AMP

Proceeding of the
7th Annual Science & Engineering
Research Conference

Our mission

To increase the number of minority graduates in the fields of Science & Mathematics and Engineering

The Hook for Science, Mathematics, and Engineering at the Highest Level

The SCAMP Science & Engineering Research Conference is a major opportunity to highlight the outstanding talents in the National Science Foundation's SCAMP program. The research conference showcased students engaged in outstanding research in academic, industrial, and government laboratories in the states of South Carolina, North Carolina, and Georgia.

We would like to express our appreciation to the research mentors, judges, sponsors, Dr. Roosevelt Y. Johnson, and the SCAMP Statewide Office for an outstanding research conference as well as our congratulations to the student participants.

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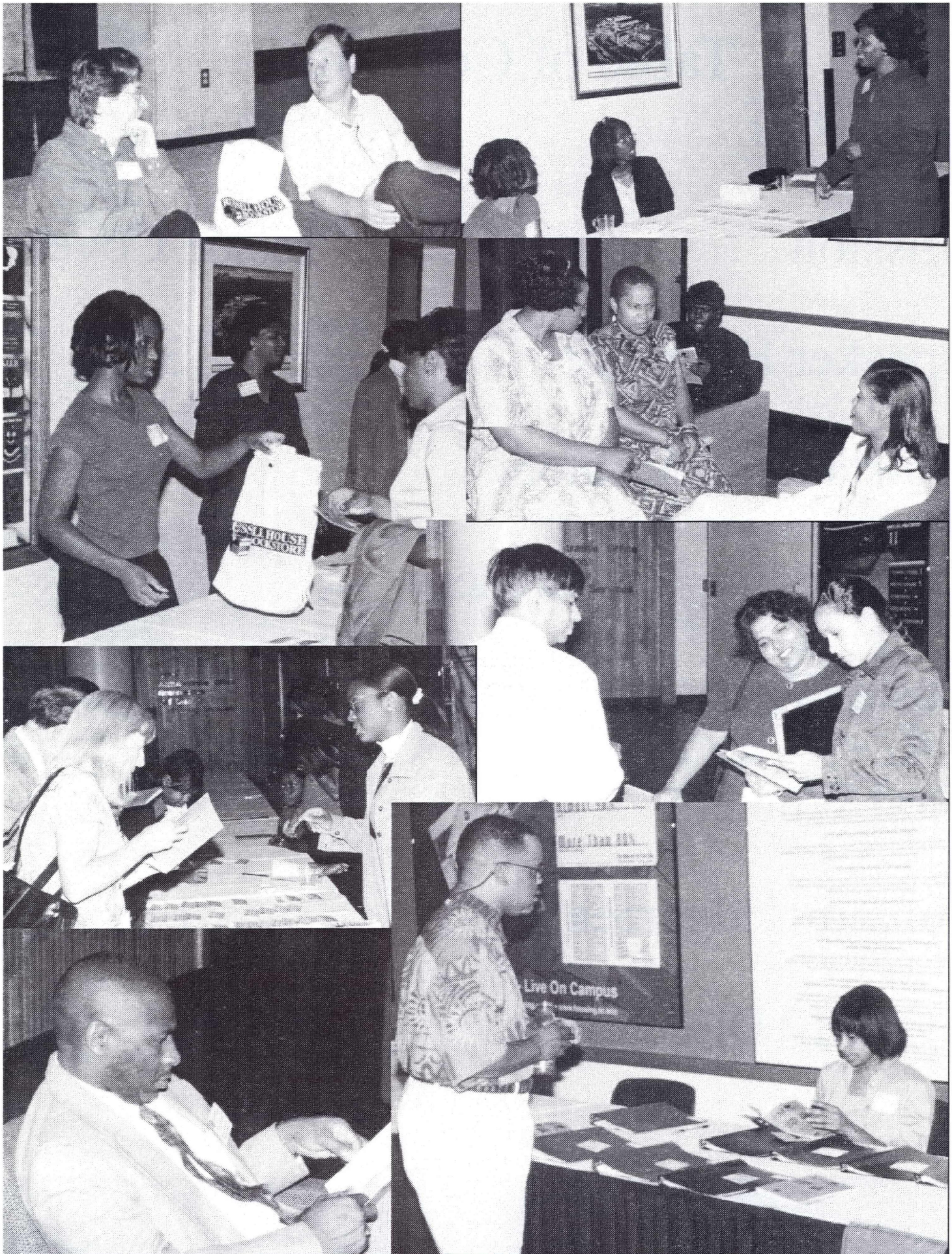

Live On Campus

Roosevelt Y. Johnson, PhD

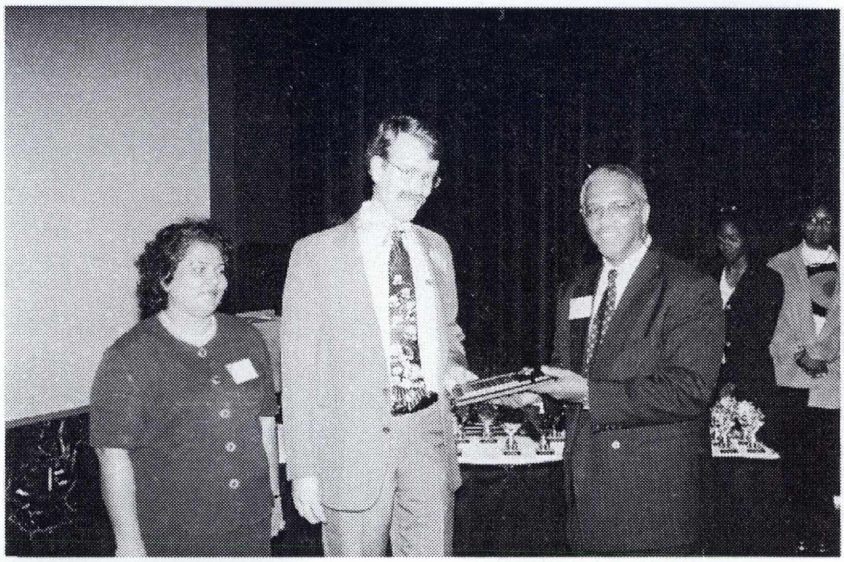
Program Director
Division of Human Resource Development
National Science Foundation

Dr. Johnson received his baccalaureate degree in Zoology in 1968 from Howard University (Washington, D.C.) and earned his doctorate in Microbiology from Indiana University (Bloomington, IN) in 1972. As a NIH Fellow, Dr. Johnson engaged in postdoctoral research in the area of plant molecular biology at the University of Washington (Seattle, WA; 1972-74). Dr. Johnson has held full and adjunct faculty positions at Pacific Lutheran University (Tacoma, WA), Howard University College of Medicine, Howard Community College (Columbia, MD), Towson State University (Towson, MD), and Howard University College of Liberal Arts. Dr. Johnson has also served as an official collaborator at the Los Alamos National Laboratories (Los Alamos, NM; 1986-89), conducting research directed toward elucidating the molecular basis of salt tolerance in plants. From 1989 to 1995, Dr. Johnson served as a program director with the National Science Foundation (NSF). During his tenure at NSF Dr. Johnson managed the Minority Research Initiation (MRI) Planning Grant program, the Research Improvement in Minority Institutions (RIMI) program, the Research Careers for Minority Scholars (RCMS) program the Graduate Research Traineeship (GRT) program and the NSF-NATO Postdoctoral Fellowship program in the Directorate for Education and Human Resources. From 1995 to November 1997, Dr. Johnson served as Deputy Director and Acting Executive Director of the National Consortium for Graduate Degrees for Minorities in Engineering and Science (GEM Consortium), where he was responsible for the management of the GEM Fellowship program and operations at the GEM Center (South Bend, IN). From November 1997 to February, 2000 Dr. Johnson managed administrative operations in the Division of Undergraduate Education at the National Science Foundation. Dr. Johnson is currently a Program Director in the Division of Human Resource Development within NSF's Directorate for Education and Human Resources, where he manages the Alliances for Graduate Education and the Professoriate (AGEP) program. The AGEP program has the specific objectives of a) increasing the number of underrepresented minorities receiving doctoral degrees in science, math and engineering (SME) and b) increasing the number of

Best Overall Mentors

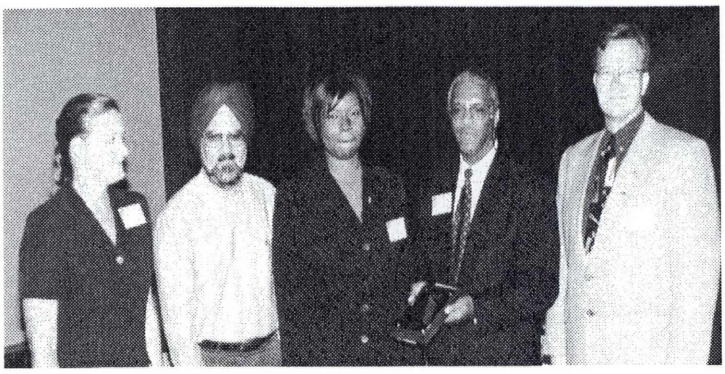
Dr. Ken Voss
Lead Scientist
USDA-ARS

Dr. Duncan Buell, Chair
Computer Science Department
University of South Carolina



Dr. Linda Jones, Assistant Professor
Department of Physics
College of Charleston

Best Overall Researcher



Candace Luces

Claflin University
Research Mentor: Dr. Wuthier
University of South Carolina

Determination of the Binding Affinity of Fusarochromanone (FC-101) For Bovine Serium Albumin (BSA)

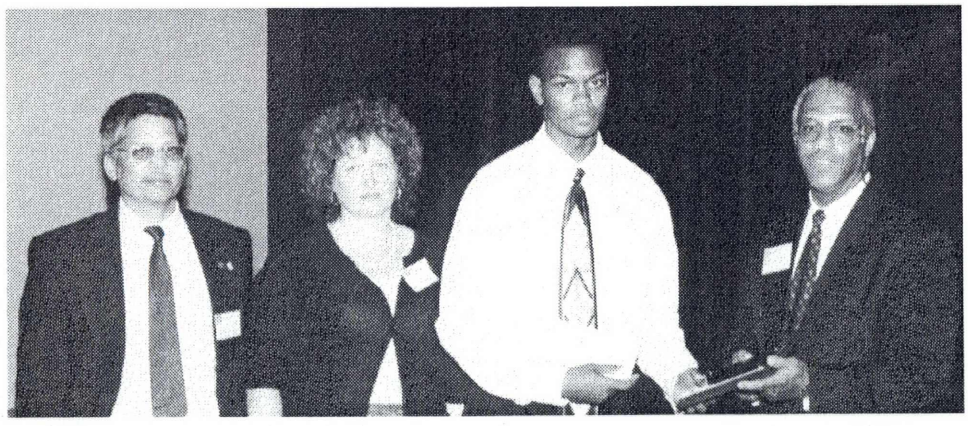
An important new method for treating cancer is to block angiogenesis, the formation of new blood vessels needed for cancer growth. I studied a newly discovered anti-angiogenic agent, Fusarochromanone (FC101). In addition to its ability to block angiogenesis, FC101 is highly inhibitory in the growth of human melanoma cells *in vitro.* However studies conducted *in vivo* showed the drug to be much less effective. This led us to explore whether the differences were due to FC101 binding to albumin, the major protein in blood serum. In our studies we used bovine serum albumin (BSA) as an experimental model. A simple binding (association) reaction would be as follows:

BSA + FC101→ BSA·FC101 complex.

Molecular-sieve chromatography using Sephadex G-25 was used to investigate binding of FC101 to BSA. This gel filtration method enabled us to distinguish between free (unbound) FC101 and BSA, and the BSA·FC101 complex. A Hitachi UV Spectrophotometer was used to measure the concentrations of FC101 and BSA by using absorbencies at two specific wavelengths (383 nm and 280 nm). Experimental data were used to calculate the binding constant for FC101 binding to BSA. Studies were repeated at several concentrations of FC101 to determine whether more than one molecule of drug binds to the protein. My findings reveal that 2 molecules of FC101 bind to one BSA, with a binding constant (K12= [BSA·FC101]/[BSA][FC101]^2) of 1.68 x 10^8 M^-2. This translate into the following relationship: BSA is half-saturated with FC101 at a free FC101 concentration of 75-80 μM. Generally, only free (unbound) drugs cross membranes into tissue sites and protein binding thus affects the rate of drug distribution. From our model, it is evident that a significant amount of FC101 is bound to albumin in blood, resulting in a lower concentration of unbound FC101 available to inhibit the growth of tumor cells. Therefore, studies are now warranted to determine the levels of bound and free FC101 in actual blood samples to determine the dosages needed to attain effective drug levels.

Troy Nelson

College of Charleston
Research Mentor: Dr. G. Sarvate
College of Charleston



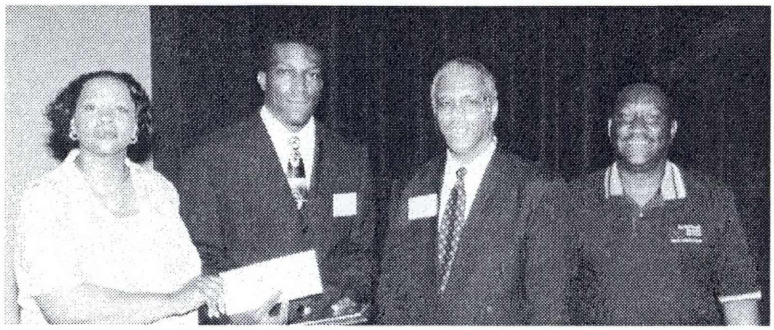
BET TRIFECTA at the BELMONT

Easy to understand problems stated in Discrete Mathematics can help one understand the essentials for Computer Science. Therefore, for my research, I took an interesting problem of finding the top 3 horses from a set of 25 under certain conditions and solved it. In the process, I studied LISP programming, Mathematical Induction, Logic, Complexity of Algorithms, and other problem solving strategies which help me in understanding the interconnection of the programming processes and mathematical processes.

Poster Presentations

Engineering

First Place



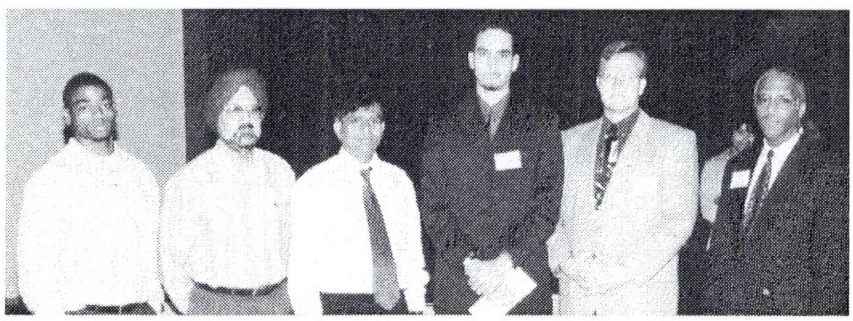
Kenny Brown

South Carolina State University
Research Mentor: Dr. John Foulk
Agricultural Research Services

Relationships between the Linear Density and Fiber Fitness

The linear density of 9 different International flax ranging in diameter from 30.23 to 59.87 ηm and micronaire ranging from 3.65 to 7.4 were tested. Flax originally used to form in ancient Egypt has reemerged as a composite, non-woven, and textile fiber in the U.S. Many automobile companies such as BMW, Volkswagen, Ford, Subaru, and others use this fiber in their interior panels as a naturally renewable product. Conducting this research will hopefully assist in fibers processing and high-speed production allowing cotton and flax to be used as a blend in the textile industries. Flax is an environmentally safe and renewable fiber, which could become a substitute for synthetic fibers. Studies have shown that it can be grown profitably with a high processing yield and be produced into a yarn of high quality. The ASTM cotton testing method D1577 was used to find the linear density of flax fibers. 500 fibers from 9 standards were randomly removed, cut, separated, counted, and weighed accurately to .00001 mg. The linear density was then calculated in denier units according to ASTM methods and compared to the standard fiber micronaire readings and the diameter. To show fiber fineness relationships, figures were constructed comparing the linear density, micronaire, and fiber diameter. The procedure was repeated three times due to the natural variations found between flax fibers. Linear density, micronaire, and fiber diameter relationship were observed between linear density and micronaire, micronaire and weight, linear density and fiber diameter, and micronaire and fiber diameter. These relationships will allow future predictions to be made about flax fiber linear density, diameter, and micronaire with results possibly contributing to increased production.

Second Place



Jose Quintero

Claflin University
Research Mentor: Adrienne Cooper
University of South Carolina

Horseradish peroxidase

Horseradish peroxidase (HRP) catalyzed-polymerization of phenols has been, for some time now, the subject of widespread research. This process of polyphenol synthesis represents an alternative for the production of phenolic resins without the use of the toxic compound formaldehyde. Phenolic resins are presently used for the production adhesives and bonding materials (plastics). This new polymerization process also represents particular potential in wastewater cleaning, and in the production of battery electrodes and plastics. In our study, polyphenol yields and molecular weights have been closely analyzed with respect to HRP concentrations and addition rates of the oxidant. We have also investigated the efficiency of crude horseradish root in the polymerization reaction. Analysis of phenol retrieval via the methods of filtration and water bath evaporation were also individually evaluated. HRP-catalyzed polymerization of p-phenylphenol were attempted, in a reaction media composed of 85% dioxane and 15% water/acetate buffer (pH 5). Hydrogen peroxide was used as the reaction initiator (oxidant). Moreover, the polymerization of p-phenyphenol proved to result from the above conditions. It was concluded from different reaction conditions, that polymer yields increases as a function of HRP concentration and lower hydrogen peroxide addition rates. As expected, increased p-phenylphenol concentrations in the reaction media also afforded an increase in polymer yield. My presentation therefore is on the evaluation of the possible cost-efficient process for large-scale production of polymers and discusses factors that affect their molecular weight.

Poster Presentations

Computer Science and Mathematics

First Place

Sheron Decker

South Carolina State University
Research Mentor: Dr. D Himmelsbach
Agricultural Research Services

Automation of Chemometric Pre-processing and Multivariate Processing
Using MATLAB

Chemometric preprocessing (e.g. smoothing, scatter correction, mean centering and derivitization) plus multivariate processing (partial least squares-1[PLS1]) was automated using the MATLAB software package. The combined algorithm was applied to the example of employing near-infrared Fourier-transform (NIR-FT) Raman specta to provide calibrations for the prediction of the amylose and protein contents of rice flour. The original spectral data was acquired on a Nicolet 950 NIR-FT/Raman spectrometer then transferred to GRAMS/32 where baseline correction and normalization were performed. The resulting spectral files were imported into MATLAB and processed using the automated routine developed to produce plots of: predicted residual sums of squares (PRESS) versus latent variables (LVs), root mean square error of cross-validation (RMSECV) versus widow size or gap for Savitsky-Golay smoothing of 1st -4th order derivatives and 1st or 2nd order gap difference derivatives. From the plots generated the best preprocessing parameters could be determined. The use of the automation of routine cut the processing time for calibration development by several days enabling greater laboratory throughput.

Second Place

Rachel Austin

Claflin University
Research Mentor: Dr. Grego
University of South Carolina

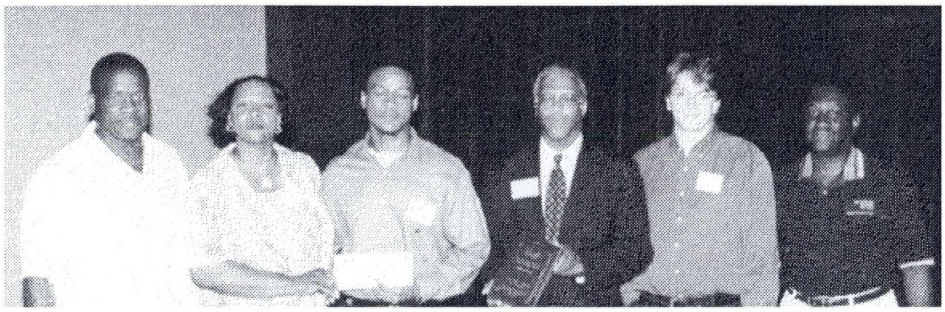
Do SCAMP Programs Motivate Students To Attend Graduate School?

The goal of the South Carolina Alliance for Minority Participation (SCAMP) is academic excellence I Science, Mathematics, Engineering, and Technology. It is a support program to increase the number of minority students who receive bachelor's degrees in these fields of study. Each year graduating seniors that have participated in SCAMP programs are required to fill out a survey. The survey consists of questions regarding the amount of influence each program had toward their decision to graduate with a science degree. The survey is also used to determine the number of participants the program has influenced to attend graduate school. The questions are analyzed by creating regression trees, which split the students into smaller subgroups. These subgroups may show a closer relationship between each program and its influence on the students' decisions. In the past, the Statistics laboratory has used this process and found that the Mentoring, Advisement, and Scholarship programs play important roles in the student's decisions. Their results have been updated to include the 2001 Exit Survey Data.

Poster Presentations

Biology and Chemistry

First Place



Tyson Anderson

South Carolina State University
Research Mentor: Tony Glenn
Agricultural Research Services

A Study of Infection and Endophytic Colonization of Corn Seedlings by *Fusarium* Species

The fungus Fusarium circinatum causes pitch canker disease resulting resinous exudation on the surface of pine trees. F. circinatum is a close relative of F. verticillioides that is the most common fumonisin B1 producing fungus associated with corn. Fumonisins are a group of mycotoxins commonly found in corn worldwide and are toxic to farm animals and suspected of causing esophageal cancer in humans. Both F. circinatum and F. verticllioides have the ability to detoxify antimicrobial defense compounds produced by corn. However, whether F. circinatum has the capacity to infect and colonize corn endophytically was unknown. To test this, F. circinatum strains NRRL 25333 and T212 were examined along with F. vericillioides strains NRRL 25059 and MRC 826, which are known to infect corn. Seed of the sweet corn hybrid Silver Queen were inpoculated with the fugal strains and then planted and grown in a growth chamber. Eighteen days after planting, tissues samples were taken from the seedlings, surface sterilized, and placed on agar growth media. The examination of outward growing fungi indicated that F. verticillioides that do not produce any asexual spores (conidia) were inoculated onto corn seed, and endophytic infection of seedlings was assessed after 20 days. Conidia are typically produced in large numbers and are the main mechanism of dispersal for the fungus. In general, those strains that could not produce under conidia were not able to infect corn. These studies increased our knowledge of those species of Fusarium that may infect corn under natural conditions and the necessary biological requirements that lead to infection.

Second Place

Lisa Huggins

Claflin University
Research Mentor:
Clemson University

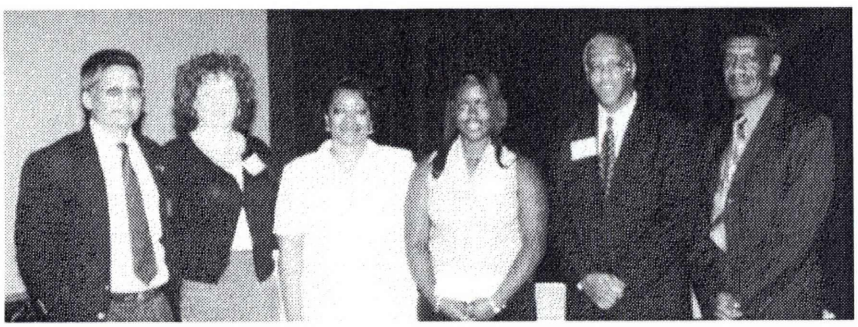
Structural Characterization of Biomimetic Protein Segments

A synthetic biopolymer with the properties of spider silk could be used to produce fibers with many commercial applications. Using advanced genetic engineering, researchers have synthesized proteins with structures similar to those of natural spider silk. Before these synthetic polymers can be commercialized, a better understanding of the proteins structures and their relationship to fiber properties must be realized. This project hopes to define the structure of collagen spidroin 2 through sequence analysis, characterization techniques such as circular dichroism spectroscopy, and molecular modeling. This information can be used to design and progress a fiber with improved tensile strength and elasticity.

Poster Presentations

Biology and Chemistry

Third Place



Diane Holmes

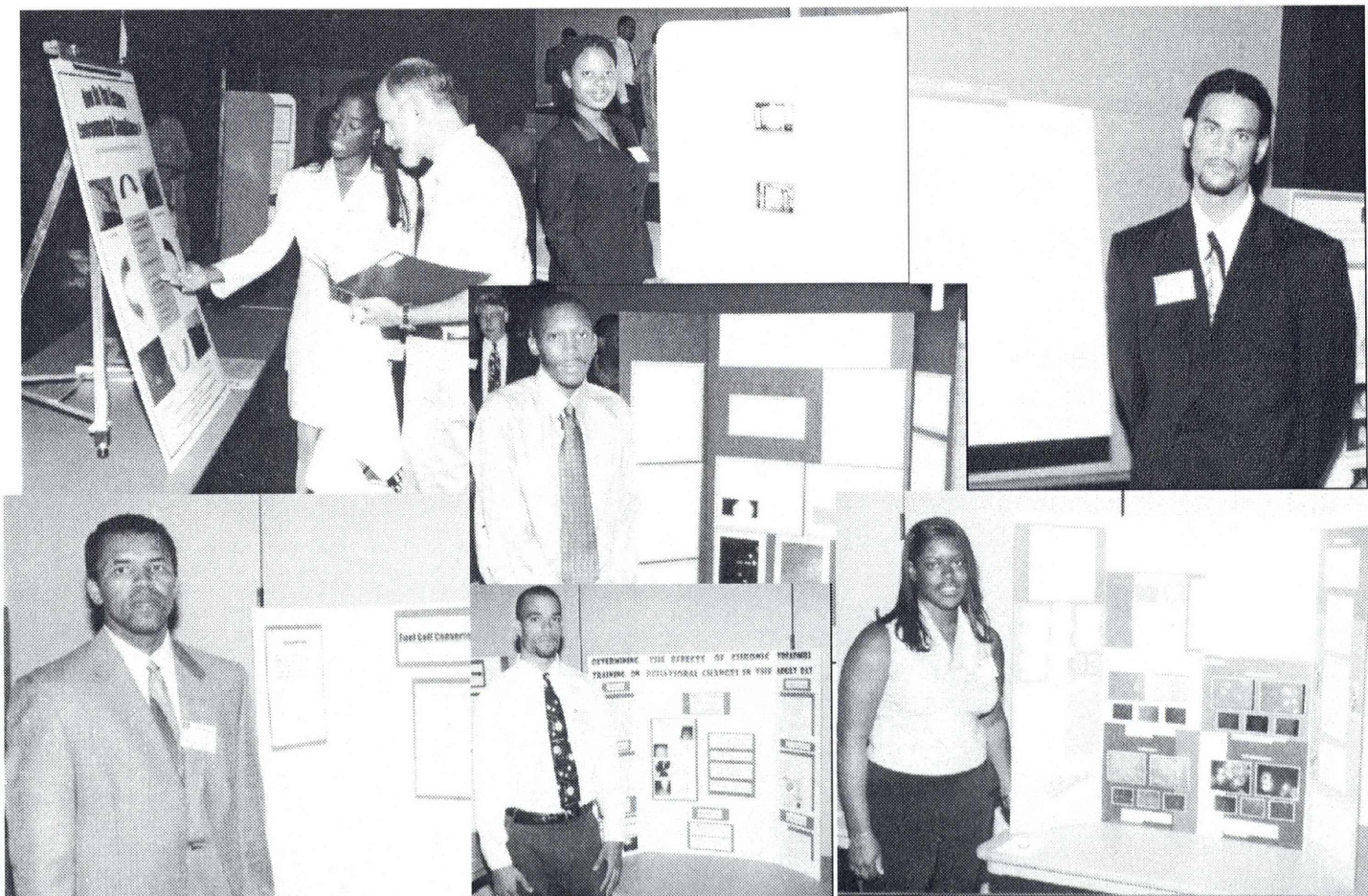
College of Charleston

Research Mentor: Dr. Linda Jones

College of Charleston

Photodynamic Therapy

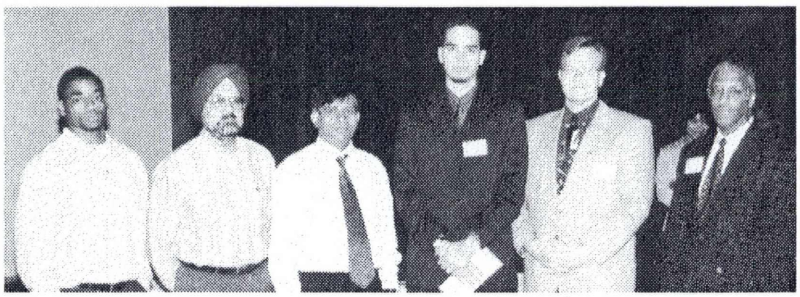
Photodynamic Therapy (PDT) is a cancer treatment that has been used experimentally to treat many types of cancer. Photofrin-sensitized PDT has been approved by the FDA for treatment of esophageal cancer. PDT involves the interaction of photosensitizing dye and light. Cancerous tissue is destroyed due to the reaction of the dye and light, while normal tissue is left unharmed. Merocyanine 540 (MC540) is an experimental photosensitizing dye that reacts with green light. L1210, leukemia cells are sensitive to MC540 while A549, lung cancer cells are resistant to MC540. The mechanism of MC540 is not known. We hypothesized that A549 cells have mulit-drug resistant transporters that allow it to be resistant to the MC540, while L1210 cells do not have these transporters. Chloro-dinitro benezene is an inhibitor that is known to alter the transport for substrates of MRP1 membrane proteins. A549 cells became more resistant while L1210 cells showed no apparent change. These results support our hypothesis.



Oral Presentations

Engineering

First Place



Jose Quintero

Claflin University
Research Mentor: Adrienne Cooper
University of South Carolina

Horseradish peroxidase

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Second Place

Deidra Cade

Clemson University
Research Mentor:
Clemson University

The Relationship of Structure, Processing, and Product Properties in Designed Polyolefins

Metallocenes are organometallic complexes used to catalyze polymers. Metallocene-catalyzed polymers such as polyolefins are valued as precursors for engineered fibers and films because of their controlled molecular weight distribution and designed branching. The polymers' architecture and processing behavior are directly related to product characteristics such as increased impact strength, toughness, and improved clarity. This research involves as investigation of several experimental polyolefins. Tasks include characterization of the precursors, analysis of the rheology, determination of optimum processing conditions for fiber spinning, and fiber production. The data will aid in defining the interrelationship of polymer structure, processing behavior, and product properties.

Oral Presentations

Computer Science and Mathematics

First Place

Rajananthini Velummylum

Claflin University
Research Mentor: Dr. Duncan Buell
University of South Carolina

Sorting on a Parallel Distributed-Memory Computer

We will present the implementation of a parallel quick-sort with random sampling on a Beowulf-class parallel distributed memory computer. Sorting is an application best done with shared memory, and yet distributed memory computers are the price-performance leaders. To overcome the need for shared memory, we use random sampling of the local arrays in order to predict how to use the memory efficiently.

Second Place

Charlitrice Bridges

Benedict College
Research Mentor:
University of South Carolina

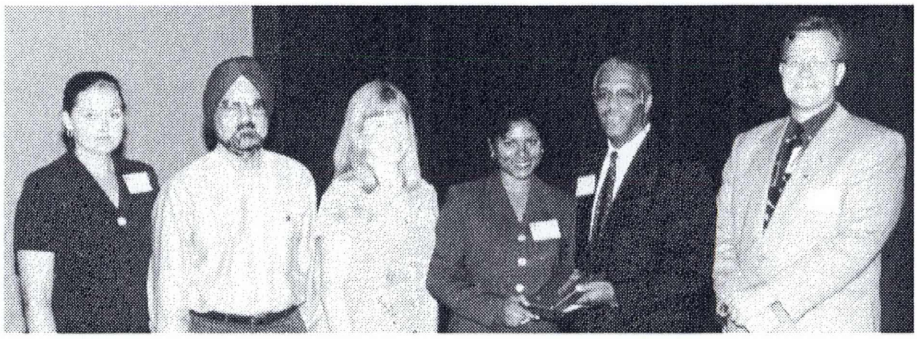
Emphasis on the Dimensional Graphics and Web Page Design

Using Softimage 3D, I produced an army tank. With the different modules, I was able to create the object and animate it. The tank creation was done in the model module using a variety of shapes. Each shape was scaled and translated to create the desired image. The animation was created using the motion module. It allowed me to show the movements of the tires. HTML code was introduced to start the creation of a web page. Instructed on how to create a page, links, and images. Using HTML, I plan to my personal web page.

Oral Presentations

Biology and Chemistry

First Place



Lisa Huggins
Claflin University
Research Mentor:
Clemson University

Structural Characterization of Biomimetic Protein Segments

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Second Place

Tiffany Gary
Voorhees College
Research Mentor: Albert Abbot
Clemson University

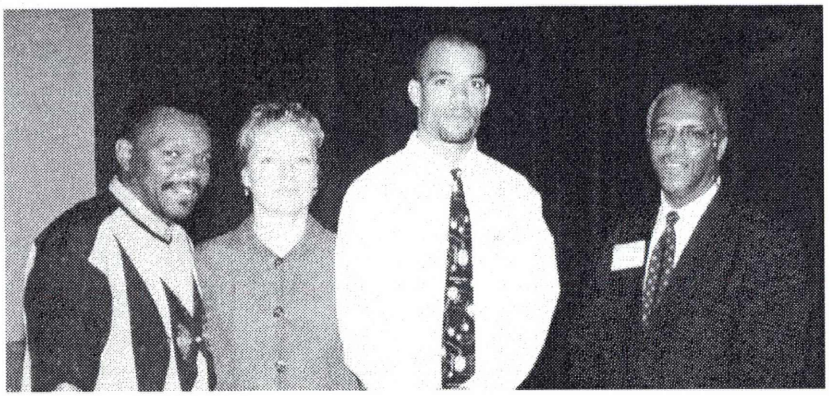
Synthetic Spider Silk Protein Production and Purification

Spider silk has outstanding strength and elasticity. For years scientists have tried to duplicate this fiber to make marketable materials such as sutures and bulletproof vests. This project engineered an artificial protein sequence that mimics that of the Golden Orb spider's dragline silk. My work had two components: (1) protein production, using techniques such as inoculation, incubation, centrifugation, dialysis, immunnoblotting, and coomassie blue staining, and (2) protein purification using a barch/gravity flow column. It was determined that we had successfully produced the desired spidroin-2-like protein, which is to be used.

Oral Presentations

Biology and Chemistry

Third Place



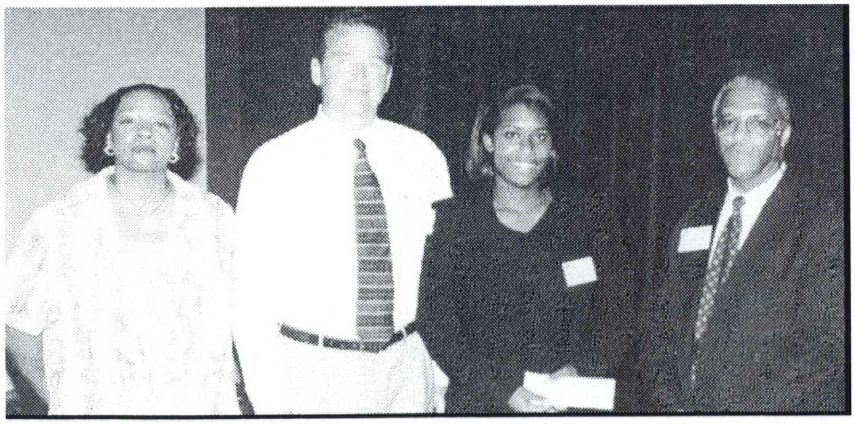
Jerome Bethea

University of South Carolina
Research Mentor: Dr. G. Hand
University of South Carolina

To Determine the Effects of Chronic Treadmill Training on Behavioral and Neurochemical Changes in the Adult Rat

More than 19 million Americans suffer from anxiety disorder, obsessive-compulsive disorder, phobias and generalized anxiety disorder. The purpose of our study was to determine the effect of physical activity on anxiety behavior and examine the nuerochemical changes that take place in the brain of rats. We examined neurochemical and behavioral adaptations that take place in response to chronic exercise. The neurotransmitters examined were dopamine, norepinephrine, and 5hydroxytryptamine (5-HT, serotonin). Metabolites of dopamine and serotonin, 3,4 dihydroxyphenlacetic acid (dopac) and 5-hydroxyindole-3-acetic acid 95 HIAA) respectively, were also examined. Twelve female Sprague Dawley rats were divided into two groups: runners) (n=5) and non-runners (NR0 (n=7). The R group ran on a treadmill 5 days a week, one hour per day, for 10 weeks. The behavioral tests included: elevated plus maze, defensive withdrawal, open field, and novel object. All of the rats were tested in each test. The R group remained in the open arm 10 times longer than the NR group in the elevated plus maze test. R had 2 times as many exits from the box as NR in the defensive withdrawal test. R had 3 times as many rears as NR in the open field and the R group in the novel object test exhibited 4 times as many rears as the NR group. The results from this study indicate exercise reduces anxiety in rats suggesting physical activity positively affects anxiety-related behaviors.

Third Place



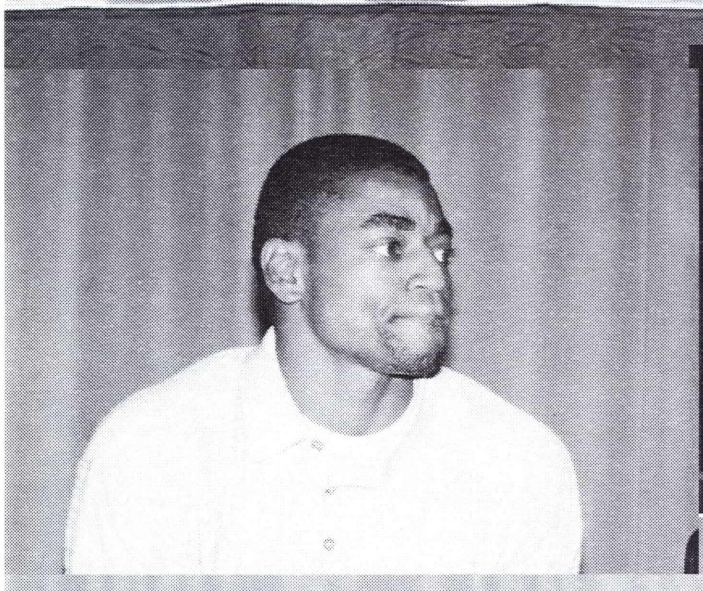
Natavia Middleton

University of South Carolina
Research Mentor: Dr. Ajoy Chakrabarti
South Carolina StateUniversity

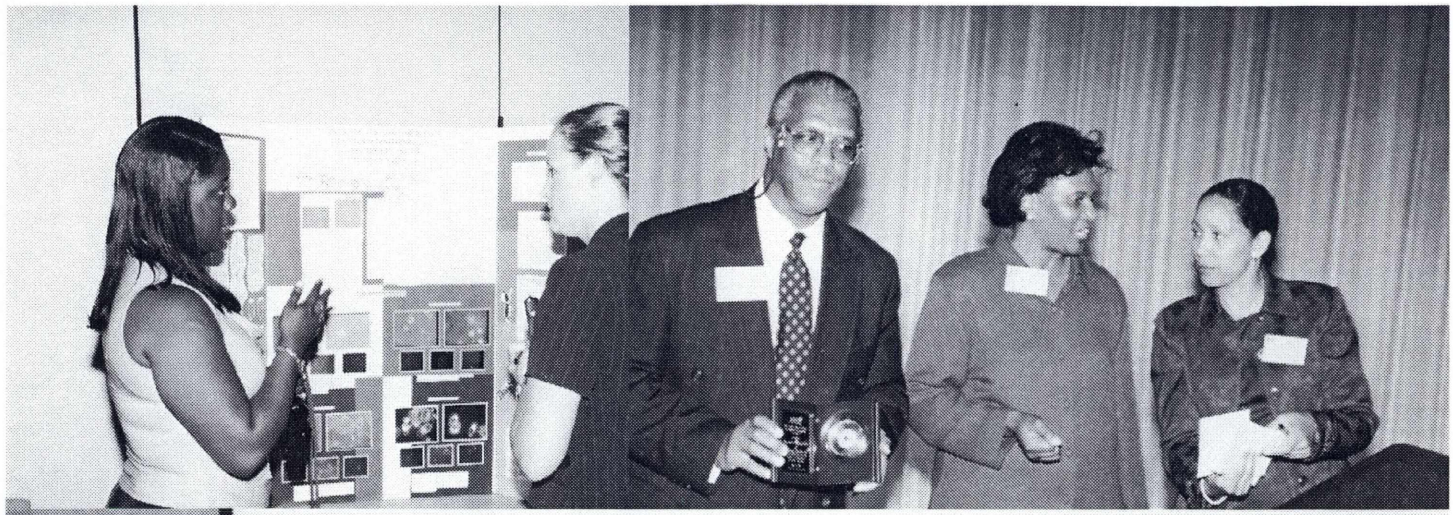
The Outdoor Conditions of Soil pH and Plant Growth

Plant development is a progressive change from seed germination through juvenility, maturity, flowering, and fruiting. Environmental factors, such as soil pH, may influence the developmental times or block particular stages altogether. Soil pH is an indication of the acidity or alkalinity of soil and is measured in pH units. Our aim was to observe plants under outdoor conditions and to examine if a specific pH will effect the growth and yield of a particular plant species. In addition, we determined that specific pH treatments provided different crops and weed species with an individual optimal yield of fruits and flowers. During this specific time period, careful observation of plant growth and yield was analyzed and discussed. As a result, we have found that the crop and weed species in this experiment that preformed best and therefore progressed from seed germination to fruiting and flowering was in pH 7 soil.


Takita Fuller




Takita Fuller



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Dr. Ralph White	Project Director
Dr. Angela W. Williams	Project Manager
Mrs. Anita Corbin	Project Assistant
Dr. John Grego	Project Evaluator
Holmes Finch	Project Evaluator
Dr. Juanita Scott	Benedict College
Dr. Shingara Sandhu	Claflin College
Dr. Robert Snelsire	Clemson University
Dr. Dinesh Sarvate	College of Charleston
Dr. Ronald Drayton	Midlands Technical College
Ms. Concetta Crawford	Benedict College
Ms. Alisa Smalls	SCSU
Mr. Dwayne White	USC
Ms. Gianna Gardner	
Dr. Elahe Mahadavian	SCSU
Dr. Jon Rose	USC
Dr. John W. Baynes	USC
Mrs. Saphronia Johnson	USC
Ms. Sherine Obare	USC
Ms. Primrose Musingarimi	USC
Ms. Kanika Darby	USC
Mr. Qunicy Ford	USC
Ms. Terri Wright	USC
Ms. Takita Felder	USC
Mr. Martin White	USC
Dr. Judith Salley	SCSU
Dr. Cassandra Smith	Voorhees College
Dr. Mike Perkins	USC
Mr. Rick Bailey	
Ms. Rose Jenkins	Claflin University
Mr. Noel Coldwell	
Mrs. Florence Anoruno	College of Charleston
Mrs. Leslie Robertson	
Dr. Nesan Sriskanda	Benedict College
Dr. Linda Jones	
Mrs. Juanita Hopper	SCSU
Dr. Neyoka Fisher	
Ms. Princetta James	
Dr. James Anderson	
Senator John W. Matthews	Chairman, Legislative Black Caucus
Ms. Judy L. Trimble	Spallation Neutron Source Human Resources
Dr. Linda Cain	Oak Ridge National Laboratory, Oak Ridge TN
Ms. Ella DuBose	Spallation Neutron Source
Dr. T. Scott Little	EPSCOR Director
Ms. Michelle Nix	Savannah River Site
Dr. Mike Matthews	Department of Chemical Engineering/USC
Dr. Paul Beasley	Trio Director/USC
Dr. Jerome Odom	Provost, USC
Mr. Thomas Johnson	US DOE/Savannah River Operations
Dr. Judy Bostik	US DOE/Savannah River Operations
Ms. Beverly Wright	
Ms. Claire Cornell	
Dr. A. James Hicks	National Science Foundation
Dr. Danny Akin	USDA-ARS, Athens, GA
Dr. Tangali Sudarshan	USC

Dr. Gerald Crawley	Dean, College of Science and Math
Mr. Karen Lee	USDA-ARS, Clemson
Dr. Sharon Nicodemus	WSRS
Ms. Susan Davis	USDA-ARS NCSU
Mr. Tony Edmund	South Atlantic Region, USDA-ARS
Ms. Cynthia Anderson	US DOE/Savannah River Operations
Ms. Tania Smith	US DOE/Savannah River Operations
Mr. Greg Rudy	US DOE/Savannah River Operations
Mr. Tom Heenan	US DOE/Savannah River Operations
Dr. Bernhard L. Linder	College of Charleston
Dr. Christopher Alexander	College of Charleston
Dr. Andre S. Mount	Clemson University
Dr. N. K. Swain	SCSU
Jon Lockwood	WSRS
James Johnson	WSRS
Dr. Clarke Millette	USC-Medical School
Dr. Franklin E. Barton, II	USDA-ARS, Athens, GA
Dr. Frederick Meadows	USDA-ARS, Athens, GA
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Dr. Harold Pattee	USDA-ARS, NCSU
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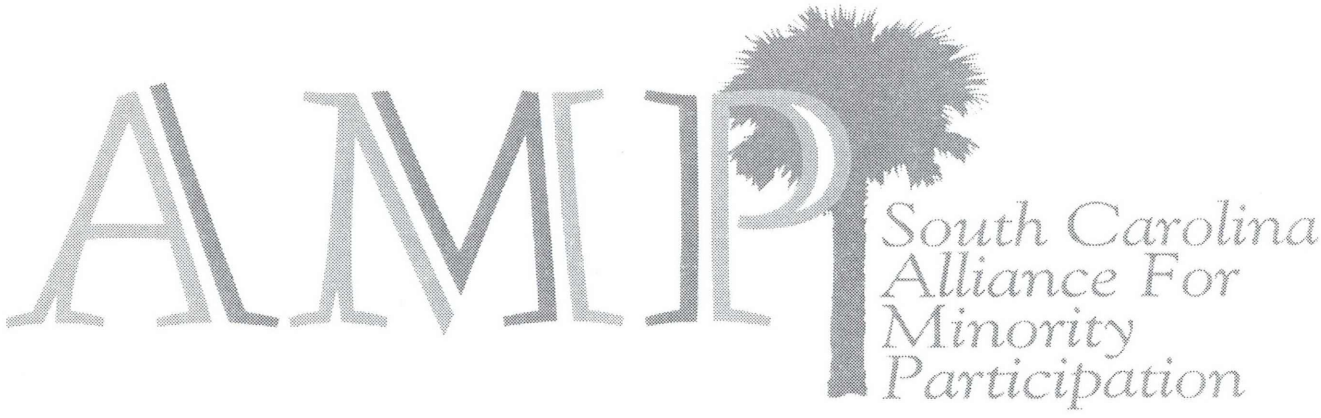

Benedict College
Ms. Vivian Counts
Dept of Biological and Physical Sciences
1600 Harden Street
Columbia, SC 29204
803-253-5280

Claflin University
Dr. Shingara Sandhu
JST Science Bldg
Orangeburg, SC 29115
803-535-5447

Clemson University
Dr. Bob Snelsire
EE Department
Clemson, SC 292634
864-656-5915

College of Charleston
Dr. Dinesh Sarvate
Department of Mathematics
66 George Street
Charleston, SC 29424
843-953-5736

Midlands Technical College
Mr. Rick Bailey
Department of Mathematics
316 S. Beltline Blvd
Columbia, SC 29205
803-738-7618

South Carolina State University
Dr. Judith Salley
Department of Biology
206 Hodge hall
Orangeburg, SC 29117
803-536-8509

University of South Carolina
Ms. Beverly Wright
College of Engineering
300 Main Street
Columbia, SC 29208
803-777-2464

Voorhees College
Dr. Cassandra Smith
Dept of Natural and Computer Science
1411 Voorhees Rd
Denmark, SC 29042
803-793-3351

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