TUSKEGEE
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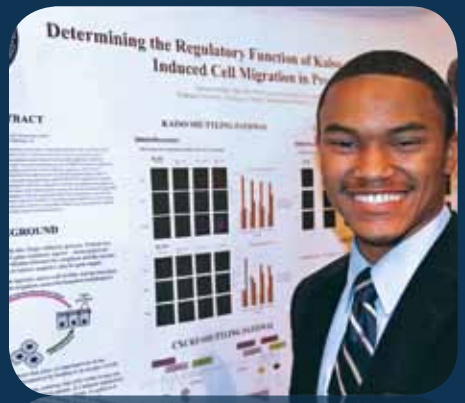


DIVISION OF RESEARCH AND SPONSORED PROGRAMS

2010-2011 Annual Report

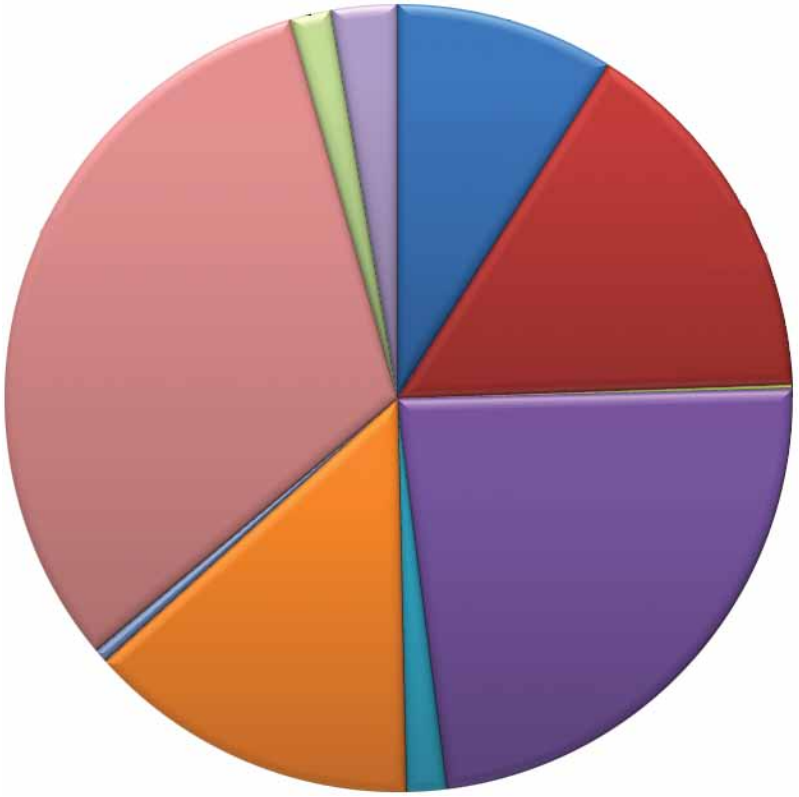
DIVISION OF RESEARCH AND SPONSORED PROGRAMS

GILBERT ROCHON
President

SHAIK JEELANI
VP, Research and Sponsored Programs

Tuskegee University recognizes the importance of external support of research and sponsored programs and the impact these vital programs have on the development of its students, faculty and society in general. Tuskegee University has a long standing reputation of being among the nation's premiere minority research institutions committed to the total development of its students and faculty. In this annual report, it is evident that through our centers of excellence and academic units, our faculty, staff and students are engaged in research that is critical to address the needs of today's citizens, industries and governments.

Since its creation in 1996, the Division of Research and Sponsored Programs has more than doubled the annual funding for research and other sponsored programs at Tuskegee University. The university concluded the fiscal year 2010-2011 with a total annual funding of $47.6 million for support of its research and sponsored programs, which represents an increase of 16 percent over the last year. Credit for this enormous success goes to faculty members, who continue to search for resources and write winning proposals. The staff members in the Division of Research and Sponsored Programs and various departments of Business and Fiscal Affairs are also to be commended for their enthusiastic support of the researchers in the grantsmanship process. These grants and contracts not only allow us to fulfill the research mission of Tuskegee University but also make a huge impact on our academic programs. Tuskegee University's two Ph.D. programs - Integrative Biosciences and Materials Science and Engineering - are prime examples of programs that are offered solely based on the expertise and resources developed by the faculty members.



This report highlights only a few major research and educational programs that were offered during the year 2010-2011. Our long-term plan focuses on actively expanding Tuskegee University's research, education and outreach activities in the areas of energy, environmental science and engineering, high performance computing, information technology, materials science, nanobiotechnology, remote sensing, microelectronics, molecular biology, immunology, public health, toxicology, epidemiology, reproductive environmental biology, and modeling and simulations.

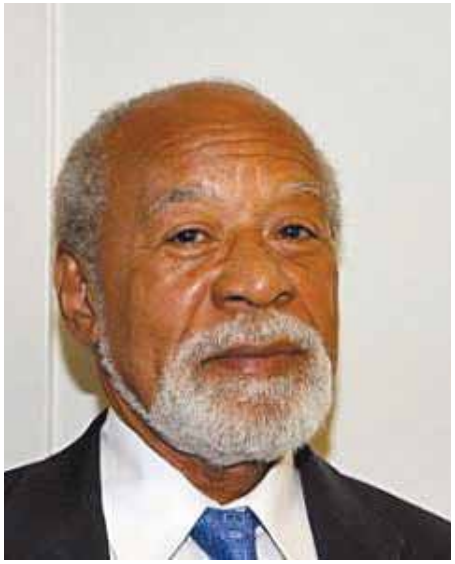
IMPLEMENTATION GRANT: DEVELOPMENT OF MULTIDEPARTMENTAL, MULTIDISCIPLINARY CONCENTRATIONS AT TUSKEGEE UNIVERSITY –HISTORICALLY BLACK COLLEGE UNDERGRADUATE PROGRAM (HBCU-UP)

PRINCIPAL INVESTIGATOR: Luther Williams
CO-PRINCIPAL INVESTIGATORS: John Davidson, Danielle Gray-Singh, and Gregory Pritchett

Over the previous funding cycle of the HBCU-UP grant, it was observed that students, despite good performance in the required mathematics courses and beyond, still have deficiencies in mathematical problem solving. It appears that "mathematics" and the "other natural sciences" are viewed as separate domains and the expected transfer of mathematical concepts and applications to biology problems is remarkably limited. Furthermore, it has been noted that students fail to see the interconnections between any of the STEM disciplines. Consequently, the hallmark of the current HBCU-UP initiative is to launch an aggressive campaign to deliberately make those connections and to increase instructional synergy between math, physics, biology and chemistry. The nexus for this effort is the Biology Department, which presents a unique opportunity to: (a) function as conduit to populate the computer science physics, engineering and mathematics departments and (b) initiate a paradigm-shift that erodes (or blurs) the boundaries between STEM disciplines. Second, the current program is built on the successful foundation established in the previous phase of the HBCU-UP grant, which resulted in the development of six multidisciplinary courses, to inaugurate TU's first interdepartmental, interdisciplinary concentrations in Biophysics and Quantitative Genomics. Third, this plan, **through the Office of Undergraduate Research (OUR)**, concurrently addresses the historical under-representation of minority doctoral ranks in STEM by intensifying efforts to attract students to graduate school through developing an evening component of the SWORD (Survival While on the Road to the Doctorate) program. In addition, the plan is designed to provide a coordinated approach that will strengthen students and faculty research and technological skills through collaborative efforts; strengthen the overall instructional infrastructure informed by the goals of this grant; and improve skills and abilities of the STEM students at Tuskegee University.

During the 2010-2011 academic year, the Office of Undergraduate Research has focused on three major activities (professional development, visibility, and research exposure) to enhancing student knowledge of graduate programs and research opportunities. Several workshops and private sessions were conducted regarding resume, personal statement, and cover letter formatting. All workshops involved the presentation of scholarship, professional and graduate program information to enhance awareness. In addition, student scheduled individual sessions for revision of documents that were created as a result of workshops provided. Individual sessions included the review of applications for summer research opportunities. Visits were made to a variety of courses, campus-wide, to talk about the graduate school, professional development opportunities, and summer research programs. Distinguished Scholar Seminar Series was held throughout the fall and spring semesters, involving professionals from various disciplines presenting research and knowledge to guide student toward a research-based career. Several speakers were invited to Tuskegee University to share their knowledge, research, and experiences in reference to graduate studies.

The second Joint Annual Research Symposium (JARS 2011) was held in March 2011. The conference allowed for student to present research they conducted in Animal Science, Aerospace Engineering, Biology, Chemistry, Computer Science, Engineering, Material Science, Molecular Biology, and Psychology, to their peers, Tuskegee University faculty, and visiting faculty. Guests were invited to present their findings from current research projects. Networking opportunities with various organizations were also provided. Throughout the year, students were presented with material informing them about volunteer opportunities with organizations that conduct research. The Montgomery Zoo and the United States Department of Agriculture have facilities that allow volunteers to participate in research programs, some having paid internships. For example, 20 students participated in the Earth Day Safari at the Montgomery Zoo on April 21, 2011. This exposure resulted in a summer research internship offer. During the summer, the OUR partnered with Tuskegee University's Integrative Biosciences (IBS) program to assist with Research Experience for Undergraduates (REU). The OUR has collaborated with the IBS REU program in regards to recruitment of students for summer research opportunities, giving support to on-campus undergraduate researchers during the summer, and professional development workshops such as Selecting a Graduate School and Professionalism 101.



LUTHER S. WILLIAMS
Provost and Vice President of Academics Affairs

AFRICAN-U.S. NETWORK OF CENTERS OF EXCELLENCE IN WATER & ENVIRONMENTAL SCIENCE AND ENGINEERING

PRINCIPAL INVESTIGATOR: Nosa O. Egiebor
CO-PRINCIPAL INVESTIGATORS: Ramble Ankumah (Tuskegee University) and Winston Soboyejo (Princeton University)
OTHER PRINCIPAL INVESTIGATORS: Ben Oni, Tarig Hassan, Jonathan Mbah, Shamin Begum, Joseph Quansah and Mudiayi Ngandu

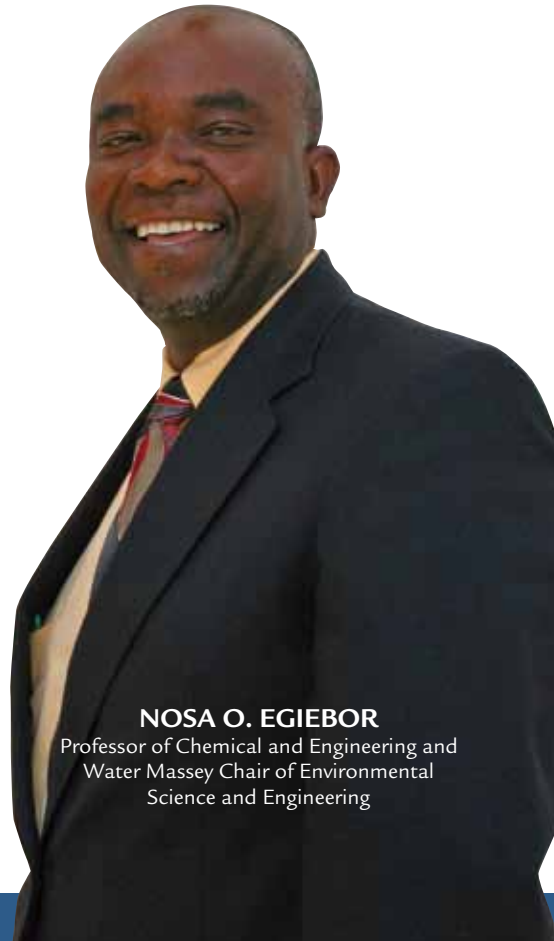
It is generally known that the North American and the African continents face some of the most serious water and environmental challenges that are further complicated by climate change issues and uncontrolled anthropogenic pollution from human activities. For example, various technical studies, including reports by the African Ministers Council on Water (AMCOW), have indicated that Africa is one of the most vulnerable continents to environmental and climate change impacts, to the extent that previous development efforts and the millennium development goals (MDGs) are in jeopardy. The arid and semi-arid regions in Africa and North America are becoming drier, while some areas of equatorial Africa and parts of southern Africa are getting wetter, thus leading to serious drought in some areas and flood problems in others. The current severe drought and famine situation in Somalia and the Horn of Africa is instructive. Global warming, resulting from green-house gas pollution, is believed to have also played a major role in climate change and higher temperatures throughout much of North America and Africa.

This project, funded under the USAID "Africa-US Higher Education Initiative", is an international partnership with Tuskegee University, the lead institution, and Princeton University together with four universities from three African countries as project partners. The International Institute for Water and Environmental Engineering (2iE) in Burkina Faso is the lead institution in Africa while the University of Mines and Technology (UMaT) in Ghana, the African University of Science and Technology (AUST) in Nigeria, and the University of Benin, also in Nigeria, are the other African partner institutions. The partnership is aimed at establishing a long-term international collaborative network of centers of excellence (COEs) in the area of water, environmental, and climate change science and engineering in selected higher educational institutions in Africa and the United States. The project is planned to be a 5 to 15-year effort that is divided into three execution and implementation phases. The first and second phases have been funded and will be executed over the next five years. The third phase will be for an additional 5 – 10 years beyond Phases 1 and 2. The project activities involve collaborative research, education, student and faculty exchange, and capacity-building efforts that will have significant benefits for both Tuskegee University and the African counterpart institutions. The major objectives of the project will include, but not limited to:

a. Developing the educational degree programs, curricula, and the human and material capacity needed to establish centers of research and education excellence in water, environmental, and climate change science and engineering at both Tuskegee University and at the African partner institutions.

b. Developing international exchange and training programs for students, faculty, and researchers between Tuskegee University and the African partner institutions in support of the research and education efforts.

c. Building the institutional capacity of Tuskegee University and the partner institutions for state-of-the-art capacity to conduct high quality research and education in water, environmental, and climate change science and engineering



NOSA O. EGIEBOR
Professor of Chemical and Engineering and Water Massey Chair of Environmental Science and Engineering

TUSKEGEE-CORNELL PARTNERSHIP FOR RESEARCH AND EDUCATION IN NANO-MATERIALS (PREM)

PRINCIPAL INVESTIGATOR: Shaik Jeelani
CO-PRINCIPAL INVESTIGATORS: Mahesh Hosur and Pradosh Ray (Tuskegee), Lynden Archer and Melissa Hines (Cornell)
OTHER PARTICIPANTS: Melissa Reeves and Tamara Floyd Smith

A long-term partnership for research and education in nanomaterials, between the Center for Advanced Materials (T-CAM) at Tuskegee University (TU) and the Materials Research Science and Engineering Center (MRSEC) at Cornell University has been established, under the Partnership for Research and Education (PREM) program, sponsored by the Division of Materials Research at the National Science Foundation (NSF).

This partnership is based on a very productive relationship TU had with Cornell for many years. This relationship had a significant impact on the development of the materials science and engineering (MSE) program at TU. Recent interactions between Tuskegee and Cornell were through two NSF grants to TU, under the Center for Research Excellence in Science and Technology (CREST) and the Nanoscale Interdisciplinary Research Teams (NIRT) programs. Through these grants, the Tuskegee and the Cornell faculty have jointly investigated the effects of modifications to the surface of the nano reinforcements on the interfacial properties of nanocomposites and also studied the influence of geometry of nanosized objects on their response to external fields.

Under the current grant, Tuskegee-Cornell PREM team has focused on the following specific research tasks:

1) Synthesis and Characterization of Cubic Cobalt Oxide Nanocomposites:

Cubic cobalt oxide nanocomposite system is of interest because suspensions of cubes are expected to exhibit enhancements over traditional spherical particles for applications such as liquid body armor as it would achieve shear thickening behavior at a lower shear rate when compared with spherical nanoparticles. In order to maintain long-term stability (> 30 days) of this system for armor application, studies of the intrinsic viscosity of the system with and without poly vinyl pyrrolidone (PVP) have been conducted and estimated it to be ≈5.03. Rheological behavior of this system depends on the viscosity being studied.

2) Surface Chemical Investigations of Inorganic Guest-Organic Host Binding

Under this task, studies on the effect of silicon carbide (ß-SiC) nanoparticles (~30nm) sonochemical coating on silicon dioxide (~ 200nm) nanoparticles and infused into SC-15 epoxy resin to increase the thermal and mechanical properties of SC-15 epoxy for structural applications has also been conducted. In order to increase the SiC binding with the polymers, sonochemically coated SiC nanoparticles by three types of polyhedral oligomereic silsesquioxane (POSS) namely: OctaIsobutyl (OI), EpoxyCyclohexyl (EC) and GlycidylEthyl (GE) POSS. XPS (X-ray Photoelectron Spectroscopy) analyses were carried out to explore the chemical composition and surface characters of SiC nanoparticles and POSS coated SiC nanoparticles

3) Studies on the effect of functionalization on the morphology, cure kinetics, multifunctional properties, and fracture behavior of MWCNTs with thermosetting polymers.

Under this task, the team has studied the effect of functionalization of MWCNTs on the thermal, thermomechanical, and mechanical properties of high temperature epoxy systems. Additionally, studies related to the effect of functionalization on the fracture behavior, electrical properties as well as the high strain rate loading of nanocomposites are being studied. In all cases, the nanocomposites with functionalized MWCNTs showed higher properties when compared with the system having pristine MWCNTs due to increased covalent bonding between polymers and MWCNTs through functional groups.

SHAIK JEELANI
VP, Research and Sponsored Programs

AQUATIC ANIMAL HEALTH TEACHING, RESEARCH AND EXTENSION SERVICE PROGRAM

PRINCIPAL INVESTIGATOR: Kunwar K. Srivastava
CO-PRINCIPAL INVESTIGATORS: Cesar Fermin, Gopal Reddy and Fredrick Tippett

This is an integrated project to initiate teaching, research and extension in aquatic animal health. The teaching part of the project is being developed by Dr. Srivastava with assistance from the collaborator, Dr. Joseph C. Newton, Associate Professor, Department of Pathobiology, College of Veterinary Medicine, Auburn University, Auburn, Ala. The research part is being conducted in collaboration with Dr. Gopal Reddy and the two USDA scientists, Dr. Phillip H. Klesius and Dr. Julia W. Pridgeon of the Aquatic Animal Health Research Laboratory, Auburn, Ala. The Extension part including the long distance learning, delivery and teleconferencing part of the project is being conducted by Dr. Cesar D. Fermin. This integrated project allows us to develop an aquatic animal health laboratory at College of Veterinary Medicine, Nursing and Allied Health (CVMNAH). This integrated project is expected to strengthen undergraduate, professional and graduate curricula and provide research projects for graduate students interested in aquatic animal health. The long distance learning, delivery and teleconferencing methods are likely to facilitate the development of a novel framework for tracking bacterial fish diseases, and help us in our attempts for preventing, and controlling these diseases. The research laboratory in aquatic animal health will help us to develop state-of-the-art diagnostic techniques where fish diseases could be readily identified. Information about the diseases identified in this laboratory could be quickly delivered via teleconferencing to all Alabama as well as regional fish farmers.

The project will help in recruiting and retaining quality students and will boost the aquatic animal health laboratory resources. Tuskegee University faculty will be exposed to state-of-the-art fish disease diagnostic techniques and will be able to undertake such experiments on their own when needed.

This project will help in developing and strengthening veterinary and graduate education in and aquatic animal health that may have great potential for careers for Tuskegee students. An infrastructure built upon aquatic animal health's biotechnological advances in the identified specialties within the Department of Pathobiology is critical in the Tuskegee University's strategic plan to prepare for the challenges of the second decade of the 21st century.

Specifically, this project will enhance research as well as teaching infrastructure in the Department of Pathobiology in the CVMNAH. Because it is the only graduate program in aquatic animal health among the HBCUs, it is likely to attract students from both national and international institutions. The improved Infrastructure will enhance faculty expertise in the molecular assays and enhance capacity to effectively teach the molecular sciences to DVM and graduate students.

KUNWAR SRIVASTAVA
Professor of Pathobiology and Attending Veternarian

SCIENCE –BASED RISK ANALYSIS AND MODELING PROJECT: PROMOTING GLOBAL TRADE IN AFRICA

PRINCIPAL INVESTIGATOR: Tsegaye Habtemariam
CO-PRINCIPAL INVESTIGATORS: Berhanu Tameru, Vinaida Robnett, David Nganwa, Asseged Bogale and Gemechu Gerbi

The Tuskegee University Center for Computational Epidemiology, Bioinformatics and Risk Analysis (CCEBRA), was provided funding by the U.S. Department of Agriculture Animal and Plant Health Inspection Service, (USDA/APHIS), to engage selected African universities and organizations to build and strengthen their sanitary/phytosanitary (SPS) science-based risk assessments capacity. This is in keeping with the World Trade Organization's (WTO) *Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement)*, which established standards for international regulations affecting agricultural trade. SPS regulation is widely recognized as an important constraint to agricultural development and trade for many developing countries. SPS capability must be strengthened: if agriculture is to continue to be an engine for growth and development in developing countries; if agriculture is to continue to meet the international needs for food security and survival; and especially if developing countries wish to participate in inter-country, U.S., and global agricultural trade.

Following a strategic plan we developed to implement this project, during the 2009-2011 period, we successfully completed the first series of introductory/intermediate level workshops (Tables 1-4). So far, we have trained 97 African scientists and government officials from 20 countries. Advanced Risk Analysis Workshop will be held August 29 - September 9, 2011, for the East Africa Region. The Advanced Workshop for West Africa and South Africa Regions will be held later this year and 2012. This will then lead to train-the-trainer workshops during the 2012/2013 project year. The culmination will be organizing and hosting the second Pan-African SPS and Risk analysis Symposium planned for the 2012/2013 project year. The final objective of these capacity building activities is to establish Centers of Excellence in each of the three African regions as well interjecting SPS and Risk Analysis in the curriculum of each of the relevant African universities.

Project Objectives

- To provide six risk analysis and SPS workshops and one train-the-trainer session to participants from governments/universities/industries/organizations in Africa in order to promote the global trade of agricultural products.
- To provide training in risk analysis and modeling with a focus on animal, plant health, and food safety risk analysis.
- To provide risk analysis and modeling training to non-traditional learners via distance education relying on information technology.
- To develop a curriculum which interdigitates SPS agreements and science-based risk analysis into the curricula of Schools/Colleges of Agriculture, Veterinary Medicine, and other relevant academic programs.
- Promote fellowships for training in risk analysis of highly promising leaders from the developed countries who have the capacity for further advanced training in the U.S.

This project and its outcome fit well within the president's vision of "Bringing Tuskegee University to the World and the World to Tuskegee University.

TSEGAYE HABTEMARIAM
Professor of Epidemiology and Biomedical Informatics and Dean, College of Veterinary Medicine, Nursing and Allied Health

MICROELECTRONICS AND MICRO-ELECTROMECHANICAL-SYSTEMS (MEMS) RESEARCH

PRINCIPAL INVESTIGATOR: Li Jiang
CO-PRINCIPAL INVESTIGATORS: Kalyan Kumar Das and Michael A. Awaah

The Microelectronics Laboratory at the Department of Electrical Engineering, Tuskegee University, was established in 1998 with support from a Department of Defense (DoD) Infrastructure Development grant. The laboratory is housed in a class 1,000 clean room. Until recently, facilities included several photoresist processing tools, a Karl Suss MJB3 mask aligner, and an AJA International Orion 5 sputtering system. In 2010, we were awarded an NSF Major Research Instrumentation **(MRI)** grant that was utilized to acquire several semiconductor measurement and processing tools to enhance our research and educational training capability. The new acquisitions include:

LI JANG
Assistant Professor of Electrical Engineering

- A Profilometer for the measurement of thin film thickness.
- A Hall System for determining the carrier type, carrier concentration, and mobility of grown films.
- A Rapid Thermal Annealer (RTA) for the removal of ion implantation damage.
- A Plasma Reactive Ion Etcher (RIE) for etch profile control and residual layer removal.
- A Solar Simulator for measurements on photovoltaic cells.

Present research activities underway in the Microelectronics Laboratory include Si/Ge MOS device studies for integrated photonic device processing, thin film solar cells, grayscale lithography by polymer photomasks for micro-electromechanical-systems **(MEMS)**, carbon nanotube film patterning for flexible microsystems, and transmission microshutter arrays for the James Webb Space Telescope **(JWST)**. Research work performed in this laboratory has resulted in three Ph.D. dissertations, 18 M.S. theses, and four undergraduate research reports. The research work performed by the students has resulted in a total of over 25 conference presentations and refereed journal papers.

In addition to the NSF MRI program, the PI has pursued state of the art MEMS research exploring the design and fabrication of transmission light valve arrays for the JWST, and was funded by the U.S. National Aeronautics and Space Administration **(NASA)** and Thurgood Marshall College Foundation **(TMCF).** Light valve arrays (also called microshutter arrays) have been developed at the NASA Goddard Space Flight Center for use with the Near-Infrared Spectrometer (NIRSpec) instrument to be carried on the JWST. This project is for an alternative design with significant advantages over the Goddard array including high transmission and high fill factor, along with enhanced durability and minimal power consumption. The project outcomes were presented at the 55th International Conference on Electron, Ion, and Photon Beam Technology and Nanofabrication (EIPBN) and received considerable attention. Additional funds have been solicited from NSF to continue support of this research activity.

PHOTOVOLTAICS RESEARCH

PRINCIPAL INVESTIGATOR: Kalyan Kumar Das
CO-PRINCIPAL INVESTIGATORS: Michael A. Awaah and Li Jiang

Photovoltaics Research:
Currently, two high efficiency thin-film heterojunction material systems are being intensely researched for the fabrication of photovoltaic cells. These are: (i) p-type-CIGS/n-type CdS, and (ii) p-type CdTe/n-type CdS. An efficiency of 19.9 percent has been demonstrated for CIGS-based laboratory devices, whereas the CdTe/CdS cells have shown an efficiency of 16.5 percent.

Ongoing photovoltaics research in the laboratory involves a study of a double heterojunction tandem device structure, with an upper ZnTe/ZnSe junction and a lower CIS/Si or CGS/Si junction separated by a Zn--O buffer layer. So far, CIS/Si, CGS/Si and ZnTe/ZnSe heterojunctions have been studied as single junction devices. The ZnTe/ZnSe heterojunction was fabricated on ZnO coated Si wafers. All the films studied here were deposited on (100) Si, initially as individual films, by RF magnetron sputtering from stoichiometric targets. Grown films were analyzed using RBS, TEM of cross-sectional samples and XRD.

Photovoltaic response has been observed for the individual device structures; current efforts are concentrated on producing tandem structure that is expected to provide a much higher efficiency than the single junction cells.

Flexible Solar Cells:
A new project initiated recently with support from the Army Research Office (ARO) involves the development of a renewable source for powering mobile military electronic components and systems. The proposed source will comprise of high efficiency flexible solar cells with an integrated super-capacitor fabricated on nylon or polyester/cotton fabrics used for the manufacture of outerwear garments or camouflage war-fighter gear and uniforms. The potentially large area device, with no or very little additional weight, is expected to serve as a portable source with storage capability providing power both in the presence or absence of sunlight. We propose to use two different approaches in order to enhance the conversion efficiency of currently available single junction Si or CIGS solar cells. The first approach would be to fabricate a structure incorporating two heterojunctions, namely, ZnTe/ZnSe and CIGS/n-Si, separated by a buffer layer, ZnO. The second approach would also involve a two junction system employing a ZnTe/ZnSe heterojunction on a prefabricated conventional Si p-n junction cell.

KALYAN DAS
Professor of Electrical Engineering

NUCLEOTIDE BINDING SITE (NBS) PROFILING OF RESISTANCE GENE ANALOGUES IN THE SWEET POTATO TRANSCRIPTOME

PRINCIPAL INVESTIGATOR: Jacquelyn R. Jackson
CO-PRINCIPAL INVESTIGATORS: Marceline Egnin-Tuskegee University and Aurelie Rakotondrafara- University of Wisconsin-Madison

Plants are constantly exposed to a broad spectrum of pathogens. To defend themselves, plants have developed a sophisticated immune system that allows them to recognize the invader and turn on an appropriate defense response. Understanding the molecular basis of innate resistance mechanisms in plants is of very high priority and is necessary for forwarding efforts to protect our global food supply.

Tuskegee University and the University of Wisconsin-Madison have come together to address this issue in a three-year project, jointly funded by USDA's 1890 Capacity Building Grant Program. The project aims to uncover novel resistance gene analogues (RGAs) from select varieties of sweet potato and explore potential sequence polymorphisms of genes predicted as viral resistance determinants. Nucleotide Binding Site (NBS) profiling of resistance gene analogues (RGAs) in the sweet potato transcriptome serves as a powerful tool in facilitating the cloning of disease resistance genes that can be engineered into desirable cultivars. The objectives of the project are:

1) To isolate putatively functional resistance gene analogues (RGAs) from different cultivars of sweet potato and characterize RGA sequences. The complexity of sweet potato's hexaploid genome has made breeding for resistance extremely difficult, therefore using Nucleotide Binding Site (NBS) profiling to isolate resistance genes in sweet potato will greatly assist with efficiently generating large collections of putatively functional R-gene and RGA fragments.

2) To analyze sequence polymorphisms in the host translation initiation factor, eIF4E, and its isoform homologues in different sweet potato cultivars and determine the relevance of eIF4E resistance to SPFMV. Despite correlations that have been established in other crops pointing to the importance of eIF4E as a recessive resistance gene against potyviruses, no study has investigated the relevance of eIF4E as a resistance determinant in sweet potato.

3) To determine the relevance of the interaction of the eIF4E/eIFiso4E and the viral protein bound to the genome, VPg, in sweet potato potyviral infections as an exploitable means of resistance Closely examining the interaction of eIF4E with the VPg of potyviruses will aid in understanding the role of eIF4E-encoding resistance genes in potyviral infections and shed light on the molecular basis of innate resistance mechanisms in plants.

JACQUELINE R. JACKSON
Research Assistant Professor of Molecular Biology and Genetics

TUSKEGEE UNIVERSITY CENTER FOR BIOMEDICAL RESEARCH (TU- RCMI)

PRINCIPAL INVESTIGATOR: Tsegaye Habtemariam
CO-PRINCIPAL INVESTIGATOR/DIRECTOR: Cesar Fermin

The functions of the TU-RCMI are fulfilled through the development of several core services and three pilot projects headed by promising bright junior investigators working in cancer and autoimmune diseases (specifically HIV/AIDS and lupus). Dr. Clayton Yates pictured above (Middle) with D. Hall (Right) and C. Davis (Left) is one of the junior stars supported by RCMI funds to work in cancer. RCMI faculty such as Drs. Yates, Martinez, and Tameru are required to make a transition from dependent to independent research by securing R type or equivalent funds to support future research. Hall is a member of the CBR internal advisory committee and also director of the Office of Sponsored Programs, now institutionalized after initial support from previous RCMI grants.

Tuskegee University is one of 18 HBCU members with support from the RCMI program. The overarching but complementary goals of the CBR are: a) to support and promote the newly created Ph.D. program in Integrative Biosciences (IBS) and, b) to focus biomedical research upon two of the health disparity diseases that include cancer and autoimmune diseases (specifically HIV/AIDS and lupus).

Policies and regulations for RCMI programs are administered by a PI/PD organization that meets twice a year with NIH officers to keep the programs on track.

Pictured below are NIH officers and PI/PD members at the 2010 annual meeting that took place in Nashville with Meharry Medical College, Morehouse School of Medicine and Tuskegee University as sponsoring institutions.

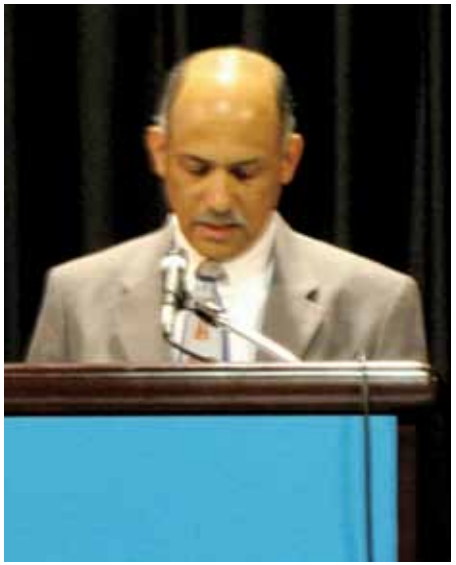
The CBR is supported by a grant from the NIH's Research in Minority Institutions (RCMI) program that was renewed in 2010 for a five- year cycle. The program serves as the cornerstone for biomedical research at Tuskegee University. The Principal Investigator (PI) and the Project Director (PD) during the year 2010-2011 were Drs. Tsegaye Habtemariam and Cesar Fermin, respectively.

The CBR represents a core institutional infrastructure, which when taken in combination with a high quality human resource base, is vital for the implementation and maintenance of a state of the art biomedical research enterprise scientists partner internally with the new Center for Bioethics in Research and Health Care (NCBRH) at the university, which promises new avenues for innovative research with ethics at its core.

The center utilizes a multidisciplinary, community-based approach to examine and articulate issues in health care research and delivery and public policy involving and affecting African-Americans and other vulnerable populations.

Information Sharing: Beginning in 1997, using RCMI funds and other resources, an Annual Biomedical Research Symposium highlights health issues that disproportionately affect humans in the Black Belt region.

As a part of TU sponsorship role for the 2010 symposium Dr. Fermin chaired several sessions at the symposium. *Detailed information about the CBR may be found at this link: http://www.onemedicine.tuskegee.edu/RCMI/Index.ht*



CESAR FERMIN
Associate Dean for Research and Advanced Studies, College of Veterinary Medicine, Nursing, and Allied Health

EVALUATION OF TILLAGE PRACTICES ON SOIL QUALITY AND CARBON SEQUESTRATION USING SELECTED SOIL ENZYME ACTIVITIES AND MEASUREMENT OF SOIL MICROBAL DIVERSITY

PRINCIPAL INVESTIGATOR: Ramble Ankumah
CO-PRINCIPAL INVESTIGATORS: Marceline Egnin and Guohao He

The relationship between physical and chemical properties of soils and soil biology is critical to understanding the interactions between these components of soil and how they respond to agricultural and environmental perturbations. Furthermore, how these perturbations affect the soil's capacity to perform ecosystem functions remain a primary goal of this focus area in soils research. Hitherto, prior studies have focused on individual aspects and have not brought together the tools to look at them in an integrative/multidisciplinary fashion. The available methods, together with current advances in soil biology, especially the development of 16S rRNA molecular tools, allows for the probing of this subject in a different way. The use of existing long-term plots with detailed history of land use allows us to compare these physico-chemical parameters of the soil with both soil enzyme activities and microbial communities and to better understand their relationship to soil health. This project uses these emerging tools in an interdisciplinary way to answer some of the pertinent questions in soil research. In doing so, this project allows Tuskegee University to enhance its capacity to be a player in this area of research and thereby adequately prepare its students in cutting edge research and teaching in the area of soils and microbial ecology. A research team, consisting of faculty members with multidisciplinary research backgrounds in soil microbiology and environmental science, agronomy (Dr. Githinji), and genomics (Drs. M. Egnin and G. He), is working collaboratively to achieve the objectives of this project. Thus, this research project supports the university's effort to build solid agricultural and environmental sciences programs. The main objective of the research is to examine how long-term agricultural practices have affected the microbial composition of these soils and thus the ability to perform critical soils functions. The research combines the use of modern molecular methods to achieve this aim.

The novelty of this research is that it combines the measurements of soil biological, biochemical, and physico-chemical parameters with well-defined sets of soils with known tillage practices. This research uses existing long-term plots from Alabama, Oklahoma and Ohio, which are well-characterized, together with an interdisciplinary approach to examine the relationship between soil enzyme activity and soil biology using current available molecular tools. The partnering of the interdisciplinary team both within Tuskegee and with our partners at USDA (Drs. M. Ibekwe, USDA Soil Salinity lab, Riverside, Calif. and S. McIntyre, Soils Grazing Lab, El Reno, Okla.) and other participating institutions (Warren Dick, Ohio State University and Yucheng Feng, Auburn University) provide a unique approach to looking at this problem.

This project will train students from the baccalaureate to the doctoral level and will also provide insights into long-term impact of agricultural practices on the key processes that regulate nutrient and biogeochemical cycles. The insights obtained will allow the agricultural, environmental community and policymakers to develop sustainable practices in food and energy production.

RAMBLE ANKUMAH
Professor and Chair of Agricultural and Environmental Sciences

DEVELOPMENT OF SILVOPASTURE SYSTEM INVOLVING MEAT GOATS UNDER PINE PLANTATION FOR ENHANCING ECONOMIC AND ENVIRONMENTAL COMPETITIVENESS OF LIMITED-RESOURCES FARMERS AND SMALL-SCALE LANDOWNERS

PRINCIPAL INVESTIGATOR: Nar Gurung
CO-PRINCIPAL INVESTIGATORS: Ronald Smith, Sandra Solaiman and Uma Karki

The southern pine plantation owners are facing many issues which include fires, storms, climate change, insects, diseases, urbanization, and fragmentation and also lost economic opportunities due to weakened timber markets. Besides, envisage native and non-native species, degraded pine ecosystems, shifting consumer demands and declining economic viability of the private forest lands have compounded their problems. The meat goat production offers potential solutions for short-term income while waiting for income from timber sales. Being active browsers, goats have plenty of opportunity to browse on understory vegetation under pine plantations. Goats are also popular with small and limited resource landowners due to several reasons such as shorter life cycle, lower requirements of inputs, ease of handling compared to cattle and increased goat meat demand in the U.S. They can be used as biological control of weeds in the pastures and forests. The ability to browse above ground benefits goats by being less exposed to internal parasitic larva. The goats in the Southern U.S. suffer from many internal parasites mainly Haemonchus contortus (barber pole worm).

Conversion of pine plantation into silvopasture system by developing understory forage crops and incorporating meat goats will provide yearly cash flow from goat sale to pine plantation owners between timber harvests. The southeastern U.S. is close to major east coast ethnic goat markets which are a comparative advantage for the region. However, the use of meat goats under pine plantation has received very little consideration to date. The proposed joint project is a true collaborative endeavor involving three institutions serving mainly minority clienteles. The collaborating partners are Florida A & M University (FAMU), and the Federation of Southern Cooperatives (FSC), Epes, Ala. The long-term goal is to develop and evaluate goat-silvopastoral systems under pine plantations as sustainable practices for small and limited-resource farmers and landowners. Specific objectives are to: 1) evaluate productivity and quality of systems' components (pine trees, forages, meat goats, and soil), 2) compare organic and inorganic fertilizers to manage silvopastoral systems, 3) determine the effect of stocking density on forage quality, productivity, and diversity and animal productivity and 4) provide education and training to students, landowners, and other clients. Two stocking rates of meat goats will be used under 27-year-old loblolly-pine plantation at Quincy, Fla. under the two systems (pasture vs. silvopasture) and two fertilizer sources, three stocking rates of goats will be used under 6-year-old long-leaf-pine plantation at the Tuskegee University site and three stocking rates of goats will be used in a 11-year-old loblolly-pine silvopasture at FSC.

The outcome will be used to educate stakeholders for developing and sustaining a viable goat-silvopasture system where all components are optimized and sustained. These institutions will also serve as avenues and demonstration sites for training and developing highly skilled professional work force and advance the cultural diversity in the agro-forestry area.

The proposed project will be layered onto the McIntire-Stennis Cooperative Forestry Program funded through the USDA's NIFA. The collaborative team comprising of various disciplines will contribute to the project by addressing various objectives outlined in the proposal. Furthermore, the project will serve to build capacity for Tuskegee University to educate students, producers and other stakeholders. The overall aim is to afford underserved and underrepresented individuals exposure to research work and inspire in them the pursuit of careers in the agro-forestry areas.

NAR GURUNG
Research Assistant Professor and Associate Director of Small Ruminant Research and Education Program

TUSKEGEE UNIVERSITY INTERDISCIPLINARY TRAINING PROGRAM IN BIOMEDICAL RESEARCH

PRINCIPAL INVESTIGATOR: Marcia Martinez

Tuskegee University has a long and honorable history as a leader in the training of African- American students. It is therefore with great pride that we announce Tuskegee University (TU) has joined the ranks of other prominent minority serving colleges and universities as a recipient of one of the prestigious Minority Access to Research Careers (MARC) Undergraduate Student Training in Academic Research (U* STAR) awards. The MARC U* STAR is a prestigious award supported by the Minorities Opportunities in Research (MORE), a branch of the National Institutes of Health (NIH). The overarching goal of MORE is to increase the number of underrepresented minorities who enter and obtain leadership positions in the field of biomedical research.

The TU MARC U* STAR is an honors program that provides tuition and stipend support for six eligible students whose career plans include biomedical research. To be eligible students must have completed 65 to 72 credits with a cumulative GPA of 3.2 or better. Upon entry into the program, MARC fellows are required to follow a core curriculum designed to improve their communication and quantitative/mathematical reasoning skills. The curriculum is also designed to engage students in multidisciplinary and interdisciplinary scientific research that focuses on issues facing their communities. The research performed by MARC fellows is mentored by the University's Research Faculty. In the past year the research conducted by MARC fellows encompassed a wide range of subject areas. Research areas covered by MARC fellows included the prostate tumor microenvironment; the use of synthetic peptides to control the growth of breast cancer cells and the development of inflammation and inflammatory induced tumors of the colon; the development and use of hydrogel nanoparticles in drug delivery; and the effects of neonatal exposure to androgens on penile development and fertility. In addition to an intramural research experience, the training of each MARC fellow is strengthened by an extra-mural research internship for which they receive support. Our current MARC fellows are completing such internships under the guidance of highly qualified research faculty at places like Purdue University, University of Cincinnati School of Medicine and NIH.

MARC students are encouraged to showcase their research in the form of both oral and poster presentations at local and national meetings. Our students traditionally do extremely well at these conferences. One of the most notable conferences that all MARC students nationwide attend is the Annual Biomedical Research Conference for Minority Students (ABRCMS). In 2010, over 3,000 students competed at the ABRCMS for recognition of their accomplishments in research. It is with great pride therefore that we announce one of our students, Ms. Amber Grace, won an award for her research presentation in immunology at this conference. Additionally, Jac'quese Hargrove won the Endocrine Society's Poster Award at the same meeting.

Although the TU MARC U* STAR program focuses on undergraduate students at the junior and senior levels, it is expected that this training program will impact students at all levels through shared classroom experiences, seminars and symposiums. The TU MARC U* STAR program will therefore supports collaborations and pedagogical reform that enhance student learning across several disciplines. This includes the development of integrative courses in the life sciences (biology and agriculture/veterinary sciences), chemistry, physics, mathematics, computer science and chemical engineering that incorporate mini-research modules in the classroom. The addition of the TU MARC U* STAR training program is therefore expected to further the goals of MORE and Tuskegee University to train highly qualified biomedical research scientists.

MARCIA MARTINEZ
Assistant Professor of Biology and MARC Program Director

STRENGTHENING FACULTY AND STUDENTS' GLOBAL COMPETENCE AND EXPERIENTIAL LEARNING IN AGRICULTURE, NATURAL RESOURCE MANAGEMENT AND CONVERSATION

PRINCIPAL INVESTIGATOR: Conrad Bonsi
CO-PRINCIPAL INVESTIGATORS: Ramble Ankumah, Eunice Bonsi, Olga Bolden-Tiller, Prosper Doamekpor, Robert Zabawa, Zachery Senwo AA&MU and Young Wang AA&MU

Tuskegee University (TU) in partnership with Alabama A&M University (AAMU) has initiated an international summer internship and experiential learning program in Costa Rica in partnership with EARTH University to broaden and strengthen students' global competence in food, agricultural, natural resource and environmental sciences to provide cultural, social, international education, research and experiential learning opportunities. The goal of this project is to strengthen our capacities and capabilities in developing competent students and faculty who apply their knowledge and skills globally in food, agriculture, natural resources and environmental sciences.

The specific objectives are to: 1). develop a summer enrichment international scholar exchange, experiential learning and education program linkage with EARTH University, Costa Rica, to broaden and enhance faculty and students' global competence in food, agriculture and natural resource management and conservation; 2). promote academic links in agriculture and natural resource management and conservation through faculty and student mobility; develop networks and relationships with EARTH University; and 3). promote awareness among students about the broad range of international opportunities in food agriculture and natural resources.

Students will be introduced to this program through a series of seminars in the first semester of each year. Students will be recruited for the program in the spring semester, using a series of interviews based on students' interest and willingness to learn new cultures and apply classroom materials to real-world environment. Prior to taking the trip to Costa Rica in the summer, the students will spend three days at Tuskegee University visiting research laboratories, field sites, research and education training, and interaction with other students, faculty and community members for social and culturally related activities, while they are guided through orientation on the exchange program. The students will travel to Costa Rica accompanied by faculty mentors. Each mentor is an expert in his/her area of research and/or teaching and will work with counterparts in those expertise areas at EARTH University. Students will be required to keep journals and submit written reports within ten days upon their return. The reports will summarize experiential learning knowledge gained through the internships. Students will also assess the effectiveness of the program and suggest potential recommendations for future improvement and better management of the program. In addition, students will participate in a series of presentations and seminars to other student groups on campus organized by the project director and co-directors. Students will use this opportunity to educate their colleagues and the general public about the multidisciplinary aspect of agriculture, while sharing their own Costa Rican/US experience. Students will also publicize the program and serve as advocates to recruit other students.

This project when completed will have a significant impact on the quality of food and agricultural sciences education at both TU and AAMU. The students will be well prepared to address the critical national issues relating to global food security and agricultural bio-security, climate change, human health and nutrition, bio-energy/biofuel, food safety, water quality and quantity, rural communities and economy, sustainable agriculture and the quality of life of families. It will strengthen and broaden the capability of the faculty and enhance the multi institutional and multidisciplinary collaborative instructional, outreach and research efforts of the faculty in both institutions. We anticipate that the project will (1) promote the development and enhancement of new curricula and related materials to meet changes anticipated within domestic and international agriculture, natural resources, environmental sciences, and food systems; (2) strengthen the faculty knowledge base to enable better preparation and mentoring of students for career opportunities in a globally competitive environment; (3) expose students to the implications of agriculture, natural resources and environment in Central America and specifically in Costa Rica; (4) provide the practical context for understanding international agriculture with emphasis on sustainable agricultural practices and ecosystem management; (5) broaden students' breadth and understanding of the global agricultural community; (6) provide comparative understanding of the agricultural, social and cultural values of Costa Rica with those of the United States; (7) develop an international research and education exchange and scholars program with EARTH University of Costa Rica for our mutual benefits, (8) serve as a venue for EARTH University students to enroll in our graduate programs. It is anticipated that this experiential learning will generate additional linkages which will eventually strengthen the project in the future and be of interest to the wider community and other HBCUs.

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