEPSCoR grants are administered through the Army Research Office (ARO), the Office of Naval Research (ONR), and the Air Force Office of Scientific Research (AFOSR), and DEPSCoR proposals are funded only if they provide the Defense Department with research in areas important to national defense. Funded grants have resulted in innovative research, patents and peer-reviewed articles.

DOD RESEARCH ACCOUNTS FOR MORE THAN ONE-THIRD OF ALL FUNDING FOR ENGINEERING RESEARCH AND PROVIDES 70% OF ALL FEDERAL FUNDING FOR MECHANICAL ENGINEERING, 60% FOR ELECTRICAL ENGINEERING, 42% FOR MATERIALS ENGINEERING, 29% FOR COMPUTER SCIENCES AND 28% FOR OCEANS SCIENCES. IT ALSO PROVIDES FUNDING FOR RESEARCH ON INFECTIOUS DISEASES AND INJURIES ASSOCIATED WITH BATTLEFIELD CONDITIONS.
The two major components of IDeA are the COBRE and the INBRE:

- The COBRE (Centers for Biomedical Research Excellence) program is designed to increase the number of well-trained investigators in the IDeA states by expanding research facilities, equipping laboratories, providing mentoring for promising candidates, and developing research faculty through support of a multi-disciplinary center, led by an established, senior investigator with expertise in the research focus area of the center.

- INBRE (IDeA Networks of Biomedical Research Excellence) increases the pipeline of outstanding students and enhances the quality of science faculty in the IDeA states by networking research intensive and undergraduate institutions. The INBRE program prepares students for graduate and professional schools as well as careers in the biomedical sciences, supports research and mentoring of young investigators, and enhances research infrastructure at participating institutions.
## Graduate Research Scholars Program Round 6 Recipients

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
<th>Inst.</th>
<th>Goal</th>
<th>Research Area</th>
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<tr>
<td>Abunaemeh</td>
<td>Malek</td>
<td>AAMU</td>
<td>Characterization Properties of Glassy Polymeric Carbon and Silicon Carbide</td>
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<td>Afroz</td>
<td>Farhana</td>
<td>UA</td>
<td>Separation Control Mechanisms of Shark Skin</td>
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<td>Allie</td>
<td>Aldinton</td>
<td>TU</td>
<td>Fracture and Fatigue Evaluation of In-situ Welded Railhead Repairs</td>
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<td>Apalangya</td>
<td>Vitus</td>
<td>TU</td>
<td>Synthesis of Nanocomposites for Biomedical Applications</td>
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<tr>
<td>Baah</td>
<td>David</td>
<td>TU</td>
<td>Microfluid Synthesis and Rheological Characterization on Non-Spherical Nanostructures</td>
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<td>Babaei</td>
<td>Hasan</td>
<td>AU</td>
<td>Phase Change NEPCM</td>
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<td>Balenger</td>
<td>Susan</td>
<td>AU</td>
<td>House Finch Mate Selection</td>
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<td>Brundidge-Young</td>
<td>Sandrea</td>
<td>TU</td>
<td>Processing and Characterization of Epoxy Composites Reinforced with Carbon Nanotubes and Carbon Nanopearls</td>
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<td>Cantrell</td>
<td>Andrew</td>
<td>AAMU</td>
<td>Effects of Forest Management Practices on Amphibians and Small Mammals</td>
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<tr>
<td>Chen</td>
<td>Yi</td>
<td>UAH</td>
<td>Mosaic Generation for Multi-Media Applications</td>
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<td>Colon</td>
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<td>AAMU</td>
<td>Electrical, Mechanical, and Optical Properties of Graphene</td>
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<td>Fan</td>
<td>Liwu</td>
<td>AU</td>
<td>Thermoconductivity of Phase Change Materials</td>
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<td>Electric Field Induced Nanofiber Alignment in Nanocomposites</td>
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<td>Brian</td>
<td>UAH</td>
<td>Global Heliopheric Models</td>
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<tr>
<td>Freeman</td>
<td>Jason</td>
<td>UAB</td>
<td>New Materials for Sensor Protection Against Laser Threats</td>
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