Annual Report: 2005-2006

Faculty, Staff & Students

AUDFS Research Team

College of Agriculture	
Donald E. Conner, Professor and Chair	HAACP, Sampling
Omar Oyarzabal, Assistant Professor	Food Sample Preparation, Food Microbiology
Jacek Wower, Professor	RNA Sensors
College of Engineering	
Bryan A. Chin, Professor and Center Director	Bulk Food Monitor, Bacteria/Spore Binding
ZhongYang Cheng, Assistant Professor	Polymers, Magnetostrictive Devices
Barton C. Prorok, Assistant Professor	MEMs Design, M^3S Devices
Dong-Joo (Daniel) Kim, Assistant Professor	MEMs Fabrication, Microcantilevers
Aleksandr L. Simonian, Associate Professor	SPR, Biochemical Recognition
Mark Byrne, Assistant Professor	Polymer Thin Films
Jong Wook Hong, Assistant Professor	Microfludics, DNA Arrays
College of Human Sciences	
Tung-shi Huang, Assistant Professor	Antibody Development, Immobilization
Jean Weese, Associate Professor	Industrial Practices, Needs
College of Science and Mathematics	
William Charles Neely, Professor	Air/Liquid Extraction, Chemical Binding
Sang-Jin Suh, Assistant Professor	Phage, Biomolecular Recognition
Curtis Shannon, Associate Professor	Self Molecular Assembly
James M. Barbaree, Professor and Chair	Microbiology, Bacteria, Spores
Minseo Park, Assistant Professor	Raman Spectroscopy
College of Veterinary Medicine	
Vitaly Vodyanoy, Professor	Molecular Recognition, Immobilization
Valery A. Petrenko, Professor	Biomolecular Recognition, Phage
Arnold Vainrub, Professor	Biomolecular Recognition, DNA

At year's end, 20 core faculty members from five Auburn University colleges contributed to AUDFS research. Recent additions to the research team include biosensors expert **Dr. Aleksandr Simonian** and biosensors fabrication expert **Dr. Dong-Joo Kim** both of whom joined the Materials Engineering Program, and microbiologist **Dr. Omar Oyarzabal,** who joined the Poultry Science Department.

At the end of Fiscal Year 2006, internal and external-source funds supported 112 students, staff and research associates in the five affiliate colleges.

Education

Dr. William Gale (Engineering) and **Dr. Donald E. Conner** (Agriculture) offered their second multidisciplinary course funded by USDA's Higher Education Challenge Grant Program. Building

on the multidisciplinary exchange of ideas and experiences of their first course, the professors designed "**Materials for Safer Foods**" (MATL 6970). The course — designed for graduate students and senior-level undergraduates — offers insight into the micro-biological/materials science issues and required characteristics of food processing surfaces. Topics covered include: the mechanisms of bacterial attachment, wetting and adhesion phenomena, materials for food preparation surfaces, corrosion mechanisms and corrosion control, sanitization practice, as well as surface finish and coatings technology.

The first USDA-funded course, **"Cross-Disciplinary Food Safety Issues" (POUL 6100)** — a multidisciplinary course for agriculture, biological sciences, engineering, and physical sciences students — is now underway and achieving great success.

By the end of Fiscal Year 2006, a total of 87 multidisciplinary degrees — 44 master's degrees and 43 doctoral degrees — have been conferred since the center was established.

Funding

Researchers concluded Fiscal Year 2006 having 21 funded proposals and white papers, totaling more than $7 million in external funding requests. Of these, 10 were individual submissions and 11 included two or more investigator submissions.

It is also significant to note that several other proposals found AUDFS conducting work with other universities, government labs and government contractors as subcontracted collaborators. Multi-institutional funded teams include a three-person research team led by an AUDFS principal investigator and involving two other institutions (sponsor: NSF), a three-person research team led by an AUDFS principal investigator and involving Greek and Armenian institutions (sponsor: NATO), and a seven-person research team led by an AUDFS principal investigator and involving an AUDFS co-principal investigator and investigators from five other institutions outside Alabama (sponsor: USDA). Research initiatives include a $1,000,000 first year effort funded by the U.S. Army to develop a universal condition monitoring system for utilizing smart sensors that will monitor critical parameters related to vehicle condition and reliability of tactical vehicle platforms which will enable predictive and proactive maintenance. Recent research also involves developing an alternate fuel source using clean and sustainable electrical energy production with a Bio Fuel Cell from poultry waste.

AUDFS has enjoyed a continuing partnership and relationship with its primary sponsor, USDA Cooperative Service Research, Education and Extension Service (CSREES). Center personnel have been frequently asked to update USDA administrators of Auburn University-based research, and program leaders have made frequent trips to Auburn University to monitor the center's research progress.

Intellectual Property and Technology Transfer

AUDFS has transferred several of its research accomplishments from the laboratory to commercial or government applications during its inception:

- AUDFS bulk food shipment-monitoring technology
- AUDFS biological organism imaging technology
- Kits for specific and sensitive detection of E. Coli
- Phage as bio-selective elements in biosensors

- Raytheon RFID bulk stag for patriot missile heath monitoring
- Meat species identification technology
- RMBM in livestock feed identification technology
- Optical microscope technology

At the end of Fiscal Year 2006, 35 new disclosures and 4 new patents were filed with Auburn University's **Office of Technology Transfer**, nearly a 60% increase from Fiscal Year 2005.

The strength of the center's industrial relations program is its Technology Preview. Each year, the center invites selected companies to Auburn University to preview its latest technological advances. Under the protection of nondisclosure agreements, AUDFS researchers present through poster sessions and presentations, their most recent scientific advances during a two-day conference. Including the industry representatives, more than 100 people from local industry and campus faculty have participated in each of these research and outreach activities annually. Continued interest in the application of AUDFS technology in the war against bioterrorism prompted a by-request, an on-campus research briefing to U.S. Senator Richard Shelby. Twenty-nine companies inquired about or collaborate with researchers regarding AUDFS technology.

In addition to ongoing industrial relations efforts, AUDFS has partnered with Aetos Technologies, Inc. Aetos is a technology development company founded to bridge the gap between **university-based research** and the **commercial market**. Aetos was established as a financial partnership with its management team, private investors and Auburn University to commercialize and market technologies developed at research institutions. Aetos has a dedicated management team and an active board of directors that includes nationally respected scientists and researchers from industry, government, and academia. The innovative Aetos Model will take new technologies from proof of scientific concept through full commercial development.

Another major accomplishment for AUDFS is a spin off Center entitled Airline Cabin Environment Research (ACER). Coordinated by Executive Director Dr. William Gale, Auburn University serves as the administrative lead for the ACER Center of Excellence (CoE). Purdue and Harvard Universities are technical co-leads, with Boise State, Kansas State, California Berkeley, and Medicine & Dentistry of New Jersey Universities as center core members. Oklahoma State and Saint Louis Universities are also ACER affiliates.

Expertise

The ACER team provides the FAA and our industrial partners with expertise in:

- The healthfulness of the cabin environment for passengers and crew
- Enhancement of aircraft environmental control systems
- Detection and mitigation of both deliberate and unintentional chemical and biological threats

Research Program

The ACER CoE was awarded funding by the FAA in September, 2004. The first round of ACER task funding was received in March, 2005, with additional funding in 2006. ACER's research currently focuses on:

- Ozone in passenger cabins
- Exposure & risks of pesticides on-board aircraft
- Cabin pressure effects on passengers and crew
- Air quality incidents

- In-flight measurements
- Contaminant transport in the airliner cabin
- Chemical–biological and air quality sensors for both routine and research use
- Decontamination of the cabin after incidents
- Disease transmission and the airliner cabin

Communications and Marketing

Whether the topic of the news report is the latest in the center's radio-frequency identification research, pathogen and anthrax detection, or BSE prevention, AUDFS research has continued to capture the attention of our local, regional, and national media. The center has averaged between eight and ten **news reports** each fiscal year. Those meriting special mentioning include coverage of the center's RFID research by **Wired Magazine** (online) and by **CNN Headline News' Hotwire**. Recent outbreaks of E. *coli* in prepackaged spinach and various locations of Taco Bell have garnered a great deal of media attention for our research center. Our scientists have prepared quotes for local, state and national news publications such as the **New York Times**.

The center strives to associate itself with the Auburn University Peaks of Excellence branding effort. Media communications, online information and industrial communications include either the Peaks of Excellence logo or reference to the Peaks program in the body of the communication.

Scientific & Engineering Advancements

Center researchers worked to continue refining current scientific accomplishments as well as developing new avenues to support the center's mission. Among those efforts are:

- Method of immobilizing antibodies onto sensor surface
- Application of antibodies for the detection of ruminant meat-and-bone meal (MBM) for prevention of bovine spongiform encephalopathy (BSE)
- Development of phage as a substitute for antibody detection of *Salmonella* and *Bacillus anthracis* (anthrax)
- Bulk food shipment monitor package
- Hand-held detection device
- Magnetostrictive sensor tags
- Micro-Mechanical-Magnetostrictive (M^3) devices
- Biological organism imaging technology

Dr. Peggy Hsieh's patented antibodies for the detection of adulteration of animal feed was released as a commercial product by Neogen, Inc. as the first test kits for the detection of MBM in livestock feed. This test will prevent the introduction of bovine spongiform encephalopathy (BSE, or "mad cow disease") into the U.S. food chain. Auburn's technology has also been licensed to Elisa Technologies for the production of ELISA test kits.

Under the partnership of Aetos, **Dr. Vitaly Vodyanoy**, a core member of the AUDFS research team invented CytoViva, a high powered optical microscopy illumination system designed to improve imaging performance. AUDFS utilizes this piece of equipment to optically image live organisms and Nanoparticles used in a variety of biomedical applications. Since its introduction into the research market, CytoViva has been utilized by researchers in the fields of biology, pharmacy, and nanotechnology.

The U.S. Army Aviation and Missile Command has just completed qualification testing of the Patriot Missile Environmental Health Monitoring System (PMEMS). This system; which monitors temperature, humidity, shock, and other missile parameters; will be installed on Patriot missiles to provide information that can be used to assess the tactical readiness of each missile. AUDFS originally developed this system for the monitoring and tracking of international containerized food shipments. Raytheon, Inc is the prime contractor for the Patriot Missile.

Operational Indicators

Activity	FY05	FY06		Change
Core faculty involved	20	20		0
Students, staff, researchers supported	**56**	**112**	⇧	**56**
Publications submitted/published	**216**	**426**	⇧	**210**
Conference/poster presentations	**98**	**124**	⇧	**26**
Funded Proposals: single PI	16	10	⇩	-6
Funded Proposals: two or more PIs	**8**	**11**	⇧	**3**
Industrial contacts	**11**	**35**	⇧	**24**
Governmental contacts	**25**	**47**	⇧	**24**
Disclosures and patents	**64**	**103**	⇧	**39**
Commercialized technology	5	5		0