Fifth Annual Undergraduate Research Conference

Gateways to Graduate Excellence in Science, Mathematics, Engineering, and Technology: A Decade of Louis Stokes AMP Achievement

ABSTRACTS

POSTER AND ORAL PRESENTATIONS

NC-LSAMP

NORTH CAROLINA LOUIS STOKES ALLIANCE
FOR MINORITY PARTICIPATION
in Science, Mathematics, Engineering, and Technology

North Carolina A&T State University
Greensboro, North Carolina
April 20, 2001

Sponsored by the National Science Foundation and Participating Institutions
Fayetteville State University, North Carolina Central University,
North Carolina State University, University of North Carolina–Chapel Hill,
University of North Carolina–Charlotte, University of North Carolina–Pembroke,
Winston-Salem State University, and North Carolina A&T State University (lead campus)

Dedicated in Memoriam

Dr. Thoyd Melton

December 4, 1947 – November 22, 2000

Dr. Thoyd Melton, former dean of the Graduate School of North Carolina Agricultural and Technical State University, was a graduate of W. S. Creecy High School in Northampton County, North Carolina. He received his B.S. degree in biology/chemistry in 1970 from North Carolina Central University. Subsequently, he earned a Ph.D. degree in microbial genetics from Johns Hopkins University in 1976.

A dedicated and committed educator for more than 25 years, Dr. Melton was Associate Vice Chancellor for Academic Affairs also at North Carolina Agricultural and Technical State University. For several years he served as Associate Dean of the Graduate School at North Carolina State University, where he was also a professor of microbiology. During his exemplary career, Dr. Melton received many awards and served on numerous local, state, and national committees. In addition, he was an active member in various graduate school organizations.

Dr. Melton demonstrated outstanding attributes as a faculty mentor for graduate students, and was also recognized as an outstanding role model for both students and faculty. We proudly dedicate the 2001 NC-LSAMP faculty-mentored research abstracts in commemoration of the life and work of a great African American scientist.

GENERAL INDEX

Abstracts are displayed as submitted without editorial modification.

POSTER ABSTRACTS

NC-LSAMP

NORTH CAROLINA LOUIS STOKES ALLIANCE
FOR MINORITY PARTICIPATION
in Science, Mathematics, Engineering, and Technology

Alisha Ann Covington
Fayetteville State University
Junior
Biology
Mrs. Minnie B. Ragland

Analysis of Antibiotic Resistance in Bacteria Found in Fayetteville State University Water Supply

Water is a naturally occurring substance ranked second to oxygen in its role of sustaining human life. Although water is a necessity for human survival, it can also cause bodily harm if found to contain contaminants such as bacteria. There are many types of bacteria that can be found in water, such as Helicobacter pylori, Staphylococcus, Shigella, E. coli, and Pseudomonas. E. coli, and Pseudomonas are the two most commonly found bacteria in water. The objective of this experiment is to determine if the bacteria in FSU's water supply are resistant to commonly used antibiotics such as ampicillin, chloramphenical, erythromycin, kanamycin, tetracyclin, penicillin, and amoxicillin. A mixed culture of bacteria concentrated from water by standard filtration was grown in Tryptic Soy Agar broth at 37ºC, in a shaking incubator for 48 hrs. Disks impregnated with appropriate antibiotics were applied to the surface of bacterial cultures layered onto TSA plates. Plates were incubated inverted at 37ºC. Plates were grown inverted in an incubator at 37ºC overnight. Plates were scored to determine susceptibility of antibiotics.

Barry G. Graham
University of North Carolina at Pembroke
Senior
Biology
Dr. Velinda Locklear Woriax

Development of an Experimental Model for Therapeutic Stem Cell Transplantation in Genetic Liver Disease

The purpose of the current study was to develop an appropriate experimental model system for examination of the potential of liver stem cells to replace liver function in animals with a specific genetic deficiency. RT-PCR analysis of albumin mRNA showed that Nagase analbuminemic (Nagase) rats, which express diminished levels of serum albumin protein, produce albumin mRNA at levels comparable to that of wild-type rats in the 5'-region of the message. However, primers to the 3'-region of the mRNA revealed the expression of a truncated mRNA. As a control, RT-PCR analysis of transferrin RNA suggested the lack of a general defect in RNA processing in these rats. SDS-PAGE and automated analysis of serum samplesdemonstrated reduced levels of albumin in the serum of Nagase rats. Immunostaining of liver sections suggested that the reduced levels reflects albumin synthesis in only a subset of hepatocytes in these animals. Immunostaining for transferrin indicated that there is no general defect in protein synthesis in Nagase rats. We conclude that the Nagase rats are deficient for normal albumin production, but do not display an albumin negative phenotype. Therefore, they are a sufficient animal model for the study of therapeutic stem cell transplantation. (Supported by GM08037-15 frm NIGMS)

Norma Lekell Houston
North Carolina A&T State University
Senior
Biology
C. H. Peterson and J. Grabowski
UNC - Chapel Hill Institute of Marine Sciences

Assessing the Economic Feasibility of Different Hard Clam Grow-Out Methods

Revenues generated from clamming (both wild and cultured) recently totaled at 3.5 million in NC, making clams the #5 fishery of the state. In light of the harvest pressure that exists on already diminished wild stocks, aquaculture will be increasingly important. Therefore, investigating the biological signs and economic feasibility is a necessity for the development and maintenance of a healthy industry. We conducted a cost-benefit analysis on the feasibility of growing hard clams at different densities, using data from an experiment that evaluated the effects of density on growth and survivorship of clams grown in tented bottom beds. Planting clams at high density reduces the cost per seed clam; however, increasing density resulted in slower growth and greater clam mortality. This trade off between density and growth/survivorship has consequences for profitability of clam aquaculture ventures. In spite of higher planting cost, growing clams at low density was more profitable then at high densities. Harvesting 7/8' clams resulted in a smaller return on the investment. Planting clams in December increased the profit margin by 13.3%. (Supported by MARC Grant 5T34GM07649-22)

Adrienne Jones
Jamica Wilkerson
Carmon Choice
Angela Harris
Winston-Salem State University
Juniors
Biology
Dr. Kim H. Tan

Detection of Phospholipase A2 Iso-Enzyme mRNAs in Rat Astrocytes Using RT-PCR Technique

Detection of Phospholiase A2 (PLA2) is a superfamily of esterases that catalyze the hydrolysis of the SN-2 ester bond in phospholipids, liberating free fatty acids and lysophospholipids. The PLA2 enzymes are categorized into Ca2+ independent cytosolic phosphoslipase (i PLA2), and the secreted enzyme (s PLA2). cPLA2 is a unique phospholipase, in that it is a receptor-regulated enzyme that selectively cleaves arachidonic acid containing phospholipids in the presence of micromolar concentrations of Ca2+, freeing not only fatty acids and lysophospholipids, but also, arachidonic acid and pro-inflammatory precursors, such as prostaglandins, thromboxanes, and leukotrienes, that take part in processes that lead to apoptosis and tissue injury. cPLA2 may also be activated by non-recptor mediated stimulation of cells by oxidation, UV light, and shear stress. A significant presence of cPLA2 has been observed in the mitochondria of rat astrocytes treated with methylmercury. Methylmercury is a pervasive and well described neurotoxin that causes the formation of Reactive Oxygen Species (ROS), such as H2O2 OH-, and O2-, that also play a role in apoptosis and tissue injury. The purpose of this investigation is to determine the relative levels of PLA2 iso-enzyme mRNA in rat astocytes using RT-PCR technique.

Marie-Louise Locklear
University of North Carolina at Pembroke
Senior
Biology
Dr. Velinda Locklear Woriax

Protocol and Detection of Isozymes of Chrysoma Pauciflosculosa

Previous studies have shown that plant species, or populations of the same species differing in geographical locations, often contain slight variations in the amino acid sequences of the same protein. This occurrence results in the production of isozymes, variant forms of the same enzymes. Chrysoma pauciflosculosa, an evergreen shrub found amongst oak scrub along sand ridges, is considered a rare plant species in North Carolina. Two sites of Chrysoma, located approximately one mile apart in Robeson County, NC, have been located. No published information on isozyme studies or population genetics exists for this species. In this pilot study, we have developed a protocol for comparison and analysis of isozymes of Chrysoma. Four enzymes have been chosen on which the comparison of isozymes between populations will be initiated. In the protocol that has been devised, plant samples are ground homogenized, electrophoresized on 12 % starch gel and/or 5.5 % acrylamide gel, then stained for the specific enzyme being studied. Our initial results indicate several variables that influence the detection of isozymes from Chrysoma. Seasonal differences, storage conditions, and extraction methods have a great effect on the viability of proteins present. This work will supply information regarding population genetics for this species.

Chanel Nichols
Rolanda Patrick
Winston-Salem State University
Sophomores
Biology
Dr. Richard Bennett, Jr.; Xueying Wang; Johnellia Montgomery

Colocalization of Cytoskeleton Proteins in CHO-K1 Cells

Ezrin is a cytoskeletal linker protein and belongs to the ERM (Ezrin, Radixin, Moesin) subfamily. Ezrin has been shown to bind to F-actin filaments in the cytoskeleton. We have made an assessment of the localization of F-actin with other cytoskelatal proteins including ezrin, vinculin, the catenines and with the transmembrane gylcoprotein MUC1. We have used FITC and TRITC labeled antibodies to visualize the localization of th these proteins in CHO-K1 cells. Although the staining patterns for these proteins in CHO-K1 cells are probably not the same as those expected in MCF-7 breast carcinoma cells, the visualization of these patterns will serve as a template for the localization of cytoskeletal and transmembrane proteins. (Supported by Grant #T37TW00032, FIC, NIH and Grant # P20RRH583, NCCR, NJH).

Nyasha Skrette
James Blackwell
North Carolina Central University
Seniors
Biology
Dr. Amal Abu-Shakra; Tomeca McLain; Eric T. Saliim

Investigating the Impact of Variations in Nitric Oxide (NO) Delivery Among Commonly Used NO-Donors

Nitric oxide (NO) has been shown to generate mutation in a variety of in vitro assays. Due to the high reactivity of NO, researchers have been selecting from a number of NO-donors or No-delivery systems to release NO in the proximity of its DNA Target. The objective of the present study was to identify how differences in NO release mechanisms may influence mutagenicity. The collection of Salmonella tester strains employed in the standard Ames assay, and those developed for use in the automated Ames II assay, offered and excellent tool to investigate the impact of variations of NO delivery into the cell among the commonly used NO-donors. The compounds were tested in four categories (1) the "NONOates", diethylamine NONOate (DEA/NO); diethylenetetraamine NONOate (DETA/NO) Dipropylenetriamine NONOate (DPTA/NO); methylamine hexamethylene methylamine NONOate(MAHMA/NO); Propylamine Propulamine NONOate (PAPA/NO); PROLINONOate (PROLI/NO); spermine NONOate (Sper/NO), (2) sodium nitroprusside, (SNP) and (3) S-nitroso-S acetylpenicillamine (SNAP). Strain TA1535 was initially employed to generate the NO-induced fold over background or mutagenicity ratio (MR) induced by equimolar doses of SNP, Sper/NO, DEA/NO or SNAP.

At the dose range of 1-10 mmol/pl, Sper/NO was the most mutagenic (MR 27) followed by DEA/NO (MR 10), then SNP, and SNAP (MR 4). But unlike SNP. And SNAP were toxic at 10 mol/pl. As expected the hisG428 strains, TA102 and TA104 were not sensitive to any of the chemicals tested. The hisG46 strain TA100 was reverted by the NO-donors, but gave lower MR's than those obtained with TA1535. The Ames II strains TA7004 was strongly reverted by the NONOates, while TA7005 exhibited a weak mutagenic response.

Victoria Romain Williams
Univeristy of North Carolina at Charlotte
Sophomore
Biology
Dr. T. Lawrence Mellichamp

Comparing the Processes of Cell Division, Mitosis and Meiosis

Mitosis is the foundation of asexual reproduction, growth and tissue repair in plants and other eukaryotes. Meiosis permits sexual reproduction and genetic change for survival. Mitosis consists of one mitotic division of a diploid parent cell, which yields two diploid daughter cells. In meiosis the diploid parent cell produces four haploid cells, once it has undergone two meiotic divisions. The various phases involved, in order to obtain these outcomes, are : Interphase, Prophase, Metaphase, Anaphase and Telophase. Subsequent mitosis, each daughter cell is completely identical to that of the parent cell. In dissimilarity, the daughter cells of meiosis are unalike in every way from the parent cell. Mitosis and meiosis are important processes that predict the survival of all organisms. The rate at which mitotic cells multiply and meiotic cells adapt to the changing environment determines the genetic continuum of that organism.

Shanita Wendette Wooten
North Carolina A&T State University
Senior
Biology
L. Akyurek, A. L. True, H. San, K. Miyaki, and Dr. E. G. Nabel
National Heart Lung Blood Institute, (NHLBI), Bethesda, MD

Differential Expression Levels of CDK/CKI Cell-Cycle Femoral Artery Injury

Vasculoproliferative disorders include atherosclerosis, transplant arteriosclerosis, and bypass graft failure, which are characterized by proliferation and migration of vascular smooth muscle cells (vsmcs) into the intimal layer. Cyclin-dependent kinase inhibitors (CKIs) are important regulators of G1 to S-phase cell cycle transition and are gene products that inhibit cyclic/CDK activity and phosphorylation of Rb, thereby inhibiting cell proliferation. We hypothesized that upon femoral artery injury, CKI and cyclin-dependent kinases (CDKs) levels would be altered. To address the role of CDKs and CKIs, femoral arteries of C57BL/6J mice were mechanically injured with a flexible wire and then harvested at different times up to 14 days. Total RNA from the medial and neointimal layers was isolated after laser capture microdissection (LCM) and then subjected to Real Time Quantitative RT-PCR (Taqman). Expression levels of p21 and p27 were detected in the vascular wall layers. This study of gene expression patterns from specific vascular layers may provide a better understanding of the cellular and molecular bases of complex vasculoproliferative disorders in vivo. (Supported by MARC Grant T34GM07649-22)

April D. Brown
North Carolina A&T State University
Senior
Chemistry
Dr. Kenneth L. Roberts

Prediction of Phase Equilibria Behavior of Aerosol OT in Supercritical Ethane

The measurement and prediction of the solubility of hydrocarbon-based surfactants in supercritical ethane (SC-C2H6) are currently under investigation in the area of thermodynamics research. The unique molecular properties of long-chain hydrocarbon-based surfactants make them quite challenging to predict in supercritical light-hydrocarbon systems. These solid-fluid equilibria properties have application to methods involving the use of a supercritical fluid or surfactant/supercritical fluid mixtures to clean industrial and commercial wastes for such applications as medical equipment sterilization, dry cleaning and food processing.

Three systems were examined in this work Aerosol OT (AOT)/ethane/water, lecithin/propylene/water, and didodecyldimethylammonium bromide (DDAB)/propylene/water at temperatures from 37 to 105 oC respectively. In each case microemulsions were observed as the compositions of the systems were varied. By determining the amount of water dissolution and surfactant amount required for each of the surfactant/supercritical fluid systems, the best condition for microemulsion formation in this work for the AOT/ethane system was observed at 57 oC with 0.5 g of Aerosol OT and 30.61 g of ethane. For the lecithin/propylene system the highest water solubility and lowest surfactant amount required were observed at 95 oC with 0.75 g of lecithin and 28.55 g of propylene.

The effects of polar, ionic and oily contaminants on water solubility were also determined for the Aerosol OT/ ethane system. For the AOT/ethane system, polar contaminants were observed to decrease solubility by 0.42% at lower temperatures and to increase water solubility by a factor of two at higher temperatures. Oily contaminants decreased water solubility by 0.34% at higher temperatures and ionic contaminants were observed to have no effect on water solubility. The effects of contaminants on water solubility and the prediction of supercritical fluid/ surfactant solubility will be discussed.

Genese Culp
Vivienne Gray
Marcus Moye
North Carolina Central University
Junior
Chemistry
Dr. Saundra F. DeLauder

A Spectroscopic Study of Hair Permeability

A spectroscopic assay has been developed which identifies changes in hair morphology as a function of cosmetic treatment. Diffusion of the dyes rhodamine 6G, and N,N-dimethyl-4,4'-azodianiline (DMADA); cationic, rhodamine 6B; zwitterionic, and methyl red; anionic, into hair samples encompassing various ethnic groups, hair treatments, and gender was followed through changes in absorbance maxima and buffered at pH 5.6. As demonstrated in previous studies, chemically treated African-American hair incorporated the most cationic dye; however, unprocessed African-American hair incorporated the least. These results support the ion-exchange model proposed by Kidwell and Blank.

Jason Davis
Francior Massey
Fayetteville State University
Juniors
Chemistry
Dr. I. Daniel Shin

Silver Recovery in the Photo Finishing Business

The photo finishing business uses many chemicals in the process of turning negatives into the pictures we see when we send our film away to be developed. Silver is the most expensive chemical involved in the process. Recovering silver has several advantages: one of them is to minimize polluted wastewater, and another is to permit efficient use of the bath chemical fixer. There are three common methods of recovering silver from the silver bearing solutions - metallic replacement, electrolytic plating, and chemical precipitation. The aim of this study is to further understand the silver recovery process. Improvement in silver recovery by varying the pH, temperature, processing time and the use of another metal in the metallic replacement technique is another of prime reasons. It would also help to find a way to reduce the amount of sludge in the chemical precipitation step. More than 94% of silver was recovered by using the above three techniques.

Cassondra Lanette Gainey
North Carolina A&T State University
Senior
Chemistry
Dr. S. V. Chittur and Dr. V. J. Davisson
Purdue University, West Lafayette, IN

Evaluation of the ADE2 Protein as a Potential Target for Ansamycin Antitumor Agents

The project's objective is to establish the molecular basis for the induction of tumor cell death by natural antitumor/ antibiotic drugs, specifically, the intracellular targets for the ansamycin class of antitumor agents (e.g. geldanamycin, GA). The cytotoxicity of these drugs has been attributed to their binding at the ATP binding site in Hsp90, a chaperone protein. However, the intracellular levels of Hsp90 (10-50 (M) and the relative affinity (Kd = 1.2 (M) do not account for GA's potency (IC50 = 2 nM). Our studies indicate that these compounds also inhibit a central enzyme in de novo purine biosynthesis and implicate ADE2 as a cellular target for GA. The human ADE2 protein gene codes for a bifunctional protein with C-terminal AIR carboxylase activity and N-terminal SAICAR synthetase activity. Western blot analysis has been used to determine the relative protein levels of ADE2 and Hsp90 in breast cancer cells (MCF7). These results would complement other studies aimed at quantification of the intracellular concentrations of GA-protein complexes and help validate ADE2 as a potential chemotherapeutic target.(Supported by MARC GrantT34GM07649-22)

Kisha Greene
Shon McCargo
Winstom-Salem State University
Chemistry
Seniors
Dr. Jill Harp

Synthesis of Piperidyle Analogs for Binding to the Dopamine Transporter

The problem of cocaine addiction is rampant in the United States and throughout various regions of the world. The neurochemical cause of the addiction is related to cocaine's ability to bind to the dopamine transporter (DAT) and prevent reuptake of synaptic dopamine (DA). The increase of the DA is thought to be responsible for the euphoria experinced by cocaine abusers due to enhanced stimulation of post-synaptic receptors. Thus, there are studies currently underway which are examining various agents that competitively inhibit cocaine but possess slower pharmacokinetics. Certain tropane agents have been shown to be very long acting (1-3 days) and would remain attached to the DAT for prolonged periods of time. In our studies, we have examined the inhibitory potency of the tropane analog, WF-23 and compared its effectiveness with the cocaine and mazindol against blocking oaubain and methamphetamine induced DA release. These two releasing agents were chosen because they release DA by two different mechanisms. WF-23 was chosen because it has proven to be extremely effective in binding to the DAT in reuptake studies. We addressed the ability of WF-23 at various concentrations in preventing neurotransmitter release regardless of the mechanism of that release. Currently, we are examining the necessity of the ethylene side arm of the tropane analogs and are synthesizing a series of piperidyl compounds, which removes this group. In this series, the aromatic ring will be modified and the resultant compounds tested in our tissue slice model for their ability to prevent DA and/or 5-HT release.

Kashenya M. Gurley
North Carolina A&T State University
Senior
Chemistry
Dr. Kenneth L. Roberts

Prediction of Phase Equilibria Behavior of Ammonium Carboxylate Perfluropolyether in Supercritical Carbon Dioxide

The measurement and prediction of the solubility of CO2-soluble surfactants in supercritical CO2 (SC-CO2) are currently under investigation by several researchers in the area of thermodynamics research. The unique molecular properties of fluorinated and silicon-based surfactants make them quite challenging to predict in SC-CO2 systems. These solid-fluid equilibria properties have application to methods involving the use of a supercritical fluid or surfactant/supercritical fluid mixtures to clean industrial and commercial wastes for such applications as medical equipment sterilization, dry cleaning and food processing.

The systems examined in this work was ammonium carboxylate perfluoropolyether (ac-PFPE)/carbon dioxide/ water system at 37 oC and pressures from 2000 to 3500 psi. In each case total solubility of the ac-PFPE surfactant was measured in carbon dioxide. The solubility of the ac-PFPE surfactant was observed to increase substantially with carbon dioxide pressure. No determination of the micellular structures produced was determined.

The effects of polar, ionic and oily contaminants on water solubility are under investigation for the ammonium carboxylate perfluoropolyether (ac-PFPE)/carbon dioxide/water system. Preliminary work utilizes a fundamental solid-fluid equilibria model to predict surfactant solubility in supercritical carbon dioxide will also be discussed in this presentation.

Kibri Hutchison
North Carolina State University
Sophomore
Environmental Science
Dr. Dev dutta S. Niyogi and Dr. Sethu Raman

Linking Air and Soil Temperatures Using Field Observations for Environmental Applications

Many ecological problems related to biosphere – atmosphere interactions, require subsurface variables such as soil moisture / soil temperature. However, there is paucity of subsurface data, and a need to develop such information based on more easily available, surface observations. We developed such a coupling based relation for air and soil temperature over North Carolina. We used two years worth of hourly observations of air and soil temperature at ten different locations to develop our analysis. The data were quality controlled, and statistically analyzed. These data were then used to develop correlation equations between air and soil temperature. These relations were then used to generate soil temperature from air temperature data, and validated with concurrent soil temperature measurements. The variability in temperatures were further analyzed for soil texture, land use, and location clusters. The soil texture / land use data are compiled at different scales (corresponding to those used in environmental and GIS models). The variability in the outcome of the different scaling is addressed as a critical issue in understanding the role of surface processes in ecosystem studies. Our study resulted in developing a simple air and soil temperature based relation that can be used in terrestrial ecosystem analyses.

Je'Velle B. Leavens
North Carolina A&T State University
Senior
Chemistry
Dr. Kenneth L. Roberts

Analysis and Evaluation of Porous Mo2N Nanostructured Catalysts for Hydrocarbon Reduction Reactions

This work details the previously unreported analysis of Mo2N macrocrystals for the hydrodesulfurization (HDS) reaction of thiophene. (-Mo2N macrocrystals are relatively small, dark metallic-gray platelets of moderately porous material which have visible dimensions varying from micron to centimeter-scaled proportions. Macrocrystalline Mo2N catalysts could be useful for several reasons including providing lower pressure drops in a packed bed reactors, being more amenable to study by advanced microscopic techniques such as scanning tunneling microscopy, and could possibly be more selective for industrial hydrodesulfurization reactions. Crystalline Mo2N also may serve as the starting point for a range of crystal chemistries: Mo2N powder can also be readily converted to carbides, borides and metal using high temperature treatments in CH4, BH3, and H2, respectively.

Macrocrystals of (-Mo2N were synthesized by temperature-programmed reaction of macrocrystalline MoO3 and NH3 or N2/H2 mixtures. X-ray diffraction analyses indicate macrocrystalline Mo2N is an aggregate of particles in crystallographic alignment with diameters ranging from 4.6 nm to 18 nm, depending on synthesis conditions. Scanning tunneling microscopy (STM) supports these observed diameters. Based on diffraction data and surface area measurements, it is concluded that the particles in each sample are found with a range of diameters, each flattened in the [200] direction with either an amorphous surface phase or polycrystalline interior. The highest crystal BET surface area achieved is 44 m2/g.

The specific thiophene hydrodesulfurization (HDS) activity (units of mol/s m2) of the Mo2N macrocrystalline catalyst at 673 K was found to be higher than the powder form by a factor of 2.5. Weight specific HDS activities and reaction product fractions over Mo2N macrocrystal and powder catalysts were roughly the same. An analysis of reaction products over a range of conversions indicates thiophene desulfurizes to form predominantly 1-butene with smaller amounts of other C4 hydrocarbons also present. Previous work reported from this group has examined the effects of reaction parameters such as temperature, reactant gas composition and water content on the synthesis of high surface area molybdenum nitride powders and the reactivity of the unsupported Mo2N catalysts for the NH3 decomposition and thiophene hydrodesulfurization (HDS) reactions. This presentation will evaluate the performance of these catalysts for hydrogen-based reduction chemistries.

Karla Allyson Mark
North Carolina Central University
Senior
Chemistry
Dr. John A. Myers

Synthesis of Isoindolequinones for Covalent Linking into a Molecular Triad for Artificial Photosynthesis

Isoindolequinones (IIQ) have the potential to serve as the acceptor portion of molecular triads for artificial photosynthesis. In order to synthesize IIQ esters, N-acyl amino acids were prepared, converted to oxazolium 5-oxides, and reacted with 2-methyl-1, 4-benzoquinone. Conversion of the ester grouping to a substituent for covalent linking to an electron transfer chromophore would lead to a molecular dyad. Thus far, two isoindolequinones esters have been synthesized in 30-40% yields. Protection of the carbon-to-carbon double bond in the quinone ring in each of the esters was accomplished using cyclopentadiene in a Diels-Alder cycloaddition. One of the protected IIQ esters had been hydrolyzed to the protected isoindolequinone carboxylic acid in modest yield. Future researchers will seek to link the IIQ system to an electron transfer chromophore in building molecular dyads and triads to be tested for photosynthetic properties.

Susana Mullikin
Fayetteville State University
Senior
Natural Science
Dr. I. Daniel Shin

Fuel Cell – The Clean Energy

Limited resources of fossil fuel and environmental harm causes mankind to look for new and cleaner ways of producing and using energy. Fuel cell is a promising alternative to produce electricity without harmful emissions. Futhermore, it is more efficient that combustion engines. Although it is more expensive to use fuel cell than gasoline or diesel now, they predict that within a decade quiet, efficient, affordable and safe fuel cells could be used in factories, offices and cars. Fuel cell converts chemical energy directly to electricity. When pure hydrogen and air are used, the only by-products are water and heat. Components, structure, electron generation mechanism, and problems of fuel cell are discussed.

Hazel Ogugua
North Carolina Central University
Junior
Chemistry
Dr. Joyce E. Royland, NHEERL U.S. Environmental Protection Agency

PC-12 Cells: Studying Cell Adhesion and Neurotoxicity of Methyl Mercury Chloride

Primed rat adrenal phenotype cells (PC-12 cells) are good models for brain development. These cells allow for the study of the effects of methyl mercury chloride (MeHgCl) on tissues resembling brain tissues. The adverse effect methyl mercury chloride has on PC-12 cells is the loss of the ability to adhere to collagen and other PC-12 cells. This effect is otherwise termed as a lack of cell adhesion. An explicit goal of the Neurotoxicology Division is the discovery of biomarkers allowing for earlier and more sensitive detection of neurotoxicity. Because cell adhesion is affected by methyl mercury chloride, it is highly possible that this substance may serve as a biomarker for neurotoxicity. An acceptable biomarker would be able to detect the smallest concentration of a known toxicant causing adverse biological changes in cells. Varying concentrations of methyl mercury chloride revealed an inverse relationship between the amounts of MeHgCl and the levels of cell adhesion. Ongoing work at the NHEERL seeks to determine the smallest concentration of MeHgCl causing significant decrease in P-12 cell adhesion.

Crystal A. Pass
North Carolina A&T State University
Junior
Food Science and Nutrition
Dr. Mohamed Ahmedna

Physical and Sensory Properties of Low-fat Table Spreads

In response to the growing demand for heart-smart foods, the food industry has introduced many low-fat margarines. However, hydrogenation of oil in margarines causes the formation of trans fatty acids, which can elevate blood cholesterol. Furthermore, the fat content of table spreads affects their physical attributes and overall sensory acceptability. The objectives of this study were to evaluate physical characteristics of low-fat table spreads and their sensory acceptability. Five commercial table spreads with oil contents ranging from 0 to 90% were bought from local grocery stores. The table spreads were evaluated for physical characteristics (color, emulsion stability, water activity, and texture) and sensory properties (color, texture, flavor, spreadability, and overall liking). Twenty-two untrained panelists evaluated the spreads using a 9-point hedonic scale and a line scale for spreadability. Table spreads with high oil content had the lowest lightness, highest b-values but were more spreadable and showed low water activity. Spreadability ratings were highest for table spreads with medium to high oil content. These same samples were most preferred by consumers in terms of overall liking and flavor. The emulsion stability of table spreads was inversely proportional to their oil content while instrumental spreadability was highly correlated with the oil content.

Aaron Pratt
North Carolina State University
Senior
Atmospheric Science
Dr. Sethu Raman

Variation of Precipitation, Maximum Temperatures, and Minimum Temperatures in North Carolina from 1949-1999

Much debate is under way about climate change and its potentially serious consequences. Much of this debate focuses on whether the planetary climate will change in a beneficial manner, or in a devastating way. In particular, there is a need to know if the climate could become more extreme, resulting in vast temperature and precipitation swings that could significantly affect the society. The purpose of this study is to look at seasonal extremes in monthly maximum temperatures, minimum temperatures, and precipitation extremes for North Carolina from 1949-1999, and determine temporal and spatial changes for these extremes. Seventy-five stations were used for precipitation, while 58 were used for maximum / minimum temperatures. The seasons were designed such that January-March was winter, April-June was spring, etc. Preliminary analysis showed the occurrence of extremes at expected areas of NC (i.e. coldest temperatures in western NC, and highest temperatures in coastal plains of NC). The analysis also showed evidence of an increasing trend in winter maximum temperatures and decreasing trend for winter minimum temperatures. Precipitation for winter also showed the presence of a 20 to30 year cycle.

Laillah Rice
University of North Carolina at Chapel Hill
Senior
Chemistry
Dr. Joseph M. DeSimone

Solid Supports for Carbon Dioxide Applicants

Current research focuses on the synthesis of spherical cross-linked polymer particles as solid supports for applications in liquid or supercritical carbon dioxide. Heterogeneous and enzymatic catalysis are among the applications under investigation. These support systems have been synthesized by suspension polymerization in an aqueous continuous phase, yielding small micro-sized beads. So far, different systems have been inspected. One of the main interests is the swell ability of these systems in liquid and supercritical carbon dioxide. This has been demonstrated by incorporating variable amounts of the fluorinated monomer into the systems. Recent investigations are focused on the porosity potential of these supports. Thus, the porous particles have been successfully polymerized using toluene as the porogen. In addition, heterogeneous catalysis into carbon dioxide will be performed by incorporating rhodium directly into the support systems with an aim in investigating the recyclability and the catalytic rate of the catalyst in both porous and nonporous systems. The efficiency of both porous and nonporous systems in carbon dioxide will be compared.

Cynthia Sherman
Shanna May
University of North Carolina at Pembroke
Seniors
Chemistry: Molecular Biotechnology
Dr. Len Holmes and Dr. Sivanadane Mandjiny

Conalbumin and Hemoglobin Protein Crystallization

Proteins consist of long macromolecular chains made up of at least 20 different amino acids. The chains can be several hundred residues long and fold into a 3-dimensional structure. Protein crystallization is a very sensitive to all kinds of environmental factors. In order to obtain a crystal, the protein molecules must assemble into a highly ordered lattice. Often, many conditions must be attempted to succeed in crystallization. This is usually done by initial screening followed by a systematic optimization of conditions (ionic strength, pH, temperature). The art of protein crystallization requires patience, experience and significant trial and error considering all of the possible crystallization conditions. The crystallization conditions of two common proteins, Conalbumin and Hemoglobin were optimized and found. This investigation allowed us to obtain large crystals of homogeneous size and shape.

Dianne Thrower
University of North Carolina at Charlotte
Senior
Chemistry
Dr. James Hovick

Determination of Synthetic Organic Dyes in Natural Hair Products

In today's society physical appearance has become a very big concern for both men and women. Men and women pay a lot more attention to hair cuts, hair color, hair perming, hair relaxing, nail manicures, feet pedicures, and so forth. A lot of these described techniques involve very dangerous chemicals, and if there is a way in which the exposure to these chemicals can be diminished, it should be done.

Natural hair dye was one way in which the exposure to chemicals was limited. An experiment was conducted on natural hair dyes, made of only the natural products of the earth, to determine if these products were indeed natural. High performance liquid chromatography was performed on 13 natural hair dyes to determine if nine temporary and direct dyes were present. It was determined that only four of the dyes tested contained at least four of the temporary and direct dyes.

Egbe Eni
North Carolina State University
Senior
Textile Engineering
Dr. Perry Grady

Energy Analysis of Yarn Production Process

Ring spinning, Rotor spinning, and Air Jet spinning are three primary methods of yarn production used in today's industries. Each specific yarn production method encompasses certain machines and processes the fiber must be subjected to before yarn formation is complete, for example: opening, carding, drawing, lapping etc. Each process employed consumes various amounts of energy depending on certain parameters such as; the amount of motor horsepower required, the weight and amount of product produced, the speed the product is fed into the machine, as well as the speed of the product exiting the machine etc. Every additional process adds to the total amount of energy required to produce the final product. By analyzing each process one can determine the optimal machine settings required to increase its efficiency. Improving the efficiency of the individual procedures will inevitably decrease the total energy usage as well as the total production cost. The College of Textiles at North Carolina State University has already created a visual C++ and Excel based model to analyze the energy consumption of individual processes.

The task of the students was to first transfer and correct any and all codes in C++ to an Excel workbook. The Excel workbook is capable of performing all previous required task formally executed by the C++ model in addition to maintaining a record of each yarn plant's energy consumption on a weekly basis. The above at this time is now working towards creating an Energy web site for the American Textile Manufactures Institute in Washington, which will be used to access an online version of the Energy models. The online energy models at this time will be based solely on Html and VB Script coding. In the future the energy web site will be connected to a database containing the results and progress of participating manufactures which will be accessible by way of password.

Marcus A. Hunt
North Carolina State University
Senior
Materials Science & Engineering
Dr. C. Maurice Balik

Diffusion and Solubility of Polymerizable Solvents in Ethylene Propylene Diene Monomer Rubber

The objective of this work is to obtain the diffusion coefficients of several polymerizable solvents in ethylene propylene diene monomer (EPDM) rubber over a temperature range of 10 70 Ú^C. The diffusion coefficient is obtained for the polymer/solvent systems of 5-methylene-2-norbornene (MNethylidene-2-norbornene (ENB), cis-cyclooctene (CCO), dicylopentadiene (DCPD), and methylene chloride (MC) in EPDM rubber using the soak-and-weigh technique. A rubber sample is placed in each solvent using a water bath to maintain constant temperature. The sample is removed from the solvent at various times during the test to measure the mass of the absorbed solvent. Each sample is allowed to absorb solvent until the system reaches equilibrium. A plot of mass absorbed vs. square root of time is used to calculate the diffusion coefficient of each polymer/solvent system. Activation energies are obtained from Arrhenius plots of the diffusion coefficient against temperature. This data will be compared with activation energies and diffusion coefficients for the same solvents obtained in natural and nitrile rubbers.

Derek D. Solomon
North Carolina A&T State University
Senior
Architectural Engineering
Dr. Peter Rojeski

Energy Efficient and Re-Commissioning Buildings

Nothing performs as it does the first time and the same is true with buildings. Through proper care and maintenance of a building can and will perform at its peak design performance. One method of monitoring the status of a building is re-commissioning. The processes of re-commissioning gives us a building report card on its performance. Re-commissioning is done through detailed monitoring, analysis and problem solving techniques of the building operating systems. These pieces of information are then gathered and analyzed to see where the systems falls short of its designed performance path. After these inefficiencies are exposed the next step is to find a cost efficient solution to the problem.

Errick Lamont Baldwin
North Carolina A&T State University
Senior
Electrical Engineering
Dr. Derrek Dunn

An Introduction to Video Over IP

Packet based switching has changed the way the world communicates. The advent of voice over IP has also opened the door to receiving video content in IP packets. Video over IP could potentially revolutionize many of the world's key government and industrial sectors. This poster will provide an introduction to this exciting technology as well as indicate future trends.

Isaac M. Black
Bert A. Davis
North Carolina A&T State University
Seniors
Engineering
Dr. Derrek Dunn

The Strengths and Weaknesses of TMDA Versus CDMA For Use As An Access Technology for Third Generation Wireless Communication Systems

This research paper is a discussion on the strengths and weaknesses of TMDA and CDMA for use as an access technology. These terms are used to describe multiple access systems. For example, TDMA, which stands for Time Division Multiple Access, is a method of digital transmission for wireless telecommunications systems that allows a large number of users simultaneously to access a single radio frequency band without interference. CDMA, which stands for Code Division Multiple Access, is a method of spreading spectrum transmission for digital wireless personal communications networks that allows a large number of users simultaneously to access a single radio frequency band without interference.

Candice Coltrane
Courtney Amos
Shedrick Bessent
North Carolina A&T State University
Seniors
Electrical Engineering
Dr. Derrek B. Dunn

TDMA versus CDMA:
The strengths and weaknesses of each for use as an access technology.

TDMA stands for "Time Division Multiple Access", while CDMA stands for "Code Division Multiple Access". Each technology essentially achieves the same goal, but by using different methods. Each strives to better utilize the radio spectrum by allowing multiple users to share the same physical channel. More than one person can carry on a conversation on the same frequency without causing interference. Where the two competing technologies differ is in the manner in which users share the common resource. TDMA does it by multiplexing up to three conversations over the same 30-kilohertz transmission channel. In reality, only one person is actually using the channel at any given moment, but only for extremely short time intervals. The user then gives up the channel momentarily to allow the others access to the same transmission channel. CDMA actually allows each user to transmit simultaneously and utilize the entire 1.25-MHz frequency cell allocation by assigning each call a unique code. This is achieved by a special type of digital modulation called Spread Spectrum. This form of modulation takes the user's stream of bits and spreads them across a very wide channel in a pseudo-random fashion.

This poster presentation will discuss the strengths and weaknesses of each for use as an access technology.

David Jones
Louis Tyson
North Carolina A&T State University
Seniors
Electrical Engineering
Dr. Derrick B. Dunn

Wireless Communications Comparisons Between Bluetooth(, Jini(, and Salutation(Protocols

Network compatibility between the varied types of equipment available in today's market has left the consumer with a major problem of the ability to connect within a network. For example, when a new piece of equipment is added to a network of either through Ethernet, radio waves, or infrared devices, the user currently in most cases has to undergo a major software change for the device to operate properly. Bluetooth, Jini, and Salutation protocols allow a device to be connected to a network with minimal problems or to create an ad hoc network automatically. Although, problems still exist with the three protocols specified, they are a major step in creating more streamlined networks. We will show the differences, similarities and operation of Bluetooth, Jini, and Salutation protocols.

Bryan Mason
Chico Foxx
Hayes Bowling
North Carolina A&T State University
Senior
Electrical Engineering
Dr. Derrek B. Dunn

Optical Routers and Their Improved Performance in Relation to LANs & WANs

The effects of the growing population of Internet users, coupled together with increased file transfer size from corporations and individuals causes bottlenecks and other network performance issues. With the future traffic of giant multimedia companies and cable companies offering voice, video, and data over the Internet this is causing the Government, Industry, and many other individuals great concern over network capacity. The research performed reveals the best way to deal with these problems. It takes a look at how to improve the speed of the Internet and increase the much needed bandwidth shortage, while increasing network security and robustness.

Renata McCloud
Shayne O'Reilly
North Carolina A&T State University
Seniors
Electrical Engineering
Dr. Clinton Lee

Methods for In-Situ Patterning of Metal Films Deposited by Evaporation

The in-situ manipulation of evaporated metal atoms during the deposition process is put forward as achievable through the use of the Stern-Gerlach Effect. A method for affecting the rate and precision of metal film deposition would be of great benefit to industry. Some type of focusing effect could reduce operation and material costs dramatically, while greater placement control would enhance versatility during the deposition process. Until now, methods of magnetically controlling the deposition process have not been extensively studied. The Stern-Gerlach Effect was uncovered in 1922 in an experiment, which sent a beam of Ag atoms through a non-uniform magnetic field. The findings were that under specific field gradient conditions spatial quantization occurs. It was later found that this beam was split into two components, spin up and spin down. Cu, amongst other metals, exhibits the same property. The process of splitting the beam suggests that magnetic control of evaporated Cu atoms might be feasible.

Wayne Morrison
Kennedy Cheruiyot
North Carolina A&T State University
Seniors
Electrical Engineering
Dr. Derrek B. Dunn

What is NAMPS, (Narrowband Advanced Mobile Phone Service)?

NAMPS is the "next generation" analog version of the AMPS system, which uses some digital technology to allow the network to carry three times the number of voice channels. In NAMPS systems each existing 30-kilohertz voice channels is split into three 10-kilohertz voice channels. Phones using NAMPS automatically switch to AMPS when a user is in an area were NAMPS are not used.
This poster will present a detail analysis of the operations of a NAMPS cellular system.

Trina Posey
Terrance Blackmon
Justin Taylor
North Carolina A&T State University
Juniors
Engineering
Dr. Derrek B. Dunn

TDMA VS. CDMA, Which Will Be the Access Technology of the Future?

Code Division Multiple Access (CDMA) and Time Division Multiple Access (TDMA) are two of the most recent and important access technologies. The task is to find which is stronger or which is weaker. TDMA divides conversations by frequency and time while CDMA encodes each call as a coded sequence across an entire frequency spectrum. Questions to be answered include: Which technology is more cost efficient? Which technology has a better future? Which technology has greater strengths or weaknesses? Lastly, which has the larger broadband? These questions and more will open ones understanding on the new technologies the wireless world has to offer.

Jason Sherrill
Roderick Bradford
John Dingle
North Carolina A&T State University
Seniors
Electrical Engineering
Dr. Derrek B. Dunn

Time Division Multiple Access (TDMA) versus Code Division Multiple Access (CDMA) for Use as an Access Technology.

The principle problem facing wireless communications systems is how to allow a large number of users access to a small allotment of frequencies. There are two principle methods being used to multiplex users on the same frequencies, CDMA and TDMA. We will discuss the strengths and weaknesses of both.

Wilson Skipwith
Terrell Goudy
North Carolina A&T State University
Juniors
Electrical Engineering
Dr. Derrick B. Dunn

Digital versus Analog

The project involves the investigation of advantages and disadvantages of digital versus analog. The characteristics of digital and analog will provide the bases to help us explore the advantages and disadvantages of digital versus analog. These conditions include signal strength and clarity of the call. Characterization of digital versus analog will include bandwidth, and level of variation of the waveform.

Idris Talib
North Carolina State University
Junior
Computer and Electrical Engineering
Dr. Dennis Maher

Electrical Properties of Metal-Oxide-Semiconductor Capacitors with Ultra-thin Gate Silicon Oxides: Current-Voltage Characteristics and Analysis

The semiconductor industry strongly relies on its ability to continuously scale device size and gate-dielectric thickness to increase performance and reduce power consumption as well as cost. In research laboratories, the metal-oxide-semiconductor capacitor (MOSCAP) is used in the electrical characterization of advanced gate dielectrics. The present research addresses the issue of the current-voltage (I-V) characteristics of n+/p and n+/n MOSCAPs with scaled-oxide thickness values (i.e., 1.5 to 2.4 nm in steps of 0.3 nm). Model-based analyses of statistically sampled I-V data sets return the area dependence of the current at a given bias voltage and hence, from a linear least-squares analysis, the current density (J) for both the case of gate injection (i.e., n+/p MOSCAP) and substrate injection (i.e., n+/n MOSCAPs). The results of these analyses demonstrate that both gate and substrate injection generate nearly the same current density relative to flatband voltage (i.e., reciprocity holds for these devices). In addition, it is possible to assess the relative accuracy of the effective oxide thickness (tEOT) values that were extracted from the C-V characteristics (see Part I) from current density (J) and a theoretical rule-of-thumb that says a change in tEOT of 0.2 nm will result in a fractional change of one decade in J. The differences in oxide thickness for both the n+/p and n+/n wafers are both ~ 0.8 nm and the fractional change in current density is about four decades. Hence, it is concluded that the relative accuracy of the effective oxide thickness values is quite high. As stated in in Part I, the second phase of this research addresses the impact of a PMA on the no PMA current-voltage characteristics and extracted metrics for the same device wafers.

Benita Powell
Toriano Franklin
North Carolina A&T State University
Sophomores
Chemical Engineering
Dr. Keith Schimmel

Fuel Cell Multimedia Module for Use in a Numerical Methods Course

In the late 1950's, the National Aeronautics and Space Administration began to search for a compact electricity generator to provide power for a series of manned space missions. NASA researchers attempted numerous solutions, including nuclear reactors, batteries, and solar power. All of these options proved to be too risky, too heavy and short-lived, or too cumbersome. After a series of trial and error, NASA decided upon fuel cells. Fuel cells are ideal for space exploration, due to their small size, high efficiency, low emissions, and minimal water use or net water production. Today fuel cells are finding a variety of commercial applications, such as in automobiles and power plants.

Recently it has become a priority to integrate research into the undergraduate curriculum for the purpose of increasing student motivation. Having research in the curriculum will help students begin to apply various strategies learned in the classroom to real world situations. Therefore, an interactive module on fuel cells has been developed that will help students to understand problem-solving strategies and to improve their performance in numerical methods courses.

Jermell G. Powell
North Carolina A&T State University
Senior
Engineering
Dr. Kenneth L. Roberts

Prediction of Human Blood Flow Behavior Using Fundamental Newtonian Flow Theory

The artificial heart has undergone a lot of scrutiny in the past due its poor survival for heart failure patients who have used it. Recently, there has been groundbreaking research done in the field of tissue engineering that has moved the spotlight from synthetic organ to a more organic counterpart. This project seeks to examine the viability and usefulness of synthetic organs and the origins and mechanisms of artificial heart failure.

In the cases of both total artificial hearts (TAH), three factors play a significant role in the failure in both TAHs. These factors include the interaction between the material and the environment (the human body) and the interaction between the material and the blood/blood vessels. Other obstacles to over come until the problem with TAHs are eliminated include miniaturizing the pumps enough for use in children, and small adults and the problems adjusting blood flow in response to physical or mental stress. This project seeks to predict and model the interactions between the manmade materials and the blood/blood vessel. The flow of blood was predicted using modified version of the Navier-Stokes equation for momentum transfer in duct systems.

Keron Subero
North Carolina Central University
Senior
Physics
Dr. Jyotsna M. Dutta and Dr. Charles R. Jones

Characterization of Gyrotron Window Materials

For the vacuum seal of high-energy millimeter wave heating sources, such as gyrotrons, and the plasma vessel in fusion experiments, heavy-duty dielectric windows are needed. Present day gyrotrons are capable of producing CW power of 1MW or more in the frequency range 100 to 200GHz. A method for measuring dielectric loss tangents is presented, that combines coherent optical resonator techniques with conventional microwave techniques to yield very high measurement accuracies. Design criteria of the open resonator are discussed and its performance characteristics for its applications in the low loss dielectric measurements are evaluated. Basic theory for the dielectric measurements is reviewed and preliminary results of the measurements on some candidate window materials are presented.

Nneka C. Ubaka-Adams
North Carolina A&T State University
Junior
Chemical Engineering
Dr. Kenneth L. Roberts

Analysis and Prediction of Mass Transfer Phenomena in Surfactant/Supercritical Fluid Cleaning Systems

A method involving the use of a supercritical fluid or surfactant/supercritical fluid mixtures to clean industrial and commercial wastes for such applications as medical equipment sterilization, dry cleaning and food processing. The removal of model contaminants from metallic, ceramic and polymeric materials at fixed conditions has been examined for the supercritical carbon dioxide system and an ammonium carboxylate perfluoropolyether (PFPE)/ carbon dioxide/water system at 37 oC and pressures from 2000 to 3500 psig. Overall the removal of the grease contaminant was observed to increase through a maximum level with system pressure for the carbon dioxide system.

This presentation will detail the preliminary research performed by this group to characterize and predict the effects of mass transfer phenomena on the supercritical CO2 cleaning of contaminated metallic substrates. Earlier work from this group has reported that the cleaning effectiveness in surfactant/ supercritical hydrocarbon systems has been observed to be strongly dependent upon such parameters as pressure, surfactant concentration, water solubility and temperature. Future research will examine the combined effects of mass transfer, solid-fluid phase equilibria, and the interfacial phenomena associated with surfactant/supercritical fluid mixtures.

Robyn Williams
Marsay Winder
North Carolina A&T State University
Sophomores
Chemical Engineering
Dr. Keith Schimmel

Supercritical Fluid Multimedia Module for Use in Numerical Methods Courses

In recent years, the Environmental Protection Agency (EP A) has banned halogenated hydrocarbons and chlorofluorocarbons used in metal parts cleaning. As an alternative, supercritical fluids have been approved for usage in metal parts cleaning. Supercritical fluids are gases that are above their critical temperature and pressure. When used as an industrial cleaning agent, these solvents are compatible with a majority of substrates encountered in manufacturing and have low operation and maintenance costs. NASA is studying the use of this new technology in their aerospace developments.

The data obtained from NASA experiments being conducted at North Carolina A&T State University are being integrated into a multimedia module. Chemical engineering students will primarily use this module. Through the use of this multimedia module, students will be able to incorporate concepts learned in numerical methods to analyze real experimental data. Macromedia's Authorware software allows information to be interactively presented. In doing so, engineering students are better able to demonstrate mastery of numerical methods concepts and experience alternative learning techniques.

RaShunna Crockett
Fayetteville State University
Junior
Computer Science
O. C. Holloway

Analysis of the Different Aspects of Debugging in C and C++

Most programs will not run the first time for program designers due to errors that are referred to as bugs. The method used in correcting these errors is called debugging. In computer science, debugging a program is detecting, locating, and correct logical or syntactical errors in a computer program. This work involved the use and review of published reports analyzing, code grinding, and various programming methods and techniques used in debugging. We looked at the debugging of computer programs (or libraries) written in C and C++ within a Unix operating systems environment. The result of this analysis suggested certain methods of using debugging techniques for specific programs and that most of these methods and ideas are applicable to other compiled procedural and object-oriented languages.

Ronnetta Monique Mosby
North Carolina A&T State University
Junior
Electronics and Computer Technology
Dr. Derrek B. Dunn

Digital Communication Using Frequency-Shift Keying

One form of modulation of digital signals onto an RF carrier uses a technique called, "frequency-shift keying" (FSK). Early forms of radio-teletype used such a form of modulation. Today, this digital modulation technique is quite obsolete in its basic form although the general principles of FSK are used in more advanced data encoding techniques.

In FSK, the two digital logic states, "1" and "0", are converted to a constant amplitude sine wave that is shifted between two possible frequencies. These two frequencies are referred to as the "mark" and "space" frequencies are usually in the audio-frequency spectrum. Popular mark\space frequency pairs are 1070/1270 Hz, 2025/2290Hz. For example, the mark frequency of 2025 Hz might represent the binary "1" and the space frequency of 225 Hz might represent the binary "0". In a radio transmitter, if an FSK signal is fed into the microphone input and single-sideband modulation is used, the RF carrier at the output of the transmitter will then be shifted between the corresponding RF mark and space frequencies.

This poster will present an operational FSK transmitter and receiver. The channel between the transmitter and receiver will consist of a fiber optic cable.

Tamarah Walton
North Carolina A&T State University
Freshman
Electronics & Computer Technology
Dr. DeWayne Brown

Verifying Kirchoff's Current Law (KCL) by Using a DC Ammeter

The goal of this project is to build and measure the current through the ammeter. While working on this project I will be able to understand current and its effects on electrical components. The knowledge I will gain from working on this project will increase my understanding of percentage error, which is the relationship between the measured value and the calculated value of current. It will give me hands on experience of how to connect a two-way resistor. This project will satisfy Kirchoff's Current Law, stating that the sum of all current entering the node is equal to the sum of all the current leaving the node. I can take the knowledge I will learn from working on this project and relate it to future classes and jobs because I will understand the concept of how electrical circuits are used.

ORAL ABSTRACTS

NC-LSAMP

NORTH CAROLINA LOUIS STOKES ALLIANCE
FOR MINORITY PARTICIPATION
in Science, Mathematics, Engineering, and Technology

April C. Cameron
North Carolina A&T State University
Senior
Biology
Dr. L.A. Neves and Dr. K.B. Brosniham
Wake Forest University

Effects of Angiotensin-(1 – 7) in the Hindquarters Vascular Bed of Ovariectimized Rats

This research was initiated in order to evaluate the vasodilator effects of Ang-(I- 7) in the hindquarter vascular beds of ovariectomized rats and compare this with the vasodilator effects of Bradykinin. Ovariectomized female Sprague-Dawley (SD) and mRen-2 transgenic [Tg+] were anesthetized with Inactin (100 mg/kg ip), and the hindquarters were perfused using a peristaltic pump under constant blood flow. Hindquarter perfusion pressure and systemic arterial pressure were constantly monitored. Mean perfusion pressure (MPP) and mean arterial pressure (MAP) levels were determined before and after intra-arterial administration of Ang-(1-7) (10(g) into the hindquarters at intervals of 5, 10, 15, and 20 minutes, respectively. Fifteen minutes after the final dose of Ang-(I- 7), 0.1J.Lg of Bradykinin (BK) was administered at the same intervals. A curve dose response was obtained by administering I(g, 10(g, and 50(g of Ang-(1-7). Ang-(1-7) elicits a reduction in hindquarter MPP (15(10 mmHg) that shows tachyphylaxis at 5 and 10 minutes after its initial administration. With a 15 or 20 minute delay, the degree of tachyphylaxis is reduced. Bradykinin elicits a reduction in hindquarter MPP (19(5 mmHg) and shows no tachyphylaxis. The reduction in hindquarter MPP by Ang-(1-7) does not appear to be dose-dependent (at 1, 10, and 50(g) and appears to be greater in Tg+ as compared to SD animals. The vasodilator response to Ang-(1-7) in the hindquarter shows tachyphylaxis and does not appear to be dose dependent.

Laveda Casterlow
North Carolina A&T State University
Freshmen
Biology
Dr. Willie Willis

The Effects of Environmental Temperature on *Campylobacter Jejuni* Infection and Recovery in Broiler Chickens

An experiment was conducted to determine if broiler chickens are susceptible to Campylobacter jejuni. Experimental injection were given at one and three days of age in a low and high environmental temperature setting. We assessed body weight and mortality, and determined if horizontal transmission was affected by the temperature. Sixty-eight day old hatch chicks were obtained from a local hatchery. Twenty-four of the chicks were divided into three groups of eight each and placed in electric battery brooder cages with a temperature of 95°F. Group 1 served as a control. Group 2 was infected on day one, and Group 3 was infected on day 3. Another group of twenty-four chicks were divided into three groups of eight each and placed into a room of 60°F in battery cages. Group 4 served as a control. Group 5 was infected on day one and Group 6 infected on day 3. Five seeder chicks were put into each treatment group seven days post infection and sampled one week after their introduction into the groups. The infective groups were orally given 1 x 10-8 CFU (Colony Forming Units) of Campylobacter jejuni. Cloacal samples were taken one day post-infection and again 7, 14, and 21 days post infection. Samples were direct plated and enriched. Results revealed that low and high environmental temperature settings did not impede the Campylobacter jejuni organism from growing but may have affected the rate at which Campylobacter was spread. Temperature settings did not affect the mortality of the birds but the infection day at which the birds were exposed to the Campylobacter organism played a key factor. Temperature settings also did not affect the body weight of the chickens. Horizontal transmission of Campylobacter jejuni was not affected by temperature.

Robert N.L. Corprew Jr.
JLC-Biomedical Biotechnology Research Institute
North Carolina Central University
Senior
Biology
Dr. Pradeep Chatterjee

Identifying position-specific Single Nucleotide Polymorphisms (SNPs) in the Entire Npr3 Gene

The natriuetic peptides (NPs) play an important role in regulating blood pressure, NPs initiate their action through binding to cellular receptors. There are three isoforms of NP receptors, NPRA, NPRB, and NPRC. NPRC is the most abundantly expressed of the three, and it is encoded by a gene (Npr3) that has been shown to control the entire NP system. Because Npr3 is a large gene, and its sequence is not yet know, we are attempting to identify single nucleotide polymorphisms (SNPs) in the human gene. Primers were designed form the cDNA sequence of a rat Npr3 gene, and used to amplify the entire Npr3 sequence from a human genomic library (Genome Systems). The resulting 160-kilo base PCR product was purified, and inserted into a PAC cloning vector. A transposon retrofitting strategy was then used to generate a high-density nested deletion series from the PAC clone containing the 160-kilo base human Npr3 gene. Data will be presented to show the size of the deletions obtained following Field Inversion Gel Electrophoresis. Successful sequencing for many of these deletions has been accomplished. The amplified DNA sequenced has been used to identify polymorphic variants of the gene in individuals. Comparison of Npr3 gene sequence from hypertensive African-Americans with normal Npr3 DNA sequence will provide valuable insight into the role of this gene in the etiology and progression of hypertension.

Selena D. Judon
North Carolina A&T State University
Senior
Biology
Dr. Charles Cox, University of Iowa, Iowa City, IA

Comparative Study of the Effects of Steep Bacteria and Two Types of Proteases on the Release of Peptides and Starch from Corn Kernels

The production of corn in the United States ranges from 230-250 million tons a year, accounting for approximately half of the world's annual production, still there is a need for higher productivity. Increasing demand for corn starch and starch-based products requires the corn milling industry to either mill more corn or increase starch yield by employing effective methods for releasing higher amounts of the bound starch from corn. It is known that the Steep bacteria grow in the milling tanks. and they release starch, but their mechanism of action is unclear. The purpose of this study was to determine what enzymes Steep bacteria may use to release starch A comparative study of the effects of two types of Steep bacteria and the two types of proteases on peptide and starch release was performed. The amounts of peptide and starch produced were measured by spectrophometric assays using Bicinchoninic acid (BCA) and iodine reagent respectively.

We found that the Serratia Protease released peptides and starch, but the Steep bacteria released starch only. We concluded that they use a starch releasing mechanism that is independent of protease activity.

Kevin T. King II
University of North Carolina at Charlotte
Junior
Biology
Dr. Todd Steck

Using Antibiotics to Determine the Role of Viable but Nonculturable *Escherichia coli* Bateria in the Recurrence of Urinary Tract Infections

Urinary tract infections (UTI) occur in 40-50% of all women. Escherichia coli is the most common pathogen isolated as the cause of UTIs. After UTIs successful treatment with antibiotics, there are thought to be no culturable cells remaining in the urinary tract. However, approximately 30% of infected women experience a recurrent UTI, and studies have shown that E. coli is the cause of more than half these infections. This research will focus on the possibility that UTIs reoccur because the E. coli bacteria are in a viable but nonculturable (VBNC) state and the antibiotics induce the bacteria to enter this dormant-like condition. VBNC cells are characterized as being viable; yet do not show visible growth when plated on non-specific growth media. The specific aim of my research is to determine if E. coli cells are induced to become VBNC by antibiotic treatment. This experiment will involve taking cultures of E. coli, adding antibiotics, and measuring the concentrations of culturable and viable cells. The difference in the number of viable and culturable cells equals the number of VBNC cells. A commercial kit (the Live/Dead Baclight Bacterial Viability Kit, Molecular Probes Inc., Eugene O.R.) will be used to quantitate viable cells. Culturability will be determined using standard microbiology procedures. If antibiotics do induce bacteria to become VBNC, this research may lead to a more effective treatment of UTIs and a lower probability of a reoccurrence.

Lamorris Loftin
University of North Carolina at Chapel Hill
Senior
Biology
Dr. Kenneth Bastow

All-Trans Retinoic Acid Inhibits Vero Cell Growth

Recent studies concerning the antiviral effects of all-trans Retinoic Acid (atRA) have revealed that this agent is effective against viruses such as Herpes Simplex Virus. While much of the subsequent research has focused on the therapeutic use of atRA, less time has been devoted to the specificity of this compound. This study deals with the effects of atRA on uninfected Vero cells. End point growth inhibition assays of Vero Cells performed in the presence of 10 % Fetal Bovine Serum (FBS) and 100¼˜M atRA, showed a 31 % decrease in viable cells in the atRA treated cells relative to untreated controls. Additionally, 50(M atRA inhibited cell growth 45 % at 5 % FBS and no less than 87 % at 2.5, 1.25, and 0.625 % FBS. 3-[4,5-Dimethylthiazol-2-yl]-2, 5-Diphenylthtrazolium Bromide cytotoxicity assay, a cellular metabolism assay, produced similar cytotoxicity effects at 5, 2.5, 1.25, and 0.625 % FBS in the presence of 50(M atRA. Varying the FBS and atRA concentrations concurrently indicated that the antiproliferative effects of atRA are most evident at the lowest FBS and highest atRA concentrations, with the largest effect seen on cells grown in 0.625 % FBS and 50(M atRA, which suggests a synergistic relationship. Future studies should focus on the effects of atRA in other cell types and how atRA affects HSV infection in permissible cells.

Rosemarie Marchan
North Carolina Central University
Junior
Environmental Science and Biology
Dr. Pradeep Chatterjee

Green Fluorescence Protein (GFP) Gene Fusions to Natriuretic Peptides Clearance Receptor gene (Npr3): Constructing a Targeting Vector for Homologous Recombination.

The Npr3 gene encodes a clearance receptor that removes the three natriuretic peptides from our vasculature and has been shown to contribute to blood pressure regulation in mouse in gene deletion experiments. Progressive deletions from the C-terminus of this gene were made in a P1 Artificial Chromosome (PAC) using a loxP transposon retrofitting strategy. A series of highly polymorphic dinucleotide and tetranucleotide repeats were identified from deletion end-sequences. The functional significance of such polymorphisms in cells and animals are being tested with GFP-Npr3 fusions by homologous recombination between the PAC deletions and a targeting vector. The targeting vector comprises a (-lactamase gene and GFP coding sequences flanked by approximately 3kb segments of DNA that are homologous to the chloramphenicol resistance and PGK puromycin genes on one side and end sequences from a deletion on the other. Since the targeting vector is constructed without any clone specific sequences, the same plasmid can be used to create fusions at different locations by inserting a 3kbp piece of DNA PCR amplified from the end of a deletion clone. This approach is potentially useful for determining the functional significance of a polymorphism in the context of the entire gene as opposed to only the cDNA.

Takiyah A. McCaskill
University of North Carolina at Charlotte
Junior
Biology
Dr. Monty Hughes

Identification of Aquaporin-8 and Aquaporin-9 in Rat Granulose Cells

Apoptosis is a biological process of programmed cell death by which cells are deleted from a population without damaging nearby cells or eliciting unwanted autoimmune reactions. Defects in this process have been implicated in many important diseases including cancer, AIDS, and some reproductive disorders. A major characteristic of apoptosis is cell shrinkage, caused by a loss of water either through simple diffusion or protein pores call aquaporins (aqps). In this study, we hypothesize that aqps account for the movement of the vast majority of water during cell shrinkage.

By examining ovarian cells (of which 99.9% die normally) we have confirmed the existence of the messenger RNA (the template used to make proteins) for two members of the aqp family, Aqp8 and Aqp9. However there are currently no tools available to exam these individual aqp proteins. Hence, we have raised antibodies against both Aqp8 and Aqp9. The purpose of this project was to characterize these antibodies by Western .Blot Analysis. These studies show the presence of Aqp8 and Aqp9 proteins in qvarian cells and will lead to mechanistic studies of aqps during cell death. Since both aqps and apoptosis have been implicated in a number of different disease states, the role of these molecules in cell death may lend insight into a number of different pathologies.

Sheldon R. Richburg
Fayetteville State University
Sophomore
Biology
Mrs. Minnie Ragland

Bacterial Components Found in Water

The purity of water is a common question today. There are varieties of different contaminants that give water different properties. These contaminants are normally metals, bacteria, and chemicals. In this brief study, the bacterial components were observed and experiments were conducted to determine the common types of bacteria. Samples came from various buildings throughout the Fayetteville State University Campus located in Fayetteville, NC. The standard method of testing water is filtering. However two different tests were conducted to determine bacterial presence. The water samples were filtered and placed on a nutrient media and placed in an incubator for forty eight hours. This method was unsuccessful. The second method was concentrating the bacteria, through centrifugation to create a pellet of bacteria. A small sample of the pellet was streaked onto specified agars and incubated for forty eight hours. Then the samples were examined and compared to known strains. The most common strains of bacteria found in water are E. coli and Pseudomonas. However, the results of the experiment suggested, that E. coli, Staphylococcus and Shigella are present in Fayetteville State University's water supply.

Elliott D. Tatum
Fayetteville State University
Senior
Biology
Dr. Juliette B. Bell

Analysis of the Effect of $BaCl_2$ on the Fidelity of *In Vitro* DNA Synthesis by *Escherichia coli* DNA Polymerase I.

Published reports examining the carcinogenic effect of BaCl2 in drinking water show no evidence of carcinogenic activity. As part of a larger project to analyze the effect of 13 metal cations on the fidelity of in vitro DNA synthesis, the effect of BaCl2 on DNA synthesis by exonuclease-deficient E. coli DNA polymerase I was examined. The M13mp2 LacZ (-complementation assay was used to detect a variety of DNA errors and to visualize these errors by blue/white plaque color. DNA gap-filling synthesis experiments revealed that addition of up to 10 mM BaCl2 does not inhibit DNA synthesis. Preliminary analysis of samples containing BaCl2 show a decrease in the mutation frequency at 10 mM BaCl2, the maximum concentration examined. Further studies are being conducted to determine the trend in mutation frequency for the BaCl2 concentrations ranges between 1 mM and 10 mM. This work is expected to demonstrate whether Ba2+ is among the metal cations that induce mutagenesis or antimutagenesis during DNA synthesis. (Supported by NIH Grant #S06 GM08206)

Tiffany Nicole Thorn
University of North Carolina at Charlotte
Senior
Biology
Dr. Susan B. Peters

Comparison of Muscle Fiber Types in the Tongue Muscles of Two Species of Frogs, *LITORIA caerulea and Bufo marinus*

Frogs share a simple tongue design, consisting of a protractor (genioglossus) and retractor (hyoglossus), which control its movement. This study compares the muscle fiber types in the protractor and retractor muscles of two frogs that use their tongues quite differently. *Litoria caerulea* protracts its tongue slowly, extending it a short distance out of the mouth. *Bufo marinus* protracts its tongue up to 30 times the acceleration of gravity while protruding it almost twice its jaw length out of the mouth. One expects *Bufo's* protractor to have a greater number of fast fibers compared to *Litoria*, but that the retractors will be similar. Enzyme histochemistry of muscle cross-sections showed that the retractors of both species had all fast fibers with similar mixtures of oxidative and non-oxidative types. Protractors of both *Bufo* and *Litoria* contained slow oxidative fibers. If *Bufo*, all of the protractor's fast fibers had similarly high levels of oxidative enzymes. However, in *Litoria*, the fast fibers contained mixtures of high and low levels of oxidative enzymes. Thus, *Litoria's* protractors have a greater diversity of functional fiber types. This indicates that the protractor may play different roles in the two species.

Emmanuel Kwame Torgbe
North Carolina Central University
Senior
Biology
Dr. Pradeep Chatterjee

Analyzing Polymorphisms in The Npr3 Gene with in-Frame Green Fluorescent Protein (GFP) Fusions: Building One Arm of Homology for Recombination.

A novel approach to analyzing the functional significance of a series of highly polymorphic tandem nucleotide repeats in the Npr3 gene is being developed using gene fusions with a green fluorescent protein (GFP) gene. A nested deletion series from the C-terminus of the human Npr3 gene contained in a P1 artificial chromosome has been made. PAC deletion clones containing different combinations of repeat polymorphisms would be fused in-frame with GFP sequences using homologous recombination and introduced into cells and animals for analysis. The GFP targeting vector includes a b-lactamase gene cassette, GFP coding sequences and a multiple cloning site flanked by approximately 3kb segments of DNA homologous to the deletion clone. One side of the homology comprises the chloramphenicol resistance and PGK puromycin genes while the other side includes the end sequences from a particular deletion clone. Approximately 3 kilobases of DNA from deletion ends are being PCR amplified with built in restriction enzyme site linkers, and inserted into the multiple cloning site of the targeting vector. This strategy can be adapted to explore the repeat elements located not only upstream of the gene but also those within introns.

Juan Hayes
North Carolina A&T State University
Junior
Computer Science
Dr. Albert Esterline

A Hierarchical Internet Whiteboard for Joint Task Planning of Mobile Agents

This research is part of an undergraduate research project through a NASA grant titled "Motion Planning in a Society of intelligent Mobile Agents." The same workspace, with obstacles, agents, and the start and goal positions of each agent, is displayed on one or more systems. There is a user at each system who is responsible for moving one of the agents from its start position to its final position without colliding with any obstacle or agent. The goal is to facilitate human cooperation across the Internet. We accomplish this through a structured whiteboard. Users interact through the whiteboard by depicting their plans as hierarchical structures showing intermediate goals. One user can concur with another's proposed intermediate goal, or he might object to it because it would interfere with the path he intends for his agent. This allows joint plans to be worked out ahead of the motions of the agents. This approach is flexible because the hierarchical representation allows planning to different levels of detail, and planning horizons may be near to the current state or far into the future.

Edgar Johnson
North Carolina A&T State University
Senior
Computer Science,
Dr. Albert Esterline

Hierarchical Multi-Agent Motion Planning using Lee's Algorithm for Groups of Multiple Agents within a Static Environment

This presentation reports on undergraduate research being conducted as part of the NASA-supported project "Motion Planning in a Society of Intelligent Mobile Agents." We think of agents in this context as mobile robots. The problem is to devise an efficient heuristic that will group several interacting agents within a static environment to move from known starting points to detectable destinations. We modify Lee's algorithm to obtain parallelism that solves the problem of motion planning for groups of multiple agents in a static environment. This is generally an optimization problem: we want a solution that gets all the agents to their destinations in the shortest time possible. A solution consists of a path for each group of agents, which are best-fit paths of each individual agent of each group.

Deidra Felton
Sompharanh Phetsomphou
North Carolina A&T State University
Freshmen
Food Science
Human Environment & Family Sciences
Dr. C. W. Seo and Ms. Sarah Williamson

Oxidative Rancidity in Heated Vegetable Oils During Storage

Oxidative rancidity is the major deteriorative reaction in vegetable oils during storage. Heat, light, heavy metals, heme pigments, the presence of oxygen and lipooxidase can trigger oxidative rancidity. Heating at high temperature is the most common abusive treatment vegetable oils receive. The first objective was to follow lipid oxidation in peanut oils during storage at 500C using the modified TBA test and peroxide value determination method (PO). The TBA values did not increase significantly in the 30-day storage period contrary to the peroxide numbers. The second objective was to show that the degree of oxidation is a function of temperature and also the length of heating and to demonstrate that oils containing higher amount of polyunsaturated fatty acids were more susceptible to rancidity. Two commercial vegetable oils were heated at 198.80 C (3900 F) for 30, 60 90 and 120 min and their degree of rancidity was determined using the PO. It was found that as the length of heating time increased, the degree of oxidation increased in vegetable oils. The degree of oxidation also increased as the storage time increased. Peanut oil showed higher peroxide values than Wessen Best Blend oils in the first three weeks of storage.

Andrea K. King
University of North Carolina at Chapel Hill
Sophomore
Chemistry
Dr. Scott Wallen

New Methods for Nanoparticles Preparation

Nanomaterials are of fundamental and technological interest due to the unique properties that they posses due to their small size. Our group is interested in the application of metallic and dielectric coated metallic nanoparticles as novel components of analytical sensing methodologies. We have recently prepared a polymeric system with silver as a coordinating ion. This material is used as a template to photolytically and chemically produce reduced meta11jc particles. An intriguing aspect in the former case is that the particles in the presence of the polymeric precursor have a tendency to align into macroscopic length scales. We will present recent results on the preparation and characterization of these materials.

Ryan Danielle Kinloch
North Carolina A&T State University
Junior
Chemistry
Dr. Julius L. Harp

Studies of Functionalized Phenpropylamines

The primary focus of this work involves the synthesis of exogenous amines as well as a-substituted amines that mimic the structure and the biological activities of endogenous amphetamine and amphetamine precursors. The synthesis involves the transformation of 3'4'-dihydroxyacetophenone via a-bromination, cyano condensation followed by cyano reduction. Ultimately, the proposed exogenous amines are expected to be used to interfere enzymatically at specific mechanistic steps in the catecholamine pathway. The enzymatic interference elicited by exogenous amines is likely to provide selective entries into the catecholamine mechanism such that specific neurological abnormalities can be offset. (Supported by MARC Grant 5T34GM07649-22)

LaFaith Miller
University of South Carolina
Junior
Chemistry
Dr. Roy E. Wuthier

Fusarochromanone, A Potent Ant-Angiogenic Agent And Effective Cancer-Treatment Drug

Angiogenesis is the formation of new blood vessels (capillaries) from preexisting vessels. It involves the proliferation of capillary endothelial cells and occurs in response to chemical signals from a part of the body that shows a need for more oxygen.

Fusarochromanone (FC-101) blocks endothelial cells from receiving the signal to form new vasculature. FC-101 is potentially more effective than other treatments because it can be taken as a pill by mouth or administered intraperitoneally, and is much less toxic than currently used chemotherapeutic agents. We are developing better methods of purifying FC-101, optimizing each step in the purification process. Examining various extraction methods, we have found that the contact time between extracting solvent and rice culture can be reduced to two hours, compared to sixteen hours previously used. We also discovered that while particle size does effect extraction, under the conditions currently used this is not a major factor. In addition, we found that while pretreatment of the rice culture with water enhances the efficacy of methanol, the length of pretreatment time can be reduced to only a minimal waiting time.

Corrie Stowe
North Carolina A&T State University
Junior
Food Science and Nutrition
Dr. Ipek Goktepe

Inactivation of Micrococcus sp. with Heat and Sodium Chloride

Micrococcus sp. are one of the most predominant spoilage bacteria in foods such as bacon, hams, eggs, dairy products, seafood, liver, and poultry. They can grow in the presence of high levels of NaCl. In the present study, Micrococcus sp. were grown in 10 mL of Brain Heart Infusion Broth (BHI) for 24 h at 37°C in order to provide late stationary-phase cells. Fresh *Micrococcus* cultures were prepared in BHI broth daily. BHI broth (10 mL) containing NaCl (0% to 10%, w/v) was inoculated with 0.1 mL of inoculum in order to obtain an initial concentration of approximately 7-8 $\log_{10}$ CFU/mL. Thermal inactivation was carried out at 55 to 65°C for 0, 4, 8 and 12 min. using a submerged coil apparatus. In order to determine the number of surviving CFU/mL after heat treatment, appropriate dilutions of samples were surface plated onto BHA plates. All plates were incubated at 37°C for 48 h. The growth of *Micrococcus* sp. was reduced at 6 % NaCl treatment; however, the most effective treatment of NaCl was found to be at 10%. Growth reduction was achieved at 4 minutes for all NaCl concentrations at 60°C.

Kantrell West
Fayetteville State University
Senior
Natural Science
Dr. I. Daniel Shin

Quantitative Analysis of MTBE by Means of NMR

Methyl tert-Butyl Ether (MTBE), one of the oxygenates, has been used as an anti-knocking reagent since it is a cost effective fuel additive which meets air quality and gasoline performance goals. It is one of the few chemicals that can satisfy the US Clean Air Act of 1990. Approximately 9.1 billion pounds of MTBE are produced in the U.S. per year, and 280,000 barrels are used in the U.S. alone everyday. Although effective, addition of MTBE creates another pollution and health risk. Since MTBE is highly soluble in water, leaking gasoline storage tanks both from underground and aboveground, as well as fuel spills on pavement, directly put more of it into groundwater than other components of gasoline. MTBE has caused cancer in laboratory animals and is classified as a possible human carcinogen by EPA. Yet no comprehensive method of accurately detecting low-level MTBE has been developed. Hence the extent of environmental impact is unclear. The purpose of this study is to possibly determine a methodology for detecting MTBE quantitatively. Nuclear Magnetic Resonance (NMR) spectroscopy is used in developing a methodology for identifying low-level MTBE. Standard addition technique has been used to analyze MTBE in different octane level gasoline.

Chavon Renee Wilkerson
North Carolina A&T State University
Senior
Chemistry
Dr. Robert Hormon
Rohm and Haas Company, Exploratory Agricultural Chemicals Group Springhouse, PA

A Bisacylhydrazine Coupling Optimization Study

Agrochemical research over the last two decades has resulted in the discovery of chemically novel insecticides that mimic the action of the two insect growth and developmental hormones, the steroidal 20-hydroxyecedysone (20E) and the sesquiterpenoid juvenile hormone (JH). Bisacylhydrazines are non-steroidal agonists of 20E and exhibit their insecticidal activity via interaction with the ecdysteroid receptor proteins. Rohm and Haas Company scientists discovered the first bisacylhydrazine ecdysteroid agonist serendipitously in 1983. The newest member of this class, RH 2485 (proposed name methoxyfenozide), was announced in 1996 and is currently under development by Rohm and Haas Company. A coupling optimization study of this compound is reviewed in this paper. (Supported by MARC Grant 5T34GM07649-22)

Kwadwo Agyeman
North Carolina A&T State University
Senior
Computer Science
Dr. Albert Esterline

Multi-user Task Integration

In our project, the same workspace, with obstacles, mobile agents, and the start and goal positions of each agent, is displayed on one or more systems. There is a user at each system who is responsible for moving one of the agents from its start position to its final position without colliding with any obstacle or agent. We are using the Tool Command Language and Tool Kit (Tcl/Tk) to create the interface. Buttons are being used for manipulations that help the users in starting and joining other users to interact within the interface. Also, buttons allow a user to move his agent around the canvas while trying to get to its goal. We are extending the implementation so that it readily accommodates more than two users. While it is easy for two users to take turns and to agree on joint plans, consensus is difficult to reach with more than two users. Part of the solution is to display an up-to-date representation of what has been agreed and the person-to-person protocols that have been accepted.

Bennet Barham
North Carolina A&T State University
Junior
Computer Science
Dr. Albert Esterline

Data Structures for Implementing an A* Algorithm for Multiple-Robot Path Planning

This research reported here is part of a project funded by NASA, titled "Motion Planning in a Society of Intelligent Mobile Agents." Our task was to implement a path-planning program for a group of agents moving in a grid partially occupied by obstacles. Each agent has a start position and a goal position. Agents must not collide with obstacles or with each other. We implemented the program using an A* algorithm that finds a near-optimal path for each agent. A* algorithm uses Euclidean distance to give a lower bound on distances in a grid, where the paths of the robots are measured by Manhattan distance. We here report on the algorithm and data structures used in out implementation. The problem requires that we keep a priority queue for each agent. To detect threats of collisions, we explore the search spaces of all robots at the same time. This requires coordination of the manipulation of the data structures used for the searches for the various agents.

Michael C. Faulcon, Jr.
North Carolina A&T State University
Junior
Computer Science
Dr. Albert Esterline

Robot Motion Planning using the A* Algorithm in the Presence of Multiple Agents

This project is part of an undergraduate research study supported by NASA through a grant entitled "Motion Planning in a Society of Intelligent Mobile Agents." We are working towards a package that will plan paths for mobile robots to travel from their start positions to their goal positions on a grid without colliding with one another. In addition, these agents will be avoiding other task-hindering obstacles, and the shortest feasible paths are sought. The implementation is being carried out using a heuristic search known as the A* algorithm. The algorithm uses Euclidean distance to give a lower bound on distances in a grid, where the paths of the mobile agents (robots) are measures by Manhattan distance. Paths that result in collisions are not expanded. We also allow for some control through human-computer interaction. This way they will be intelligent enough to function on their own and we will still be able to control them if the need or desire arises.

Muntasir Ahmed Khan
North Carolina A&T State University
Senior
Computer Science
Dr. Albert Esterline

Operating System Support for High-Speed Communication

The role of an operating system (OS) is to mediate and multiplex the access of multiple application programs to the computing resources provided by the underlying hardware. Unfortunately, current operating systems are threatening to become bottlenecks in delivering input/output (I/O) data streams to application programs. This research finds techniques to eliminate processing I/O bottlenecks in operating systems, with particular focus on high-speed networking. Limited memory bandwidth is a potential source of performance problems. Cache systems can hide the slow speed of main memory only when the memory accesses generated by a program have good locality of reference. Accesses to I/O data generated by operating systems and applications, however, tend to have poor locality. Removing I/O bottlenecks requires an integrated design of application programming interface, cross domain data transfer, buffer management and network interface. This research introduces techniques to remove the I/O bottleneck without sacrificing the structure of operating system and applications. This research describes the techniques that are part of a coordinated design to minimize main memory traffic. It presents an OS facility called first buffers (fbufs), a high-bandwidth cross-domain transfer and buffer management facility, and shows how it can be optimized to support data that originates and/or terminates at an I/O device, potentially traversing multiple protection-domains, both in monolithic and server-based operating systems.

Que'Shetta Manning
North Carolina A & T State University
Junior
Computer Science
Dr. Albert Esterline

Using Quadtrees to Find Channels for Robot Motion Planning

This research is part of an undergraduate research project supported through a NASA grant titled "Motion Planning in a Society of Intelligent Mobile Agents." My area of focus is on the use of quad-trees to find channels of movement through out the system. A channel is a sequence of adjacent cells that are either "empty" or "mixed". If all the cells are empty, the channel is said to be an E-channel; otherwise, it is said to be an M-channel. By using the representation of E- and M-channels, we now implement a very familiar search known as the breadth-first-search to look for a path. Using the following simple first-cut planning algorithm: Search the connectivity graph associated with the decomposition for a channel connecting the cell containing the initial position to the cell containing the goal. If the outcome of the search is an E-channel, return success. If it is an M-channel, proceed to the next step. Otherwise, return failure. Once this algorithm has been applied, the breadth-first-search will visit each empty cell accessible from the initial cell and connect it to the next empty cell to form a path.

Jenelle Ore
North Carolina A&T State University
Junior
Computer Science
Dr. Albert Esterline

Cell Decomposition in Quadtrees for Robot Motion Planning

This research focuses on the approximate cell decomposition approach, by representing the robot's free space Cfree. I will be focusing mainly on controlling the amount of free space around a generated path by setting a minimal size for the cells. the decomposition of the workspace into ever smaller rectangloids describes a tree structure. Each node of the tree is a rectangloid cell, which is labeled as empty, full, or mixed. Only a mixed cell may have children. The tree I will use for decomposition is called a quadtree. We associate a C-sentence S_k with every mixed cell *k*. When a mixed cell is divided into smaller cells, the C-sentence associated with it is used to compute the label (empty, full, or mixed) of each newly created cell. A cell *k* is said to be inside the C-constraint e_{ij} if all the points (x, y) in *k* satisfy e_{ij}. It is outside e_{ij} if all points (x, y) in *k* contradict e_{ij}. The algorithm for labeling a new cell and simplifying the C-sentence will be used later in the research.

Guadalupe Rojas
North Carolina A&T State University
Senior
Computer Science
Dr. Albert Esterline

Hierarchical Motion Planning of Groups with Multiple Agents within Static Environments

This research is part of an undergraduate research project supported in part by a NASA grant, titled "Motion Planning in a Society of Intelligent Mobile Agents." We are concerned with a group of agents, which traverse a grid environment. These agents start from their initial position traveling to their goal within an envelope. They travel along paths together within an envelope. Agents have a path from their initial cells to their respective goal cells. This collection of paths creates a complete channel. An envelope moves along a channel. The envelope will start moving from the beginning of a channel to the end of the same channel and tightly enclose a group of agents from start to end. Now our problem is to construct safe channels (no agent collision) within the same environment, which transport agents of a group to their goal as soon as possible.

Edward T. Saddler
North Carolina A&T State University
Junior
Computer Science
Dr. Albert Esterline

Multiple-Robot Motion Planning using the A* Algorithm with an Enhanced Heuristic Function

We here report on research being done by students attending North Carolina Agricultural and Technical State University through a grant funded by NASA. This research addresses motion planning for a group of robots. We use a grid that contains obstacles as well as a starting point and a goal point for each robot. The aim is to get the robots from their starting points to their goal points in the least number of steps and in the process avoid any collision with the obstacles and other robots. This task is realized with an A* algorithm, which uses Euclidean distance to give a lower bound on distances in a grid, where the paths of the robots are measured by Manhattan distance. The Euclidean distance between a robots position and its goal gives an estimate of how far the robot has to go. Large distances cause the heuristic search to explore other paths. To avoid collisions among robots, we add to this distance a term that increases as a robot approaches other robots. This causes the search to avoid paths that come close to other robots.

Patrick Spears
North Carolina A&T State University
Junior
Computer Science
Dr. Albert Esterline

Rules of Engagement for Computer Facilitated Cooperation

This research is part of an undergraduate research project supported through a NASA grant titled "Motion Planning in a Society of Intelligent Mobile Agents." In this research we are exploring ways to support joint activities with computers. The test application we are using involves users moving agents around a grid that includes obstacles. Each user controls exactly one agent, which has an initial and a goal position. Agents must not collide with each other. In face-to-face conversation involving two people, there are two roles: the speaker and the addressee. For the conversation to proceed correctly, it is critical that that addressee remain engaged in the conversations by performing certain acknowledgement actions, such as shaking his head. It is also critical that the two participants switch roles smoothly (that is, take turns). We are exploring ways to support such activity in computer-facilitated cooperation.

Renard Spratling
North Carolina A&T State University
Freshman
Computer Science
Dr. Albert Esterline

Multi-user Distributed Workspace for Joint Motion Planning

This research is part of an undergraduate research project supported through a NASA Grant titled "Motion Planning in a Society of Intelligent Mobile Agents." In modern computer science, the communication between multiple users is highly valued. The aim of our research is to establish effective means of allowing multiple users to communicate with each other while at separate machines. Currently, the users work together to navigate their respective agents on a grid to reach common goals. A communication medium needs to be established between the users to allow them to relay plans for accomplishing the goal. We are implementing such communication by utilizing graphical user interface functionality and client/server technologies available in Tcl/Tk (Tool Command Language/Tool Kit) for the establishment and maintenance of communication between all involved parties over a network. The Tk extension of the Tcl language allows for the generation of an interface for the interaction between users. We utilized the message board capability of Tk to display necessary messages and text to all users. We are exploring Tcl/Tk's functionality for ease of communication between multiple computer platforms through the use of tcp/ip protocols.

Kimberly Webb
North Carolina A&T State University
Junior
Computer Science
Dr. Albert Esterline

Computer Displays of Common Ground to Facilitate Joint Activities

This research is part of an undergraduate research project supported through a NASA grant titled "Motion Planning in a Society of Intelligent Mobile Agents." We are identifying methods of using computer displays to facilitate highly cooperative tasks. The joint activity that we use as an example involves users moving agents through a grid with unoccupied (obstacle) and free cells. Each user is responsible for moving exactly one agent from an initial to a goal position; agents must not collide with each other. As a joint activity progresses, a common ground, shared by all participants, is built up. This common ground is critical for the successful completion of the joint activity. We are investigating the best ways to display this information: command histories, visible indications of agents' previous paths, indications of the person-to-person protocols use for various purposes, and so on.

Troy Green
University of South Carolina
Senior
Mechanical Engineering
Dr. Kinku Endale, USDA, Agricultural Research Service, Watkinsville, Georgia

Impact of Tillage and Fertilizer Treatment on Cotton Yield and Water Quality

The purpose of this research is to compare combinations of poultry litter versus chemical fertilizer and conventional tillage versus no tillage on surface and sub-surface movement of nutrients on cotton production as well as cotton yield. Through research, we will determine how sustainable cotton production is under the contrasting conditions in the southern Piedmont. What are the yields? What are the economical returns? What can farmers do to preserve the nutrients of the soil? The research seeks the answers to these questions.

There are twelve 30 ft x 100 ft plots of cotton consisting of four combinations. The combinations are: conventional tillage and chemical fertilizer (CTCF), conventional tillage and poultry litter (CTPL), no tillage and chemical fertilizer (NTCF), and no tillage and poultry litter (NTPL). Each combination is replicated three times for a total of twelve plots. The water quality data is measured through runoff and drainage-samples.

After each rainfall event, samples were taken from the runoff and drainage samplers and the data information of each plot were recorded through instruments known as dataloggers. My responsibilities consisted of programming and monitoring water samplers for the runoff and drainage collection, monitoring soil moisture of each plot, downloading data from dataloggers, as well maintaining the maintenance of the all equipment used.

Erick G. Pryor
North Carolina A&T State University
Senior
Material Science
Dr. Kenneth L. Roberts

Characterization and Analysis of Iron-Based Electrodes in Molten Carbonate Systems

The dissolution of the cathode is a primary life limiting constraint of MCFC's. With currently available NiO cathodes, the goal of 40,000 hours for the lifetime of MCFC's appears achievable with cell operation at atmospheric pressure. However, the cell lifetime at 10 atm and higher cell pressures is in the range between 5,000 to 10,000 hours. The dissolution and precipitation of the NiO cathode materials and corrosion of the metal bipolar plate are primary life limiting constraints of MCFC's, particularly in pressurized operation. Further research is necessary in order to understand the corrosion processes occurring at the cathode/molten carbonate interface and to identify the most appropriate materials as cathodes for MCFC's.

Key milestones for achieving the goal and objective for developing a superior cathode for MCFC's are: (i) construction of molten salt cell for corrosion and electrochemical studies in molten carbonates at 650oC, (ii) preparation of binary iron-based electrodes and coatings, (iii) microscopic and electrochemical characterization/ utilization studies of the cathode materials under different operating conditions, and (iv) determination of the corrosion rates of the cathode materials under different operating conditions.

This presentation will discuss the research to identify the most appropriate materials as cathodes for MCFC's and to understand the corrosion processes occurring at the cathode/molten carbonate interface. Electrochemically modified iron-based coatings will have high corrosion resistance in molten carbonates at 650°C combined with high rate of oxygen reduction (low polarization resistance and high exchange current density). The oxide films will be formed on in-house prepared binary iron-based electrodes and coatings.

Rahul Saddy
North Carolina A&T State University
Senior
Industrial Engineering
Dr. Ji.Y.Shen

Structural Modeling for a Structural Damage Detection System

In an attempt to develop a structural health monitoring and damage detection system, which will be considered as a sub-system of NASA's generic post-test/post-flight diagnostic system for rocket engines, we are working on the first-stage task – structural modeling. The proposed system consists of five sub-modules: Structural Modeling, Measurement Data Pre-Processor, Structural System Identification, Damage Detection Criterion, and Computer Visualization. The current task is to develop the first module.

The common practice to date for structural modeling is to use AutoCAD. But, the complexity of engine components requires a further improvement in structural modeling techniques. We are considering to add a scanning and mapping technique to our computing system. The basic idea is to produce a full and accurate 3-D model of an object by tracing on multiple overlapping photographs taken from different angles. There is no need to input point positions, angles, distances or axes. Photographs can be taken by any types of cameras with different lenses. With the help of a software called PhotoModeler, the production of the prototypes of any complex structural components becomes more efficient, and an accurate model of the object can be easily produced by sending the prototype model to the AutoCAD package for necessary modification.

Making 3-D drawing from an existing part using PhotoModeler essentially consists of taking photos; importing them into PhotoModeler; referencing and processing the data points; marking points, lines and surfaces of interest; adding scale; rotating the model to a proper orientation; and finally exporting the model to AutoCAD. The technique is presented in this paper through developing a computer model of an engine blade. It is proven that the technique is very useful in making AutoCAD drawings of complex engine parts, and reduces the time and effort which is intensive if using AutoCAD only. The technique can also be easily applied to all other engineering disciplines.

Asia C. Wells
North Carolina A&T State University
Senior
Engineering
Dr. Kenneth L. Roberts

Supercritical Fluid/Surfactant Mixtures for Contaminant Removal from Various Substrates

A method involving the use of a supercritical carbon dioxide or a reverse micellular solution in a supercritical carbon dioxide to clean industrial wastes from coupons of metal for machining operations is discussed in this work. This method involves the use of carbon dioxide or a reverse micellular solution in carbon dioxide or light hydrocarbon to clean industrial wastes from coupons of metal for machining operations. Once the contaminants have been dissolved into solution, they can be separated from the supercritical fluid and later recycled back to the process. The removal of model contaminants from metallic surfaces at fixed conditions was examined for mixtures of surfactants and supercritical fluids at low to moderate temperatures and pressures from 1000 to 3500 psig. Overall the removal of the grease contaminant was observed to increase with pressure. The effects of additional polar, ionic and oily model contaminants on removal efficiency were also examined.

Franklin E. Leaven, Jr.
North Carolina A&T State University
Senior
Electrical Engineering and Applied Mathematics
Dr. Abdollah Homaifar

Classification and Evaluation of Parallel Methods for Power Supplies

Due to rapid advancement in the areas of computer and communication, power supplies must be able to provide high currents, and achieve high efficiency and reliability. Distributed Power Systems have been proven to be effective in meeting the demands of the computer and communication industry by allowing these systems to obtain the following characteristics: good reliability, ease of maintenance and repair, improved thermal management, and redundancy. Some of the issues involving parallel methods for power supplies are: current sharing, voltage regulation, system stability, modularity, and fault tolerance. This paper analyzes some of the most popular parallel methods for power supplies, and investigates the issues associated with these methods. Emphasis will be placed on discussion of merits and limitations associated with different parallel schemes.

Patrick Murphy
North Carolina A&T State University
Senior
Electrical Engineering and Applied Mathematics
Dr. Abdollah Homaifar

An Experimental Current Sharing Design and Implementation

Implementation of parallel power supplies in the area of distributed power systems have allowed these systems to become more efficient in producing high currents from low input voltages, reducing stress on devices, and increasing its redundancy and reliability. The major problems in this area are effective current sharing control, voltage regulation, and stability. In this paper the Master-Slave control strategy for parallel operation of the buck converter is investigated. Analysis and design considerations of output voltage regulation and load current sharing are presented. An experimental system of two (48V/5V and 1A) models is analyzed and simulation results verify the already hypothesized performance of current sharing.

Oliver Hinds
North Carolina A & T State University
Senior
Computer Science
Dr. Albert Esterline

Joint Activity Coordination and Planning in Multi-Agent Environments through Computer Integrated Communication

This research is part of an undergraduate research project supported through a NASA grant titled "Motion Planning in a Society of Intelligent Mobile Agents." An important consideration in modern computer science is the problem of harnessing the power and reliability of computation to complete important tasks. Our research attempts to identify methods of using computers as the arbiter of tasks that require intensive cooperation. We integrate without introducing side effects that would hinder the achievement of tasks performed by humans. Thus, our integration is more predictable than the collaboration among unaided individuals towards the same task. We concentrate on identifying effective types and important content of communication, which guide the cooperation toward successful completion of a joint activity. Specifically, we consider a joint activity that involves human controlled proxy agents traversing a static environment split into a grid of discrete cells either empty, or containing an agent or obstacle.

Reginald Watson
Raynard Sumpter
North Carolina A&T State University
Sophomores
Electrical Engineering and Applied Mathematics
Dr. Mingxiang Chen

Geometric Proof of A Vector Triple Product Identity

The expression of the form a x (b x c) is a so-called vector triple product. The identity

a x (b x c) = (a * c)b – (a * b)c

is one of the fundamental identities in vector algebra. Although this identity can be proved by using the algebraic definition of cross product, the algebraic proof does not reveal any geometric meaning of the identity.

We present a geometric proof of the identity. We first carry a few steps of simplifications: (1) we may assume that vectors a, b, and c are unit vectors; (2) we may assume they are coplanar. We then use extensively geometric interpretations of both dot product and cross product of two vectors in our proof. In particular, we prove the special case
a x (a x b) = (a * c)a – (a * a)b.

Shareed S. Ali
North Carolina Central University
Junior
Physics
Dr. B. Vlahovic

Development of a Polarimeter to Analyze Polarized Beam in Few GeV Range

The physics program at Thomas Jefferson National Accelerator Facility includes fundamental experiments with polarized photons beam in few GeV energy range. Development of the Polarimeter with an absolute accuracy better than 5% for use in Hall B experiments is the subject of my presentation. We take advantage of the recent progress in silicon micro strip detectors for measurement of the geometry and angle correlation in electron positron pair production from an amorphous converter. A detailed analysis of the setup including Monte Carlo simulation will be presented.

Shanese Collins
Manu Edwards
Jamie Ryan
Fayetteville State University
Sophomores
Physics
Dr. A. Y. Abokor

Electron Spin Resonance of Paramagnetic Substances

Electron Spin Resonance (ESR) is an important technique for investigating the microphysical quantities of the electron. This technique reveals the internal magnetic fields of a sample substance. With the resonance method used, the difference in energy between two spins of the electrons of a paramagnetic substance, namely, diphenyl-pikryl-hydrazyl (DPPH) is measured directly. A sample of DPPH is placed between a pair of Helmholtz coils and an r.f. coil (frequency range 15 to 150 MHz). The sample absorbs r.f. energy, thus measurably changing the impedance of the r.f. oscillatory circuit. The resonant frequencies f at different field strengths B are measured (using various display techniques). From the graph of f vs B, the gyromagnetic ratio (g-factor) is determined for the DPPH electron spin system. The DPPH is a radical in which a free electron is present in a nitrogen atom. Thus, the g-factor is expected (theoretically) to slightly deviate from that of a free electron (g =2.0023). The experimental result agrees, within $\pm 1.5\%$, with the theoretical calculations of the g-factor.

Mariamma Kambon
North Carolina Central University
Junior
Physics
Dr. B. Vlohovic

Development of a Polarimeter to Analyze GeV Range Photon Beam -Japan experience

The physics program at many research facilities: JLAB, LEGS, GRAAL, DESY, SAL, MAMI, and INS, will benefit from an improvement in the polarimetry for linearly polarization photons measurements. At the lower energies the pair production method off nuclei is known to be the most successful. However, because the opening angle between the $e(+ ,e(-$ pair decreases as the energy of the photon increases, this method has not been applied to higher energies. We extended this method to entire JLab energies regions, by taking advantage of new development in microstrip detectors technologies. At the same time we also improved it at lower energies. We have already built and tested a prototype. The preliminary results are promising and the measured analyzing power is as high as predicted.

Our experiment at Spring-8 in Japan, from March 3 to March 182001, made the first direct measurement of the azimuthal asymmetry in e+e- pair production by linear polarized photons in the energy range 1.5-2.4 GeV. More than 8 millions events were recorded. The asymmetry signal is strong, as it can be seen from the figure in the attachment to this message. We had found a preliminary value of A =0.17. The statistical accuracy of this preliminary result based on small portion of data is about 0.02. The preliminary value of the asymmetry is less than the expected value A=0.22-0.24. However, it is an online result, which need offline corrections on acceptance and accidentals. The use of the ratio of the pair components energies should increase the value of asymmetry and reduce the value of systematic error of calibration. Detailed results will be presented.

Joseph P. Reynolds
North Carolina Central University
Senior
Physics
Dr. Kinney Kim

Comparison of Recent Nondestructive Testing Techniques of Composite Materials

Nondestructive Testing (NDT) of composite materials is essential for testing aircraft structural integrity, preventing catastrophic failure. Composite materials have superior qualities over steel and aluminum, high resistance to oxidation, heat and stress, lighter weight for increased fuel efficiency. However a small stress fracture or delamination may propagate leading to serious failure of the structure. There are several techniques to examine internal structures. Our task is to find one that is easily implemented in the field application and with a resolution of less than 0.1mm.

The methods investigated each have their strengths and weakness. We found x-ray absorption radiography to have superior resolution but limited to relatively thin sheet of composite material (~ 1 cm at most). Fast neutron radiography picks up where x-ray's end however this has insufficient resolution. Embedded fiber optics has a very high resolution but is also limited to distinct location of the sensor. These limitations are leading us to investigate other possibilities such as resonant ultra sound spectroscopy, acoustic plane wave reflection from a composite laminate, or phase shift x-ray radiography.

Dana Maurice Warren
North Carolina Central University
Junior
Dr. Jyotsna M. Dutta
Physics

Atomic Force Microscopy To Investigate Surface Morphology of Semiconductors

In contemporary photovoltaic research, scanning probe microscopy has proven to be an indispensable tool for nanoscale characterization and analysis of semiconductor materials. The scanning tunneling microscopes (STM) developed in the 1970s and 1980s, make use of the quantum phenomenon called vacuum tunneling, and utilizes the tunneling current to produce surface features as small as atoms. One obvious disadvantage to the STM is the fact that the specimen surface has to be conductive. This was overcome by the application of the Atomic Force Microscope (AFM) in 1986. A user friendly computer code in Visual Basic has been developed for the AFM located in the Nanoscale Laboratory at NREL, and the application of the code has proven to provide the surface morphology more accurately. Some preliminary results will be presented and the accuracy of the results will be discussed.

Author Index

POSTER PRESENTERS

Author Index

ORAL PRESENTERS

North Carolina Agricultural and Technical State University is committed to equality of educational opportunity and does not discriminate against applicants, students, or employees based on race, color, national origin, religion, gender, age, or disability. Moreover, the University is open to people of all races and actively seeks to promote racial integration by recruiting and enrolling a larger number of white students.

450 copies of this public document were printed at a cost of $1888.92 or $4.20 per copy.