WBHR LS-AMP UNDERGRADUATE SYMPOSIUM

July 17-18, 2005

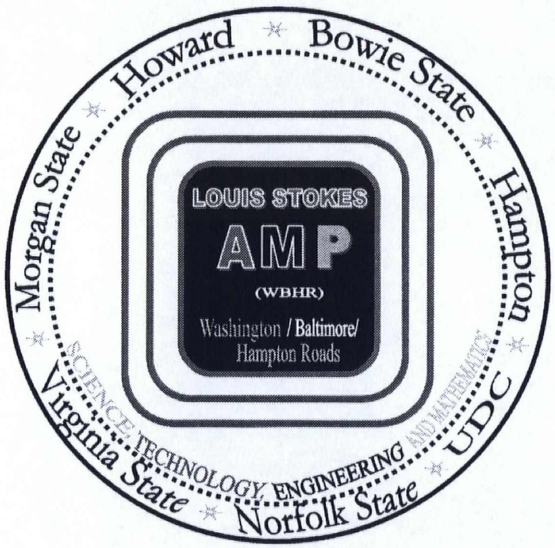
Hampton University

Hampton, Virginia

Washington/Baltimore/Hampton Roads-Louis Stokes Alliance for Minority Participation Program

LSAMPS PROGRAM

Science, Mathematics, Engineering & Technology
5th Undergraduate Research Symposium



School of Science and School of Engineering and Technology
Hampton University

Hampton University

Is proud to host the

5th Undergraduate Research Symposium

July 17-18, 2005

Hampton University, Host

Dr. William R. Harvey, President

Dr. Joyce Jarrett, Interim Provost and AMP Co-Sponsor

Dr. Harold Marioneaux, Dean, School of Science

Dr. Eric Sheppard, Dean, School of Engineering and Technology

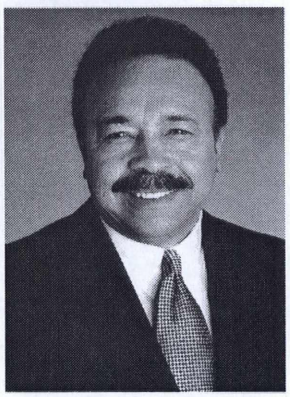
Dr. Elaine Eatman, AMP Campus Coordinator

HAMPTON UNIVERSITY

HAMPTON, VIRGINIA 23668
(757) 727-5231

OFFICE OF THE PRESIDENT

July 15, 2005



Greetings:

The Hampton University Community extends a warm welcome to each of you on the occasion of the Fifth Annual Summer Student Research Symposium of the Washington Baltimore Hampton Roads Louis Stokes Alliance for Minority Participation (WBHR-LSAMP). We have planned an exciting and stimulating symposium designed to inspire and challenge you. I hope that you will learn and grow throughout the sessions and that you will enjoy the beauty of your surroundings at our *Home by the Sea.*

This symposium provides an excellent opportunity for you, as young scientific investigators, to showcase your research talents. Through your oral, poster, and/or media presentations, each of you will be reviewed and receive recognition of your research efforts by your peers as well as distinguished scientists. We hope that your accomplishments here serve as a springboard to even greater achievements in the future.

Thank you for your decision to participate in this symposium, and congratulations on your unique research presentation. I wish you the best of luck in this activity and heartily welcome you to *Our Home by the Sea.*

With all good wishes,

W. R. Harvey

William R. Harvey
President

HAMPTON UNIVERSITY
HAMPTON, VIRGINIA 23668

OFFICE OF THE PROVOST
(757) 727-5201

July 14, 2005

Dear Conference Participants:

On behalf of Hampton University, I welcome the Washington Baltimore Hampton Roads Louis Stokes Alliance for Minority Participation (WBHR LS-AMP) to the Fifth Annual Undergraduate Research Symposium. The theme, *"Learning Science Through Research,"* reflects the new paradigm for preparing students for playing significant roles in the fields of science, engineering and mathematics during the 21st Century. It echoes the new teaching-research axiom: *"Teaching Science the Way Research Is Done."*

The student presentations at this symposium demonstrate that this is being done at the participating institutions represented here today. The quality of the student research presentations is a tribute to the mentors and truly underscores their shining examples of significant research. My sincere appreciation is extended to the Co-Principal Investigator and Coordinator from Hampton University for hosting the 5th Annual Student Research Symposium.

The student participants are receiving superb training and research experience at Bowie State University, the University of the District of Columbia, Howard University, Morgan State University, Norfolk State University, Virginia State University, and Hampton University. The various enrichment experiences afforded by this alliance, WBHR LS-AMP, will ensure that graduates will have a great future in diverse science areas.

To all of the participants of this conference, I extend my best wishes for success in pursing your goals of becoming research scientists and scholars.

Sincerely,

Joyce M. Jarrett

Joyce M. Jarrett
Interim Provost

Philosophy of WBHR LS-AMP

The Washington Baltimore Hampton Roads Alliance for Minority Participation (WBHR-LSAMP) includes Howard University as the lead institution with Bowie State University, Hampton University, Morgan State University, Norfolk State University, the University of District of Columbia, and Virginia State University as partners. Project administration is structured to ensure involvement at the highest academic levels at all of the partner institutions. In addition, strategies are being implemented that emphasize retention, recruitment and tutoring throughout the undergraduate Science, Engineering and Mathematics (SEM) programs rather than just at the initial year.

The goals and objectives established for the WBHR-LSAMP are:

- *To work closely with staff of existing programs such as EXCEL, HBCU Initiatives, TRAGG, ONR, McNair Scholarship Program and institution-wide counseling and tutorial programs for freshman/sophomore students in SEM areas, to ensure that students are receiving good introductory course work and individualized counseling to successfully complete majors in SEM fields;*

- *To provide junior and senior level students at all of the participating institutions an opportunity to integrate research into their SEM curriculum by providing academic credit for their undergraduate research and ensure that they have an opportunity to work in a research environment through a semester/summer exchange during the academic semester at a level one research university, in industry and/or at national or governmental laboratories;*

- *To facilitate the transfer of science, mathematics, engineering, and technology (SMET) students from community colleges that have articulation agreements with institutions within the WBHR alliance for summer/transfer enrichment programs and ensure their successful completion of B.S. degrees in a SMET field;*

- *To provide mentoring workshops to SEM faculty and introduce all faculty to new pedagogy for teaching and mentoring students in SEM fields by working closely with existing programs, and implementing new initiatives;*

- *To prepare prospective SEM graduates for graduate training in SEM fields by providing assistance and tutorials for the Graduate Record Examination, senior comprehensive examinations and seminars in research methodologies and instrumentation.*

The ultimate goal of the WBHR LS-AMP program is to graduate 1600 B.S. level students per year by 2005; actively recruit and retain at least 200 community college transfer student in undergraduate degrees in SEM fields; and enroll approximately 300 SEM students per year in graduate degree programs in SEM fields.

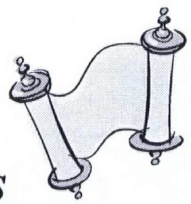


Table of Contents

WBHR-LSAMP
Research Symposium
July 17-18, 2005

PROGRAM

July 17, 2005

6:00 p.m. – 8:00 p.m.	*Poster Set-up* *Reception & Registration* *Light Snacks & Beverages*	*Student Center* *Ballroom*

July 18, 2005

7:30 a.m. – 8:30 a.m.	*Continental Breakfast*	*Theatre Lobby*
	Poster Set-up & Registration (Continued)	*Theatre Lobby*
8:30 a.m. – 9:15 a.m.	*OPENING SESSION* *Greetings:* ➢ *Dr. Harold Marioneaux, Dean School of Science* ➢ *Dr. Eric Sheppard, Dean School of Engineering and Technology* ➢ *Dr. Joyce Jarrett, Interim Provost* *Welcome and the Occasion:* ➢ *Dr. Clarence Lee, Executive Director*	*Student Ctr. Theater*
9:30 a.m. – 10:45 a.m.	*POSTER PRESENTATION*	*Student Ballroom Lobby*
10:45 a.m. – 11:00 a.m.	*BREAK*	
11:00 a.m. – 1:00 p.m.	*ORAL PRESENTATIONS* *Mathematics, Computer Science, Physics* *Biology, Chemistry, and Environmental Science* *Engineering and Technology, and Aerospace*	 *Theatre* *Ballroom A* *Student Lounge*
1:30 p.m. – 3:30 p.m.	*LUNCHEON MEETING* *Moderator-Dr. Carolyn Morgan* *Grace-Dr. Alfred McQueen* *Introduction of Speaker-Dr. Barbara Abraham* *Key Note Address-Dr. Claudia Rankins, Asst. Dean, School of Science* *Award Presentations-Dr. Edison Fowlks & Ms. Merle Byrd* *Closing Remarks- Dr. Clarence Lee/Dr. Elaine T. Eatman*	*Student Ballroom B&C*
3:30 p.m.	*Adjournment*	

Biography of Keynote Speaker

Dr. Claudia Rankins

Dr. Claudia Rankins is the Assistant Dean for Research and Student Affairs for the School of Science, and the Chair of the Department of Physics at Hampton University. She directs four summer research programs from middle school through post baccalaureate studies. During the academic year, she teaches physics and mathematics courses.

Her formal education includes military training, certification as translator and interpreter for German, French and English, a B.S. in Mathematics with a minor in Political Science, an M.S. in Statistics, an M.S. in Physics, and a Ph.D. in Physics with an emphasis in theoretical nuclear physics.

Over the past seven years, Dr. Rankins has secured almost $7 million in external grants that support pre-college activities in science and mathematics and undergraduate research -- two areas she champions.

She is the mother of one son who is pursuing his Ph.D. in Aerospace Engineering. In her spare time, Dr. Rankins enjoys sports, fast cars, and reading about science.

ORAL PRESENTATIONS

SECTION I. BIOLOGY/CHEMISTRY/ENVIROMENTAL SCIENCES

Ballroom "A", Student Center, Hampton University

Section Leaders: Dr. James Forbes and Dr. Joseph Williams
Judges: Dr. Cecile Androas-Selim and Dr. Charles Bump

BIOLOGY

1. **Gus Reporter Gene Based Spatial and Temporal Gene Expression Patterns of Receptor for Activated C Kinase1 (RACK1) Genes in Arabidopsis.**
   Student: Brittany Shaw
   Mentor: Dr. Hemayet Ullah
   Department of Biology, Howard University, Washington, DC

2. **Functional Analysis of Protein Kinase C (PKC) Isotopes in Co-Cultures of Trypanosoma lewisi Parasites Co-Cultured with Mouse Spleen Derived Fibroblast and Peritoneal Cavity Lavage Macrophage Cells, In Vitro.**
   Student: Diane R. Washington
   Mentors: Dr. Ayele Gugssa, Dr. Mohammed Ashraf, Dr. Clarence Lee
   Department of Biology, Howard University, Washington, DC

3. **The Association of Drip Tip Length on Epiphyll Abundance and Herbivory in Exterior versus Interior Plants of Pipei terrabanum.**
   Student: Thomas Hardy and Ravindra Gopaul
   Mentor: Dr. Raymond Peterson
   Department of Biology, Howard University, Washingon, DC

4. **Effects of Food Restriction and Ad Libitum Feeding on Sleep Deprivation-Associated Hypermetabolism in Rats.**
   Student: Rolicia Martin
   Mentor: Dr. Michael Koban
   Departmant of Biolgy, Morgan State University, Baltimore, MD

5. **Enzymatic Analysis of Tissues Extracted from Rats Exposed to Micro Gravity.**
   Student: Jamisa Curry
   Mentor: Dr. G.B. Oguntimein
   Department of Civil Engineering, Morgan State University, Baltimore, MD

6. **Investigation of Absorptive Capacity of Chitosan**
   Student: Olatunde Animashann
   Mentor: Dr. G. B. Oguntimein
   Department of Civil Engineering, Morgan State University, Baltimore, MD

7. **Flavonoid Profiles of Heuchera Sub-Sections Rubescentes and Elegantes.**
   Student: Gloria Johnson

Mentor: Dr. Barbara Shipes
Department of Biological Sciences, Hampton University, Hampton, VA

8. **Amplification and Purification of Plasmid DNA.**
   Student: Hamilton Allen
   Mentor: Dr. Tabmitha Jervey
   Department of Biology, Norfolk State University, Norfolk, VA

9. **Contributing Factors of Coexistence of Escherichia coli Strain 0157:H7 and Antibiotic Resistant Staphylococcus aureus Isolated from Virginia Beach Coastal Waters.**
   Students: Talia Fletcher and Ranese Freeman
   Mentor: Maureen Scott
   Department of Biology, Norfolk State University, Norfolk, VA

10. **The Effects of Growth Hormones on Glutathione Reductase (GR) Activity in Pisum sativum L., cv. Alaska.**
    Student: Adrianne Wiggins
    Mentors: Dr. Camillia Okpodu and Ms. M.T. Abdullah
    Department of Biology, Norfolk State University, Norfolk, VA

CHEMISTRY

11. **Examining Dioxin Introduced in Meat Products Using High Resolution NMR Spectroscopy.**
    Students: Sable Nelson and Healey LeCator
    Mentor: Dr. Shawn Abernathy
    Department of Chemistry, Howard University, Washington, DC.

12. **Synthesis and Evaluation of Vitamin E Conjugates.**
    Student: Jeffery Zulu, Jr.
    Mentor: Dr. Norman Kondo
    Department of Chemistry, University of District of Columbia, Washington, DC.

13. **Synthesis, Structure, and Anti-Tumor Activities of a Series of New Ionic Organotin Compounds.**
    Student: Nelly Koranteng
    Mentors: Dr. G. Eng, Dr. X. Song, and Ms. A. Zapata
    Department of Chemistry, University of District of Columbia, Washington, DC.

14. **Rare Earth Dopants in HCl and HBr Solutions.**
    Student: Natasha Ferguson, Department of Chemistry, Hampton University, Hampton, VA.

Mentor: Dr. Uwe Hommerich, Department of Physics, Hampton University, Hampton, VA.

15. **The Theoretical Study of the Magnetic Properties of Quinoidal Oligothiophenes.**
Students: LaTonya Waller and LaTrese Wilder, Department of Chemistry, Norfolk State University; Trina Fletcher, Department of Industrial Technology, University of Arkansas at Pine Bluff.
Mentor: Dr. Suley M. Black, Department of Chemistry, Norfolk State University, Norfolk, VA

16. **Theoretical studies of Random Laser in Diffusion Approximation.**
Studens: Jakub Novak, Department of Management and Information Systems; and Zenawi W. Kabato, Department of Chemistry, Norfolk State University
Mentor: Dr. Mikhail A. Noginov, Department of Physics, Norfolk State University, Norfolk, VA

17. **Synthesis of Ring Opening Metathesis Polymerization (ROMP) Monomers.**
Student: Taina D. Cleveland
Mentor: Dr. Suely M. Black
Department of Chemistry, Norfolk State University, Norfolk, VA

18. **Investigating the Impact of Technology Enhanced Learning in the Chemistry Curriculum.**
Students: Marcia Mena and Sherita Wilson
Mentor: Dr. S. R. Chaudhury, Department of Chemistry, Norfolk State University, Norfolk, VA

SECTION II. MATHEMATICS/PHYSICS/COMPUTER SCIENCES

Theatre, Student Center, Hampton University

Section Leaders: Dr. Carolyn Morgan and Dr. Bagher Tabibi
Judges: Dr. Hamidullah Farhat and Mr. Williams Watson

MATHEMATICS

1. **A Study of Watson's Triple Integrals.**
   Student: Triszan Moore
   Mentor: Dr. Asamoah Nkwanta
   Department of Mathematics, Morgan State University, Baltimore, MD

2. **A Multivariate Statistical Analysis of Crime Rates in U.S. Cities.**
   Students: Kendall Williams, Department of Mathematics, Howard University, Washington, DC; Ralph Gedeon, Miami University, Miami, FL
   Mentor: Dr. Vasant B. Waikar, Miami University, Miami, FL.
   Department of Mathematics, Howard University, Washington, DC

3. **Mathematical Modeling in Business: Time Is Money.**
   Student: Angelitta Britt
   Mentor: Dr. Jiashi Hou
   Department of Mathematics, Norfolk State University, Norfolk, VA

4. **Exact Solutions of Cubic Equations.**
   Student: Angela Sims
   Mentor: Dr. Shahrooz Moosavizadeh
   Department of Mathematics, Norfolk State University, Norfolk, VA

5. **A Numerical Stimulation of 3D Flow Near A Cone with Ribs**
   Student: Lucious A. Thomas, Applied Mathematics,
   Mentor: Dr. Arun Verma
   Department of Mathematics, Hampton University, Hampton, VA

PHYSICS

6. **Highly Porous Silica Nonoaerogels for Ultrfast Nonlinear Optical Applications.**
   Student: Ashley Jackson
   Mentor: Dr. B. Tabibi, Dr. K.P. Yoo, Dr. S.Y. Kim, Dr. S.S. Jung, Dr. M. Namkung
   Department of Physics, Hampton University, Hampton, VA

7. **Mossbauer Spectroscopy on Iron Overloaded Livers.**

Student: Andre Murdock
Mentor: Dr. Frederick Oliver
Department of Physics, Morgan State University, Baltimore, MD

8. **Development of an Active Mamosite.**
Student: Jacquelyn Nicole Winston, Department of Physics, Hampton University, Hampton, VA
Mentor: Paul Gueye, Thomas Jefferson National Laboratory, Newport News, VA, Dept. of Physics, Hampton University, Hampton, VA

COMPUTER SCIENCE

9. **Clustering Heterogeneously Distributed Data Sets.**
Student: Phillip Hayes, Jr., Department of Computer Sciences
Mentor: Dr. Eduardo A. Socolovsky, Department of Mathematics, Norfolk State University, Norfolk, VA
10. **Manufacturing With Computer Numerical Control (CNC).**
Student: Ashley Turner
Mentor: Dr. Jeenson Sheen
Department of Technology, Norfolk State University, Norfolk, VA

11. **Web Delivered Exam System**
Students: Dion John, Enolia Awofodu, Gerald Emanali, Etete Ibok, Huan Li
Mentor: Dr. LaVonne Manning
Department of Computer Sciences, University of District of Columbia, Washington , D.C.

SECTION III. ENGINEERING/ ATMOSPHERIC SCIENCES

Student Lounge, Student Center, Hampton University

Section Leader: Dr. Morris Morgan and
Judges: Dr. Ira Walker and Dr. Alphonso Smith

ENGINEERING

1. **Using Shock Wave Theory to Estimate Delay Due to School Bus Stoppage.**
   Student: Kareen Rush
   Mentors: Dr. Manoj Jha
   Department of Civil Engineering, Morgan State University, Baltimore, MD

2. **Computer-Aided Design (CAD) Software Use as Network Solver for Tunable MFMS Devices, Circuits, and Systems.**
   Student: Alioune Diallo
   Mentor: Dr. Jeyasingh Nithianandam
   Department of Electrical and Computer Engineering, Morgan State University, Baltimore, MD

3. **Design of a Pin Dio de Phase Shifter.**
   Student: Bernard Griffin
   Mentor: Dr. Corey Dickens
   Department of Electrical and Computer Engineering, Morgan State University, Baltimore, MD

4. **Design of a Voltage Follower Using a Field Effect Transistor (FET).**
   Student: Gerald Russell
   Mentor: Dr. Corey Dickens
   Department of Electrical and Computer Engineering, Morgan State University, Baltimore, MD

5. **Modeling of GaN Schokkty Diode Detector.**
   Student: Amaro Thiam
   Mentor: Dr. Corey Dickens
   School of Engineering and Technology, Morgan State University, Baltimore, MD.

6. **Implementing an Algorithm Using Complex Programmable Logic.**
   Student: Kenneth Kimari
   Mentor: Dr. Kemi Ladeji-Oasis
   Department of Electrical and Computer Engineering, Morgan State University, Baltimore, MD

7. **Synthetic Vision Systems.**
   Student: Teisha Hall
   Mentor: Dr. Craig Scott
   Department of Electrical and Computer Engineering, Morgan State University,
   Baltimore, MD.

8. **The Use of Gallium, Aluminum, and Arsenic in a Hetrojunction Transistor(HBT) Inverter.**
   Student: Wilbert Henderson
   Mentor: Dr. Corey Dickens
   Department of Electrical and Computer Engineering, Morgan State University, Baltimore, MD

9. **Effects of Microwave Radiation on Schottky Diodes.**
   Student: Cheree Armstrong
   Mentors: Dr. Sean Jones and Dr. Kyo Song
   Department of Engineering, Norfolk State University, Norfolk, VA

12. **Fabrication and Study of Colossal Magnetoresistance LSMO Thin Films.**
    Student: Maxim Noginov, Department of Engineering/Physics, Cornell University, Ithaca, NY
    Mentors: Dr. Aswini Pradhan, Center for Materials Research, Norfolk State University and Dr. Rakhim Rakhimov, Department of Chemistry, Norfolk State University, Norfolk, VA

13. **Wireless Sensor Networks.**
    Student: John Marcus Coker, Department of Engineering, George Mason University
    Mentor: Dr. Rasha Morsi, Department of Engineering, Norfolk State University, Norfolk, VA

14. **Investigation of Beam Diagnostics on Various Coherent Sources.**
    Student: Kyal Wright
    Mentors: Dr. Kyo Song and Dr. Sean Jones
    Department of Engineering, Norfolk State University, Norfolk, VA

15. **Renewable Energy: Wird –Solar Hybrid Energy System**
    Students: Steven Onoijuanfo and Daykaker, Department of Mechanical Engineering
    Menotors: Dr. Esther Osopanya, Department of Electrical Engineering and Computer Sciences, Dr. Calvin Brooks, Department of Mechancial Engineering
    University of District of Columbia, Washington D.C.

ABSTRACTS

HAMPTON UNIVERSITY

FROM ORDER TO CHAOS: CHAOS IN TOKAMAKS DUE TO TEARING MODES I

In this and the next paper, we show how tearing modes create chaos in generic tokamaks, and how we can build barriers inside the chaos in tokamaks. We have constructed a symplectic map to calculate trajectories of magnetic field lines in generic tokamaks. Poloidal flux χ is the generating function for the map, the toroidal flux y is the action, the poloidal angle q is the angle. We use the generic safety factor profile for the tokamaks. We apply the magnetic perturbations (m,n)={(3,2),(2,1)}, each with the same amplitude d. When d=0, we see invariant tori. For d from 1 X 10^{-4} to 7.5 X 10^{-4}, tori are destroyed and islands are formed. For d greater than 7.5 X 10^{-4}, islands overlap, and finally create full-scale chaos. In the next paper, we show how we can erect a barrier inside this chaos to control transport. This we do by adding a term of order d^2 to the generating function.

Students: Kyle R. Alt. Austin Lathrop High School, Fairbanks, AK. NASA SHARP, Hampton University, Joshua E. Moloney. Ames High School, Ames, IA. NASA SHARP, Hampton University, Iris A. Tavarez. Irvin High School, El Paso, TX. NASA SHARP, Hampton University, Esther O. Uduehi. Francis Joseph Reitz High School, Evansville, IN. NASA SHARP, Hampton University

Mentors: Dr. Alkesh Punjabi. Hampton University
Dr. Halima Ali. Hampton University

FROM ORDER TO CHAOS: CHAOS IN TOKAMAKS DUE TO TEARING MODES II

In the previous paper, we showed how tearing modes create chaos in tokamaks. In this paper, we show how this chaos can be controlled by erecting barriers. We have constructed a symplectic map to calculate trajectories of magnetic field lines in tokamaks. Poloidal flux χ is the generating function for the map, the toroidal flux y is the action, the poloidal angle q is the angle. We use the standard safety factor profile for the ohmically heated tokamaks. We apply the magnetic perturbations (m,n) = {(3,2),(2,1)}, each with the same amplitude d. As shown in the first paper, these perturbations lead to the creation of chaos within the tokamak for values of d above 7.5×10^{-4}. Barriers are created through the addition of a term of order δ^2 to the generating function. This term can transform chaos at the barrier location into a good magnetic surface. We show that this newly created barrier surface is impermeable to surrounding field lines and therefore can prevent chaos on one side of the barrier from crossing to the other side. This invariant torus inside the chaos can help reduce transport in tokamaks.

Students: Kyle R. Alt. Austin Lathrop High School, Fairbanks, AK. NASA SHARP, Hampton University, Joshua E. Moloney. Ames High School, Ames, IA. NASA SHARP, Hampton University, Iris A. Tavarez. Irvin High School, El Paso, TX. NASA SHARP, Hampton University, Esther O. Uduehi. Francis Joseph Reitz High School, Evansville, IN. NASA SHARP, Hampton University

Mentors: Dr. Alkesh Punjabi. Hampton University
Dr. Halima Ali. Hampton University

TEST RUNS USING A REGIONAL ATMOSPHERIC MODEL TO SIMULATE NEAR-SURFACE WEATHER VARIABLES

Regional atmospheric models are commonly used to investigate lower atmospheric processes related to weather and climate conditions at different times and geographical locations over the globe. Recent satellite technology has an important value in improving the current state of forecast skills obtained from these models. For example, the fifth-generation Pennsylvania State University-National Center for Atmospheric Research (PSU-NCAR) Mesoscale Model (MM5) used in this study neglects description of aerosols in the parameterization. This neglect of aerosol description reflects an important deficiency in the derivation of three important surface exchanges; namely incoming shortwave radiation, incoming longwave radiation, and precipitation. Thus, this deficiency also affects the ability of models to make accurate weather and climate forecast. Along with this research goal, in this study, we present the current ability of MM5 model in documenting the surface energy and heat balance at different grid scales focusing the vicinity of Virginia in mid-Atlantic region. Time series and spatial patterns of near-surface temperature and short-and long-wave energy components are illustrated for evaluation. In our future efforts, we will assimilate aerosol optical data from NASA satellites into the mesoscale atmosphere model to study the effects of aerosol on cloud microphysics, precipitation processes and the energy balance as it relates to the hydrological cycle.

Students: EMINE BAY & CRAIG HANLEY

Mentors: Dr. ISMAIL YUCEL & Dr. TOM KOVACS

ULTRASONIC DETECTION OF ADHESIVE BONDS

Adhesive bonds have many applications today. Instead of riveting, welding or screwing, all of which can cause unnecessary stresses, the materials together you can simply use an epoxy to bond the materials in question. This method of bonding is used in everything from airplane wings to the manufacturing of buildings. It is imperative that one be able to gauge whether or not the materials are bonded together correctly, a weak bond could potentially be a life-threatening situation. This is our area of research. We are using ultrasonic techniques to test for the presence and integrity of the adhesive bonds between metal-metal interfaces. We will use ultrasonic methods of detection. We have learned how to use the ultrasonic machine as well as how to read the computer program that interprets the information. Ultrasonic testing is the ideal method, as it leaves no marks, causes no damage, and can be achieved through relatively simple, inexpensive procedures. In order to complete our research we prepared a series of samples. We used Aluminum sheets that were cut down to a manageable size; approximately a 1 and ½ inch square. We then bonded each sample. We artificially introduced an outside factor to cause selected samples to not bond properly. We then used ultrasonic methods to test the various samples. We are still comparing and interpreting the data from the various samples.

Students: Jamal R. Burch. Trinity Christian School of Academics, Fayetteville, NC. NASA SHARP, Hampton University, Arturo M. Escajeda, Montwood High School, El Paso, TX. NASA SHARP, Hampton University

The Effects of Acid Rain on Aquatic Organisms

Acid rain or acid deposition is one of the most serious environmental issues that the United States faces. A very general definition of acid rain is acid falling out of the atmosphere. This occurs not only in the form of rain, but also as snow, fog, and gases or particles. Rain becomes acidic when it is mixed with pollutants that are released from automobiles, oil refineries and mills. When acid rain maintains a pH level of 5.6 or lower it has a tendency to destroy our plants, animals, and buildings. This acidic deposition affects a great variety of plants and animals. The effects or acid rain are most clearly seen in the aquatic environments.

The purpose of this two-part project is to (1) find out about the affects that pH has on the reproduction of aquatic animal life, and (2) determine if a pollutant known as acid rain would affect the cell structure of aquatic plants. It was also to determine if acid rain was the cause of our low number of aquatic animals and plants.

To complete this project, I first began to breed the brine shrimp in a neutral substance (Water). I transferred a comparative amount of shrimp into two other containers, once they had grown into full shrimp. I watched the reproduction of all three containers of brine shrimp and recorded the differences in the amount of shrimp in each of the different containers. Finally, I compared the differences that are noticed among the three different substances.

The first part of the second experiment was to examine the cell structure of spirogyra algae. I placed the algae on microscopic slides and examined two different pieces of algae. Next, I prepared a simulated acid rain solution and let the algae sit in it for a few days. I examined the algae every day to see if there were any changes in the cell structure. After some time, I used the explanations from the experiment to determine the results.

Student: Jaronica Byner

SPECTRAL ANALYSIS OF EUROPA'S SURFACE

In 1610, Galileo Galilei discovered Europa, a small moon orbiting Jupiter. Since Galileo's discovery, this moon has attracted attention from scientists and astronomers across the world. Regardless of the large amount of research already completed, there is still much to be learned about Europa.

Spectral data from a spacecraft called Galileo has shown Europa to have a water- ice surface, and possibly a liquid ocean below it. This spacecraft, named after Europa's discoverer, orbited Jupiter and its moons. With the data received most scientists believe there is a subsurface ocean on Europa. However, the thickness of the ice layer and of the ocean is unknown. This is important to know because mineral salts have been discovered on Europa. Evidence has been found to suggest these discovered salts are hydrated, or could be found in the subsurface ocean. An environment such as this could have potential to sustain life. The thickness of the ocean is an important factor concerning this potential. The purpose of this experiment is to verify the authenticity of previous scientists' work on this subject. We believe that our work will be very close to the previous results.

We have and will not begin our experiment at Hampton University. This is due to instrumental failure concerning the spectrophotometer, which is vital to producing our experimental data. Our investigation would have involved creating substances that copy the spectra of planetary material under conditions of Europa. Such conditions include temperatures that drop as low as 80K (-315°F) and various pressures. Such data would help scientists analyze spectra received from Galileo. Featured is a summary of past work on Europa. Future studies will be discussed as well.

Contributors in this project are Dr. Williams, Dr. Bump, R. Jacob, *Science Magazine*, Beckman Coulter Inc., Space, USGS Speclab.

Students: Crystal Connor. Southwest Guilford High School, Jamestown, NC. NASA SHARP, Hampton University, Noah Judson. Mount Baker High School, Everson, WA. NASA SHARP, Hampton University

Mentor: Dr. Joseph Williams, Hampton University

PIEZOELECTRIC POLYMERS

For the past six weeks, our team has been working on exploring and improving NASA's current best polymer to try to make it more effective. Our research included finding information on how to create a piezoelectric material that can be used as smart material for NASA's purposes. Smart materials are materials which are capable of changing their shape based on certain stimuli. Piezoelectric materials respond to electrical charges; when they bend they produce a charge, and when a charge is applied these materials change shape quickly.

The ultimate goal of our team's research efforts are to explore different piezoelectric polymers and find one or more that can be used by NASA. Piezoelectric polymers are currently being used by NASA in the field of aviation. NASA believes that one day they will be able to use smart materials to produce planes with "morphing wings". The significance of what we are doing is simple, it will help NASA by being more cost effective, meaning that it is cheaper to manufacture and produce while they get more out of their money. We believe that by the end of the eight-week program the research team will have discovered that the polymers we are working with are better suited for the use of NASA than their current polymer.

Each apprentice is given a different polymer to work with to find out if it has a better dipole moment and a lower heat of formation than NASA's current polymer. In order to find this information we were introduced to a molecular editor program called MOPAC. This program required J-mol or Chime plug-in to feed back output files of requested information. This type of editor made calculations much easier and faster than having to perform them manually. MOPAC is used to predict chemical and physical properties, dipole moments, heats of formation, Cartesian coordinates, and other useful data pertaining to polymers.

The polymers have been found to be relatively higher than NASA's polymer and more effective. Throughout this project we acquired organizational skills, time management skills, computer usage skills, and MOPAC usage skills.

Students: Germany M. Collier. Jacksonville Early College High School, Jacksonville, FL. NASA SHARP, Hampton University
Jonathan Jackson,. Victory Christian Center, Charlotte, NC. NASA SHARP, Hampton University, Maria Zamora. Santa Teresa High School, Sunland Park, NM. NASA SHARP, Hampton University

Mentor: Dr. Charles M. Bump, Hampton University

Rare Earth Dopants in HCl and HBr Solutions

Potassium Lead halide crystals synthesized in the Crystal Physics Laboratory were doped with rare earth lanthanides to enhance the crystal's optical properties. In order to deduce the concentration of the rare earth dopant within the crystal, comparison samples of different Dysprosium(Dy) samples of different concentration were utilized in order to generate unique Dy peaks in regards to transmission and absorption. These peaks would be compared to a sample of the dissolved crystal in hopes of a match. The final analysis of the crystal, at the time of this presentation, did not show unique Dy peaks due to time restraints and the concentration of the crystal.

Student: Natasha Ferguson, Sophomore Chemistry Major, Hampton University

Mentor: Advisor: Dr. Uwe Hommerich,Department of Physics, Hampton University

MONO-ENERGETIC BRACHYTHERAPY SOURCES

Brachytherapy is a method of cancer treatment in which a radioactive source is placed in a catheter and introduced into the body directly adjacent to a tumor. The idea is that the radiation emitted from the source will kill the cancer cells while trying to spare healthy ones, as cancer cells are incapable of repairing themselves. Current knowledge ignores the adequacy of high and low energy beta radiation utilized in alienation during the treatment of cancer. Let us postulate the problem in basic terms, if only one type of energy is effective in eradicating cancer cells, the other is only damaging healthy tissue and possibly causing more incidents of cancer. The aim behind the experiment is to send electrons through a magnetic field, bending their paths. Low- energy electron trajectories will bend at a smaller angle than high-energy electron paths, separating the two. Our part in the experiment is to build a radiation detector capable of defining the number of incidents in a particular location, thus allowing for the corroboration of the location where the cancer cells will be placed. This will allow the team to determine how much energy the cancer cells are exposed to, consequently determining which ones are exposed to low energy electrons or high energy electrons. Future research will depend on the outcome of the current experiment.

Students: Alfredo Hinojosa, Jr. Zapata High School, Zapata, TX. NASA SHARP, Hampton University, Raziel Melchor, Montwood High School, El Paso, TX. NASA SHARP, Hampton University

Mentor: Dr. Paul Gueye, Hampton University

FLAVONOID PROFILES OF *Heuchera* SUB-SECTIONS RUBESCENTES AND ELEGANTES

Flavonoids are ubiquitous in plants and have been studied intensively since the early 1960's. They are the products of secondary metabolism, may be regarded as biochemical markers and play an ecological role. Research has shown that flavonoid profiles are species specific. This research examines the specificity of flavonoid profiles in ten *Heuchera* species from Sub-sections Rubescentes or Elegantes in five different states. Four questions are addressed: How does the Sub-sectional flavonoid chemistry correspond with the taxa under consideration? Do correlations exist between flavonoid profiles and various morphological features? Might flavonoid profiles assist the taxonomic revision of these plants? What is the degree of flavonoid variation present in sympatric and allopatric populations? Results indicate a tighter correlation of species in Sub-section Elegantes than in Rubescentes; flavonoid profiles do correlate with morphological identification of five of the taxa under consideration; flavonoid profiles appear to assist the taxonomic revision of two taxa and variable correlations exist among sympatric and allopatric populations.

Student: Gloria Ann Johnson

Mentor: Barbara Shipes, Ph.D.

Redesign, Re-Engineering, and Reverse Engineering in Manufacturing Legacy Parts

Reverse engineering is the contrary of the traditional forward engineering in which a physical system is erected from an existing design or another form of engineering data. With the aid of a design, the physical system can be reproduced or improved upon. However, in reverse engineering, the physical system is duplicated without the aid of original engineering data, such as drawings, documentations, or a computer model. It involves finding out how the product works and utilizing the technology used to develop the original design. This type of engineering is necessary when there is insufficient documentation for the product or if the original manufacturer no longer exist. In order to reproduce the existing product, data of the product itself must be reproduced. Often drawing of the design is accomplished by computer-aided drafting (CAD) software. The CAD drawings can then be used by CNC machines, which produces the prototype for further testing and then for actual production and manufacturing. Currently, I am using Auto-CAD software to generate drafts for a given sample part.

Another aspect of engineering design is to perform analysis for improvement of the parameters involved in the design. There are programs that can provide numerical calculations such as thermal and structural analysis in the engineering design. Identifying key material properties and how these factors affect the overall performance in strenuous conditions are some of the essential steps of the redesigning process. These programs can evaluate solutions of various parameters effectively and efficiently. Such factors determine the optimum performance and durability of the engineering products. Our ultimate goal is to utilize an efficient and advanced program called "ANSYS" for the numerical analysis and modeling purposes. Utilization of this software can combine the requirements to determine the physical appearance and also the mechanical performance factors of the part. By simulating different parameters of redesigned products using software instead of constantly producing physical prototypes, the most efficient design can be determined. This would substantially save manufacturing costs, and delivers the superior engineering products in a more timely fashion.

Student: Terrell Johnson

Mentor: Dr. Amir Hoshang Chegini Department of Chemical Engineering
School of Engineering and Technology, Hampton University, Hampton, VA

A New AIDS Strain; More Cause for Concern

AIDS is a rapidly spreading sexually transmitted disease that is devastating people all over the world. There are many theories on why, how, and by what means the virus spreads however, not many concrete answers have been generated. The main reason for the continued mystery of the HIV virus is due to the rapidly changing nature of the strains. During the course of this project we propose to uncover the similarities and differences of the old and new strain of the virus. We will research why and how the new strains have evolved, where the initial documented case was located, and whether this location provided optimal situations for the virus to evolve into the new strain we see today.

Student: Regina Buki Kalejaiye

EVALUATING THE HYDRO-ESTIMATOR SATELLITE RAINFALL ALGORITHM OVER A MOUNTAINOUS REGION

This research focuses on the performance and accuracy of the Hydro-Estimator (HE) rainfall algorithm, which is a part of NOAA/NESDIS. The portrayal of timing, intensity, and duration of convective rainfall is extremely important over complex regions, particularly mountainous ones, as natural disasters, such as flash floods, can occur quickly. Hence, a precise satellite reading over an area is essential. However, due to a lack of observation networks in mountainous regions, much of the information gathered from satellites over complex regions has been inaccurate. To correct this problem, a new rainfall observation network has been placed in northwest Mexico established as a facet of the North American Monsoon Experiment (NAME). This new observation network provides gage-based precipitation measurements with higher resolution to further evaluate the climate of northwest Mexico. In regards to this research, rainfall measurements from point observations obtained from 86 rain gages are compared to rainfall estimates from the HE from 1 July to 15 September 2003 and 13 August to 16 September 2004. From previous experiments in 2002, the HE tended to overestimate rainfall in lower elevations and underestimate in higher elevations as terrain-induced convective currents change and complicate the pattern of convective rainfall. As of now, analyzing the recent data is underway to generate figures. Based on the outcomes, the HE algorithm can be modified to more precise and accurate estimates of rainfall over the northwest Mexican mountains.

Students: Aaron Juarez. Socorro High School, El Paso, TX. NASA SHARP, Hampton University

Mentor: Dr. Ismail Yucel, Hampton University

Detection of Fatigue Cracks in Aluminum Sheets by the Measurement of Electrical Resistivity

Riveted joints on aluminum sheets are widely used in several structures. Sheets under rivets are subjected to fatigue stresses in structures like aircrafts. Periodic evaluation of such cracks at the initiation of cracks is very important to avoid catastrophic failure. Present work aims at using electrical resistively measurements to detect and evaluate fatigue cracks underneath rivets. The measurements are carried out without the need for the removal of rivets. A dedicated probe suitable for the measurement in riveted region is used in combination with a low-noise instrumentation to acquire data. The research effort evaluates the effectiveness and limitations of the technique in detecting fine cracks.

Student: Matthew Myers, Department of Electrical Engineering School of Engineering

Mentor: Dr. Vadivel Jagasivamani, School of Engineering and Technology

Zoology

In this project, we investigated to what extent asthma and chronic bronchitis are two different lung diseases in the respiratory system of the human body. Asthma is a chronic inflammatory lung disease characterized by spasms or constriction of the bronchial tubes, and a secretion of thick mucus activated by irritants. Bronchitis is defined as an inflammation of the airways accompanied by coughing and spitting up of phlegm. Asthma is a chronic condition that affects the lungs whereas bronchitis is the presence of mucus producing cough. Although these two lung diseases emerge differently, pollutants in the atmosphere trigger both diseases. Both diseases can be treated with anti-flammatories/corticosteroids, bronchodilators or rescue medications. After experimentation and further research we came to the conclusion that both diseases are equally detrimental to the human respiratory system.

Students: Jazmine Overton & Mirriam Kimani

Mentor: Mr. Michael Druitt

CORRELATION OF GROUND AND SATELLITE AEROSOL MEASUREMENTS

Understanding the effects of aerosols is important in understanding the changes in the earth's climate. The CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation) satellite will launch this September and provide valuable data on clouds and aerosols. The objective of this research project is to assess the use of Aeronet sunphotometer data to validate the initial measurements that will be received from CALIPSO by using the MODIS instrument on a satellite already in orbit. Data recorded and posted on the Aeronet (AErosol RObotic NETwork) and the MODIS (MODerate resolution Imaging Spectroradiometer) websites were downloaded and compared.

The Aeronet data is taken from sunphotometers that are located on the ground at sites all over the world, while the MODIS data are taken from instruments located on the Terra satellite that is orbiting the earth. The variable that is being compared from these two sources will be the AOD (aerosol optical depth) and the distance between the MODIS and Aeronet measurements. Each Aeronet site takes measurements at certain time intervals, but from the same physical location, while MODIS takes measurements constantly, but from varying locations as the satellite moves in orbit. AOD from these two sources are compared for various separation distances. The distance that MODIS and Aeronet observations are no longer correlated is assessed. This project concentrated on one area, specifically the Aeronet site, COVE, located off the coast of Virginia.

Students: Brooke Pollock, East Anchorage High School, Anchorage, AK. NASA SHARP, Hampton University

Mentor: Dr. Tom Kovacs, Hampton University

Ultrasonic Methods of Testing Disbonds

Ultrasonic pulse echo method of testing materials has been used for evaluating the integrity of structural components. Detection of the adhesive bond integrity is one of the major concerns in several industries such as the Aviation industry. The skin of every aircraft is being tested for soundness of bonding periodically to avoid catastrophic failure. The testing procedure is very laborious and consumes a lot of time to perform. Aluminum bonded samples of aluminum were prepared with different degrees of bonding. The samples were tested using pulse-echo method to identify poor bonds. Amplitudes of reflections from the bond interface, time-of-flight in the sample, and attenuation of sound waves in the material were experimentally measured. In the current work better methods of identifying disbonds using the measured data have been evolved and reported.

Student: Allister Primo, Senior Student, Department of Electrical Engineering School of Engineering and Technology

Mentor: Dr. Vadivel Jagasivamani, School of Engineering & Technology

Researchers Discover Insect Breathing Mechanism

Insects make up ninety-five percent of the animal species on the earth. The largest orders of insects are the beetles (Coleoptera), having 125 different families and approxiamately 500,000 different species.

Insects have three main part body parts – head, thorax, and abdomen. The head is primarily used for eating, sensing things, and gathering information. Insect mouthparts have evolved for chewing, piercing-sucking, sponging, sucking, rasping-sucking, cutting sponging, and chewing-lapping.

All insects have two antennae that they use to sense the world around them. Insects use their antennae to feel, smell, as well as taste. The thorax protects the body and gives support for the three pairs of jointed legs and, one or two pairs of wings on some insects. The legs may be adapted for running, grasping, digging, or swimming.

The abdomen contains the organs used for digestion and reproduction. The inside of an insects body has an open circulatory system allowing body fluids to flow freely around inside the exoskeleton, it has many breathing tubes. Air enters the insect through openings in the exoskeleton known as spiracles. Through the process of breathing oxygen moves throughout every part of the insects body. Insects don't have lungs; instead they equipped with an internal system of tracheae tubes that exchange oxygen through slow passive mechanisms one of which is diffusion.

Students: Ebone Satterwhite

Golden Webbed Spider

For my research project I have chosen to put my focus around the spider. I am hoping that I have enough courage to sit through and look at all the pictures that I will have to see of them. My focus will be drawn toward the Golden Webbed spider, nephila calavipes. I have wondered often when prey is caught in the web, which gender is dominant when it comes to handling the prey but just haven't had the chance to do research on this topic Golden web spiders can be found in areas of open space, on forest trail edges, and in areas of high humidity. Golden Web Spiders have interesting behavioral strategies, but little is known about whether or not males use the solitary web of females for prey. When males are juveniles, they capture prey on their own webs. As they reach adulthood, they migrate to the webs of females in order to mate. The mating behavior of Nephila clavipes is considered to be sexually dimorphic. The female has an average size of about one to two inches long. The male is normally half of the size of its female companion, but can be found as small as one centimeter in length. Adult females are comprised of an elongated abdomen, usually yellow in color, and hairy legs that alternate between black and yellow. Males have been found to have more of a dark brown color. Males do not inhibit the webs of females until they reach maturity. Males locate themselves in the hub of the web, near the top, and about 5cm above the females. Roughly 4 days before females are ready to complete their final molting process, they cease prey capturing and web reparations. They are sexually available and receptive for approximately 48 hours. Though predation of males is not common with Nephila.

Student: Lovelee Smith

Mentor: Mr. Michael Druitt

Searching for a Gene on Chromosome 4q32-34 that is Responsible for Familial Pancreatic Cancer in Family X

All forms of cancer, including pancreatic cancer, have genetic roots because altered genes elicit the growth of abnormal cells. Pancreatic cancer is the fifth leading cause of death in the United States. The majority of the people diagnosed with this particular cancer die within six months of the diagnosis because there is no early detection method. Although pancreatic cancer arises sporadically in most individuals, this research strictly focuses on the inherited forms. The purpose of the current research is to discover a gene, located on chromosome 4q32-34 (a region composed of 10 million base pairs containing at least 60 genes) that is responsible for familiar/inherited pancreatic cancer, specifically in family X. This knowledge will hopefully improve the early detection of cancer by allowing us to distinguish abnormal pancreatic cells before they reach fatal, cancerous stages and by enabling us to apply the acquired information to sporadic forms of pancreatic cancer.

Students: Caresse A. Spencer, Teresa A. Brentnall, M.D. David Crispin, Kara White
Temple University Minority Access to Research Careers/Physician Scientist Training Program, Philadelphia PA 19140, USA and Hampton University, Hampton VA 23668, Department of Pathology, Division of Gastroenterology, University of Washington, Seattle, WA, 98195, USA

A Numerical Simulation of 3D Flow Near A Cone With Ribs

The purpose of this research was to study the internal flow behavior of a wedge-shaped nozzle. The results are vital to improving aero-performance, i.e. reducing drag, and increasing thrust benefits. The background related to this compressible flow problem is discussed and conservation equations for continuity, momentum, enthalpy, and entropy are presented for several coordinate geometries. These equations, along with appropriate state equations and boundary and initial conditions, are solved numerically using VULCAN, a Fortran-based computational software package. A brief discussion of the numerical simulations for three coordinate geometries: two-dimensional, axi-symmetric and three-dimensional nozzle configurations are presented. Lastly, the results are summarized and suggestions for future research are highlighted.

Student: Mr. Lucious A. Thomas,Graduate Student, Applied Mathematics Department, Hampton University, Hampton, VA

Mentor: Dr. Arun Verma, Department of Mathematics, Hampton University, Hampton VA

DYNAMIC RELATION OF THE MAGNETOSPHERE'S PLASMA SHEET AND AURORAS

The objective of this research project is to investigate the plasma sheet of the magnetosphere and connect its activities with the occurrences of auroral substorms in the earth's atmosphere. Through intense study of the plasma sheet's proton and magnetic field pressures, a correlation of electrical and magnetic activities within and around the plasma sheet to atmospheric substorms which cause auroral displays is made. The Cluster-3 satellite which travels through the plasma sheet in a polar orbit provides crucial information on proton velocity, temperature, and density and also thickness of the sheet at a given time. This satellite also gives magnetic field readings of the sheet of which a stable sheet based on the Harris Sheet Model would give a clearly defined transition from positive to negative. Conversely an unstable sheet would give a wobbly reading switching between positive and negative multiple times. Possibly an unstable reading of the magnetic field and a thinner plasma sheet constitutes much activity in the auroral ring. Using ultra-violet image databases from University of California-Berkeley and University of Iowa of the aurora from a satellite position in space, times at which the aurora was active can be recorded and correlated to data from the Cluster-3 satellite of the plasma sheet. Making connections between the thickness of the plasma sheet and complexity of surrounding magnetic field and auroral substorms will help to better understand the geophysical phenomena of auroras.

Student: Jaron Wilson. Greensboro Day School, Greensboro, NC. NASA SHARP, Hampton University

Mentor: Dr. Bill Paterson, Hampton University & Dr. William R. Paterson

DEVELOPMENT OF AN ACTIVE MAMMOSITE*

Brachytherapy is a type of treatment for cancer. Brachytherapy refers to the technique of implanting radioactive sources directly into a specific part of the body. This research involves modifying the Mammosite, which is a breast brachytherapy instrument, and makes it into a sensitive detector with the use of scintillating fibers. If successful, this will allow for dose accuracy within 2% and position accuracy within 1mm. Currently, there is no way to measure the actual dose delivered to the patient or detect the position of the radioactive seed once the Mammosite has been placed in the breast.

Students: Jacquelyn Nicole Winston & Paul Gueye, Physics Division, Thomas Jefferson National Laboratory, 12000 Jefferson Avenue, Newport News, VA 23606

HOWARD UNIVERSITY

A Multivariate Statistical Analysis of Crime Rates in U.S. Cities

We classify a city as safe or unsafe by using multivariate methods of Principal Components Analysis, Factor Analysis, and Discriminant Analysis. In addition, we discover which variables have salience in the identification of a city being safe or dangerous. The afore mentioned analytical techniques can assist governments in finding out what variables they need to change to improve their city and make it a better place to live.

Students: Ralph Gedeon & Kendall Williams

Mentor: Vasant B. Waikar

The Association of Drip Tip length on Epiphyll Abundance and Herbivory in Exterior versus Interior Plants of Piper terrabanum.

In this study, we addressed epiphyll abundance and herbivory between interior and exterior habitats on the understory dweller, Piper terrabanum. The study also focused on the relationship between drip tip length and epiphyll abundance. There was no significant difference in the abundance of epiphylls or amount of herbivory on P. terrabanum on the interior versus exterior regions of the forest. There was also no relationship found between drip tip length and epiphyll abundance. Results suggest that the length of drip tips and the region of plant inhabitance do not affect the abundance of epiphyll colonization or herbivory.

Students: Thomas Hardy & Ravindra Gopaul

Mentor: Dr. Raymond Peterson

Examining Dioxin Introduced in Meat Products Using High Resolution NMR Spectroscopy

Polychlorinated dibenzo-p-dioxins or dioxins are a category of toxic halogenated aromatic hydrocarbons inadvertently introduced into the environment. Dioxins are unwanted contaminants typically formed by the incineration of coal, waste, wood, and other fuel sources as well as the burning of polyvinyl chloride (PVC) piping. These toxins are emitted into the atmosphere as exhaust particles and deposited onto soil and grass. From here, dioxins are eventually introduced into our beef supply from grazing cattle and it accumulates in the fatty tissue of these animals. The intent of this research is to deposit minute quantities of dioxin, in the laboratory, into store purchased meat(s) via the combustion of PVC piping and identify it using a state-of-the-art 400 MHz NMR spectrometer. The meat will be extracted using cyclohexane in which fatty acids are soluble. ^{1}H-NMR spectra of the extracts will be acquired to determine whether dioxin(s) has been absorbed into the meat. Resonance peaks residing in the region from 7.00 to 7.40 ppm's will verify the present of dioxin in the meat product. The dioxin 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) serves as reference material in this work.

Student: Sable K. Nelson and Healey LeCator, Department of Chemistry, Howard University

Mentor: Dr. Shawn M. Abernathy, Department of Chemistry, Howard University

Gus Reporter Gene Based Spatial and Temporal Gene Expression Patterns of Receptor for Activated C Kinase1 (RACK1) Genes in *Arabidopsis*

Arabidopsis is a genetic model for multicellular eukaryotes, including metazoans and is a reference plant for crops. The *Arabidopsis* genome has been sequenced. It is relatively small, the plant is amenable to genetic manipulation, and a large number of mutants are available for characterization. *RACK1* in metazoan plays a major role in coordinating different signal transduction pathways ranging from cell division to ion channel regulation by acting as a scaffold protein. The *Arabidopsis* genome has three distinct *RACK1* genes (*RACK 1A*, *RACK 1B*, and *RACK1C*). A gene promoter: GUS reporter technique was used to determine the spatial and temporal expression patterns of these three genes. Compared to *RACK1B* and *RACK1C*, *RACK1A* showed a more restricted expression that was confined to the root region throughout the developmental stages. Both *RACK1B* and *RACK1C* showed ubiquitous expression within both roots and shoots. Treatment with different growth hormones, or abiotic stresses did not alter the expression pattern significantly. Concomitant expression of all three *RACK1s* in roots and *RACK1B* and *RACK1C* in other vegetative tissues indicate that the genes may posses overlapping functions in some tissues yet maintain distinctive functions in other tissues.

Student: Brittany Shaw, Department of Biology, Howard University

Mentor: Hemayet Ullah, Ph.D.

Functional analysis of protein kinase C (PKC) isotypes in co-cultures of *Trypanosoma lewisi* parasites co cultured with mouse spleen derived fibroblast and peritoneal cavity lavage macrophage cells in vitro.

Protozoan parasites express multiple isotypes of Protein Kinase C (PKC) and it is well accepted that PKCs have an important role as a second messenger transducing diverse signals regarding cell proliferation, activation of cellular function and differentiation; but little is known about the function of PKC in the association of *T. lewisi* with fibroblasts and peritoneal cavity lavage macrophages. The western blot analysis has identified different isotypes of PKC in the parasites by. At present, we are studying the role of Protein Kinase C (PKC) and the relocalization of PKC in the association of parasites with the adherent cells. Macrophages were also activated using Lipopolysaccharide to demonstrate that activated macrophages inhibit the association and proliferation of the parasites *in vitro*. The western blot analysis of the activated macrophages conditioned the media to contain cytokines, mainly Gamma Interferon, Interlukin-6 and Interlukin-10. The parasites in the activated macrophages were shown to have a programmed cell death which was further demonstrated by the presence of caspace 3 and caspace 8 by DNA fragmentation assay using gel electrophoresis and western blot, respectively. We are characterizing the effects of parasite infection on PKC activation and activation-induced translocation of protein kinase C (PKC) isoforms in fibroblast cells as well as the parasites. Selective inhibition and activation of different isotypes of PKCs will further demonstrate the specific role of the isotypes.

Student: Diane R. Washington, Department of Biology, Howard University

Mentors: Ayele Gugssa, Ph.D., Mohammed Ashraf, Ph.D., Clarence M. Lee, Ph.D.

MORGAN STATE UNIVERSITY

Investigation of the adsorptive capacity of Chitosan

Chitosan is derived from Chitin, which is the exoskeleton of a crab or shrimp shell and some other crustaceans. Chitin, in time past caused environmental pollution when dumped on land fields as waste materials from the crab industry. In Maryland for example where the crab industry is large, this presents a potential environmental problem. Chitosan has also been known to be useful in chelating metal ions from waste streams in detoxifying chemical wastes. Chitosan possesses a property of dissolving in an acidic medium and precipitating when in a basic medium. This project explores this characteristic behavior of chitosan in the removal of dye from solution as a model for potential application in textile industry wastewater treatment. The effect of particle size of chitosan was studied. . The relationship between q =(Co-Ce)/M the ratio of dye adsorbed to the mass of chitosan to the equilibrium concentration Ce was investigated for the different particle size revealed that the Chitosan did not follow any of the three adsorption models (Linear, Langmuir and Freundlich) studied as most of the plots had correlation coefficients less than 0.5.

Student: Olatunde Animashaun

Mentor: Dr. Gbekeloluwa B. Oguntimein, Civil Engineering Department, Morgan State University, Baltimore, Maryland 21251.

Enzymatic Analysis of Tissues Extracted from Rats Exposed to Micro gravity.

Space travel is a subject area of interest that deserves a lot of attention. Studies have shown that long-term exposure to microgravity conditions affect body organs such as the heart, brain, and muscles. Research reports from NASA Ames Research Center show that microgravity exposure in mice results in a significant decrease in muscle oxidative capacity and other reports in literature have concluded that increased activity of catalase (CAT) and (SOD) appear in rats after exercise training. Other researchers also found that exercise training prior to simulated weightlessness, and dobutamine administration during simulation, helped prevent large decreases in skeletal muscle antioxidant and oxidative enzyme levels. In this project the specific activities of catalase (CAT) and superoxide dismutase (SOD), extracted from tissues (liver, diaphragm and soleus muscle) of rats that have been exposed to simulated microgravity condition and control were studied. . The enzymes were extracted from the tissues with two different buffer PBS and Tris/HCl. Preliminary results of the specific activities of CAT and SOD show a change after they are compared to the control. The SOD specific activities in all the tissues (diaphragm, liver, soleus) extracted in PBS buffer were lower for the experimental tissue compared to the control. SOD specific activities extracted in Tris/HCL buffer from the diaphragm and soleus were also slightly lower compared to the control CAT specific activities extracted from the diaphragm with PBS buffer was higher compared to the control. CAT specific activities extracted with PBS buffer from both the liver and soleus were lower in the experimental compared to the control. CAT specific activity in the diaphragm extracted with Tris/HCl buffer slightly lower than that of control while the CAT specific activity in the soleus showed a large difference compared to the control.

Student: Jamisa Curry

Mentor: Dr. G.B. Oguntimein, Department of Civil Engineering, Morgan State University, Baltimore, Maryland 21251

Computer-Aided Design (CAD) Software Use as Network Solver for Tunable MEMS Devices, Circuits, and Systems.

During the past few years, it has become apparent that MEMS and micromachining can be used to enhance devices and circuits which results in significant advantages when compared to conventional ICs. Today's customers are demanding smaller, lighter products with more features. As a result, manufacturers are being forced to come up with technological breakthroughs in order to satisfy this demand. MEMS are a combination of mechanical and electrical features in a very small package. They can be used where traditional mechanical structures would be too bulky. The development of capacitive membrane switches has enabled exciting innovation in phase shifters. In this research paper, we are using APLAC software as a network solver for MEMS devices, circuits and systems. Multiple MEMS devices, as well as the circuit that are needed to implement a tunable MEMS comb drive are connected and investigated. These circuits with MEMS components have a significant impact on electronic systems.

Student: Alioune Diallo

Mentor: Dr. Jeyasingh Nithianandam, Department of Electrical and Computer Engineering, Morgan State University, Baltimore, Maryland 21251

Design of a Pin Diode Phase Shifter

When designing a phase shifter there are two main concerns namely noise and having too much power. The goal of this project is to produce a pin diode with a low turn on voltage, high breakdown voltage, and low insertion loss. Using a pin diode to design the phase shifter the noise due to region I was reduced. In the design of the pin diode InGaAs was used for the P region and INP for the n region. Pin diode fabricated using InGaAs on InP offer lower turn-on voltage, high electron mobility, and compatibility with InP based high frequency electronics. I model physical device simulator Silvaco/ Atlas to model an InGaAs based PIN diode. Forward and reverse biased I-V curves will be simulated and analyzed with devices parameters to produce an empirical circuit. The empirical circuit will be used to design a phase shifter that will be simulated using the circuit simulator ADS. In this research comparing a PIN diode with an empirical circuit and exploring the effect of the two circuits compared to each other performed experiments. The PIN diode with an empirical circuit were duplicated and the empirical circuit and the circuits containing the actual PIN diode were used to evaluate the data. Evaluation of the data will show the advantages and disadvantages of the two similar circuits.

Student: Bernard Griffin

Mentor: Dr. Corey Dickens, Department Electrical and Computer Engineering, Morgan State University Baltimore, Maryland 21251

Synthetic Vision Systems

The need for improved safety in air traffic has increased because the Flight Safety Foundation has predicted that air traffic is expected to double over the next decade. NASA's Aviation Safety Program has proposed to develop a Synthetic Vision System that will provide pilots with improved situational awareness. A synthetic vision system is a database derived system which utilizes precise Global Positioning System navigation and integrity-monitoring sensors to provide an unrestricted synthetic view of the aircrafts current external environment. With the aid of a SVS pilots will be equipped with an unobstructed view of terrain regardless of weather and, or time of day which will enhance situational awareness. The SVS will eventually be used in military, commercial and general aviation aircrafts. The Project hopes to help NASA drastically reduce the number of Aviation accidents caused by Controlled Flight into Terrain (CFT, when the Pilot miscalculates his position and has an accident) and low visibility, thereby reducing the stress on the pilot and increasing his/her performance. The stored geo-spatial data is available in the form of DEM (Digital Elevation Model) files, which must be rendered in order for them to be readable by a pilot. The output after rendering is a mathematical approximation of the actual terrain. Current SVS uses a polygonal rendering method that is not efficient at producing a precise image. This project will explore the point cloud rendering technique using OpenGL software, at the present time no other SVS has incorporated this rendering technique. OpenGL is a software interface to graphics hardware. This interface consists of about 120 distinct commands, which you use to specify the objects and operations needed to produce interactive three-dimensional applications. This method of rendering has produced more precise 3-dimensional images, but is just as fast as the other options available.

Student: Teisha Hall
Mentor: Dr. Craig Scott, Department of Electrical and Computer Engineering
Morgan State University, Baltimore Maryland 21251

The Use of Gallium, Aluminum and Arsenic in a Hetrojunction Transistor (HBT) inverter

Using the device simulator Silvico/Atlas, a physical model of a Gallium, Aluminum and Arsenic (GaAlAs) hetrojuction transistor (HBT) will be simulated.. From the physical model, I-V data and transfer curves will be produced. Based on the I-V data and the physical parameters of the device, a small signal equivalent model will be created. Next the small model will be used to create an inverter. The inverter will be simulated in a circuit simulator.

Student: Wilbert Henderson
Mentor: Dr. Corey Dickens, Department of Electrical and Computer Engineering
Morgan State University, Baltimore, Maryland 21251

Implementing an Algorithm using Complex Programmable Logic

A complex programmable logic device (CPLD) is a type of an integrated circuit that provides the ability to customize programs and reprogram the component function. This research entails implementing algorithms using complex programmable logic devices. The CPLD used in the research is the on the University Program 2 Educational Development Board. A hardware design language, very high speed integrated circuit hardware description language (VHDL), is used. This language allows for implementation of algorithms by writing commands and compiling the commands to detect any errors before downloading on the development board. The advantage of using this language is that it easily facilitates the implementation of complex algorithms and troubleshooting for errors is easy. The problem addressed by the research is implementing algorithms that do not run in real-time in software. The CPLDs help to achieve the real-time running of the algorithms. In this research I calculated the length and width of shadows collected by a weather radar. My task involved characterizing the number of adjacent shadows in an array. When the weather radar first hits the terrain the readings collected are either 1 or 2 depending on how strong the reflected signal is and just before it hits a terrain the reading is -3. When it reads 0 this signifies a shadow. The shadow length and width is determined from an algorithm that I will implement using VHDL.

Student: Kenneth Kimari

Mentor: Dr. Kemi Ladeji-Oasis, Department of Electrical and Computer Engineering, Morgan State University, Baltimore, Maryland 21251

Effects of food restriction and ad libitum feeding on sleep deprivation-associated hypermetabolism in rats.

In previously conducted research, it has been determined that sleep deprivation produces severe physiological and psychological damage over an extended period of time. Hyperphagia is found to be an after effect of sleep deprivation and death is imminent. Many studies have been conducted over the years, from sleep deprivation as a cause of physiological damage to it being a type of stress. Ultimately, sleep deprivation has been found to increase the metabolic rate and the food consumption of the rat, as it was determined by Rechtschaffen et al. (1989). A variation of the study by Rechtschaffen et al. (1989) introducing a new element—food restriction is the subject of this study. Two experiments were conducted simultaneously. Experimental rats used in this research are either sleep-deprived and food-restricted or sleep-deprived and ad libitum fed. Both experiment and control rats were placed in the same apparatus to conduct the experiment, but control rats were able to live in cages, whereas the experiment rats were placed in Plexiglas tanks for the duration of sleep deprivation. Rats were weighted daily. Results from the sleep deprivation experiments are yet to be determined.

Student: Rolicia Martin

Mentor: Dr. Michael Koban, Laboratory of Physiology, Department of Biology, Morgan State University, Baltimore, Maryland 21251

A Study of Watson's Triple Integrals

Van Peype (1938) did a study on ferromagnetic anisotropy. In this study, he introduced three triple integrals. Fowler (1938) presented the problem of evaluating these integrals and for some time no one could solve them. Watson (1939) was able to solve the integrals for three different values. These integrals have gone on to be called Watson's Triple Integrals. Watson's Triple Integrals have been used in the study of body centered, face centered and simple cubic lattices which directly links to random walks. In this project, Watson's Triple Integrals is being studied. To establish a foundation to study these integrals, we are studying important properties and applications of triple integrals in general. The integrity of the Watson's Triple Integrals with various computer algebra systems such as Maple, Mathematica, and MATLAB is surveyed and derived. Our long term goal is to show how these integrals connect to random walks.

Student: Triszan Moore

Mentor: Dr. Asamoah Nkwanta, Department of Mathematics, Morgan State University, Baltimore, Maryland 21251

Mössbauer Spectroscopy on Iron Overloaded Livers

This work presents the results of the application of Mössbauer spectroscopy (Nuclear Gamma Resonance Spectroscopy) of iron containing species in biological iron proteins that play a very important role in biomedical research. These studies demonstrate the wide possibilities of Mössbauer spectroscopy to obtain electronic and magnetic information about normal and pathological biomolecules. The results obtained may be useful for further understanding of the molecular nature of diseases and pathological processes. Within this research, analysis of various samples of rat liver tissue will be preformed; regular liver, iron overloaded liver, and diabetic liver. The Mössbauer experimentation is preformed at room temperatures. During the analysis attention will be towards changes in the isomer shift and the quadrupole slitting. The results will be documented and our conclusion shall be based on differences or similarities in normal and abnormal livers.

Student: Andre Murdock

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Engineering
Using Shock Wave Theory to Estimate Delay Due to School Bus Stoppage

School buses are significant contributors to travel time delay on arterial streets. Currently, the Highway Capacity Manual does not provide any guidance on travel time delay due to school buses on arterial streets. Traffic on both approaches is required to stop whenever a school bus stops. This causes queues to quickly grow, especially during morning rush hours in urban areas. In this research we will develop shock waves to measure queue growth and the travel time delay due to school buses. The shock wave theory is typically applied to understand traffic flow phenomena on freeways whenever there is an abrupt lane blockage due to accidents. The shock waves generated due to school bus stoppage will be different than that along freeways due to different traffic flow properties. We will develop an approach to examine all shock waves generated due to school bus stoppage along two-lane and multilane highways.

Student: Kareen Rush

Mentor: Dr. Manoj Jha, Department of Civil Engineering, Morgan State University, Baltimore Maryland 21251

Design of a Voltage Follower Using a Field Effect Transistor (FET)

A voltage follower is designed consisting of three parts. The first component is the physical device modeling of a FET using the device simulator Atlas/Silvaco. The semiconductor being used is a base of SiC doped p-type. On top of these materials is a layer of undoped AIN followed by a thin layer of GaN. He second and third layers of semiconductors act as an insulator. The fourth layer of the device is GaN doped n-type. The top layer is of the material $Al_{.2}Ga_{.8}N$. The source and drain component of the transistor is made of a mixture of Ti and Al. The gate components of the voltage follower are Ni and Au. The second is the extraction of passive device components to create an empirical model. The empirical model equations can be applied to predict the behavior of the semiconductor. The last component is to use a circuit simulator to design a voltage follower using FET empirical model which confirms the characteristic from the mathematical equations.

Student: Gerald Russell

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Modeling of GaN Schokkty Diode Detector

Due to environmental changes such as the "green house effect", the concern for ultraviolet (UV) radiation transmission through the Earth's ozone layer is increasing. GaN schottky technology is highly promising for efficient UV detection that can be used to determine UV skin exposure and dose. GaN is a semiconductor that can be used to fabricate detectors with tunable cut off wavelengths between 200 to 365nm. Having a cutoff wavelength at 365nm, GaN based UV detectors can detect without background interference from the visible spectrum (visible blind) making them more efficient than other semiconductor UV detectors, which have to use baffles to block visible wavelengths. The ALDUV consortium has concluded that AlxGa1-xN photoconductive detectors were not adequate for solar UV-B monitoring, due to their very poor UV/visible ratio, their significant temperature dependence and their non-linearity with incident power. In consequence the main objective of this research is to model a GaN Schottky diode detector that are linear, fast, and present excellent UV/visible contrast (more than three orders of magnitude) to monitor UV radiations. GaN based schottky ultraviolet detectors that can be used to detect skin exposure will be modeled using the physical device simulator Silvaco/Atlas. Various schottky metals are examined in relation to electrical breakdown and leakage. Also the detector are optimized for responsivity, detectivity and noise equivalent power. After successfully developing the Schottky barrier UV photo detectors, we should notice that the net current under forward bias ($V > 0$) results from the large increase in electrons going from the semiconductor to the metal due to the low Barrier. On the Reverse Biased ($V < 0$) plot, the potential barrier for electrons in the semiconductor should increase and the result is a drastic decrease in the number of electrons that can get into the metal.

Student: Amaro Thiam

Mentor: Dr Corey Dickens, Department of Electrical Engineering, Morgan State University, Baltimore, Maryland 21251

NORFOLK STATE UNIVERSITY

AMPLIFICATION AND PURIFICATION OF PLASMID DNA

In vitro studies of genes or gene regulatory sequences (promoter) require DNA incorporation into an exogenous self-replicating construct called a plasmid. In our laboratory, promoter sequences for the gene UL98 from the Human Cytomegalovirus (HCMV) are under assessment and must be pure and in abundance for study. We are currently establishing a plasmid amplification/purification system at Norfolk State University. Equipment variation such as centrifuge speed and rotor size makes it necessary to amend protocols for optimal purification at NSU. Several constructs will be used for restriction enzyme analysis and transient transfection assays. Therefore, we will set up a system for the amplification/purification of wild type and mutant constructs, as well as reporter plasmids and IE constructs. The UL98 promoter reporter constructs are central in understanding HCMV early promoter regulation. The UL98 promoter is a gene found in the 98th genomic region of the human cytomegalovirus and its protein product is responsible for the alkaline exonucuclease homolog. In this study we aim to create and optimize plasmid amplification/purification protocols, to be used in further studies of UL98 early promoter regulation. Four different plasmids were transformed into E.coli JM109. pUL98CAT, pGL3Basic, pSVoCAT, and pCmCAT. Once transformed the plasmids were purified from the bacteria. Two plasmid purification systems, Qiagen and Cesium chloride were evaluated. The purification system supplying pure plasmid DNA along with substantial amounts of DNA will be used in future studies. We first wanted to generate UL98 Plasmid DNA by transforming four different plasmids in E.coli JM109. Once transformation is complete, the bacteria were amplified, which in turn will increase the amount of transformed plasmid DNA. Transformed bacteria were grown by standard microbial methods on agar plates congaing the antibiotic ampicillin. Colonies growing in this media were used in amplification. Bacteria were amplified in bacterial shakers containing LB broth. Plasmid DNA was purified from the bacteria by use of a Qiagen purification kit and by Cesium Chloride purification systems. The Qiagen kit is a standard purification system containing pre-mixed reagents. Reagents used in the Cesium Chloride procedure have to made manually. By establishing UL98 plasmid amplification and purification systems experiments needing to be carried out in other facilities can now be performed at Norfolk State University. Purified UL98 Plasmid DNA will be used in the replacement of the Chloramphenicol Acetyltransferase (CAT) gene in UL98CAT plasmids with the Luciferase (LUC) gene creating new pUL98LUC constructs. This construct will be used in an ongoing study of UL98 promoter regulation.

Student: Mr. Hamilton Allen, Norfolk State University, Department of Biology, Senior

Mentor: Dr. Tabmitha Jervey, Norfolk State University, Department of Biology, Assistant Professor

EFFECTS OF MICROWAVE RADIATION ON SCHOTTKY DIODES

Named after German physicist Walter H. Schottky, Schottky diodes are used in a wide variety of applications. This project explores the effects of microwave radiation on commercially used schottky diodes. Schottky diodes utilize a metal semiconductor junction as a Schottky barrier which makes them different from other diodes in that they have a lower forward voltage drop and faster switching times. It has been shown that different types of radiation by protons, electrons, and heavy ions can have negative effects on the operation and lifetime of Schottky diodes. These kinds of radiation effects are important for equipment operating in space and low-earth orbit. Understanding the degradation process in these devices is paramount. This work studies Schottky diodes that are exposed to microwave frequencies ranging from 10 – 12 GHz at power changes of 20 – 200 W. Other parameters will be altered such as the exposure time, which will range from 0 – 8 hours. The effects that microwave radiation exhibits on Schottky diode behavior such as turn on voltage and barrier height will be reported.

Student: Ms. Cheree Armstrong, Department of Engineering, Norfolk State University

Mentors: Dr. Sean Jones, Norfolk State University, Department of Engineering, Professor, Dr. Kyo Song, Norfolk State University, Department of Engineering, Professor

MATHEMATICAL MODELING IN BUSINESS: TIME IS MONEY

Mathematical modeling of delays in business consists of investigating and quantifying the relationship between various delays and their effects on businesses, such as fluctuation, revenue, and cost. The mathematical models are described by a set of equations using calculus and algebra. The Stella 8.0 software is used to simulate the effects of delays on businesses by solving those equations numerically. In this study, we model the competition between two businesses and study the competitive edge of one business making more efficient business decisions over another. The quantitative results are shown by graphs and tables. It models the supply-demand chain- management of two businesses selling the same products and competing for market shares. The supply-demand chains are made of five (5) basic parts, which are: Order, Inventory, Price, Sales/Total Sales, and Total Demand. To emphasize the delay effect, we assume that the two businesses make the same decisions in inventory control, but with different efficiencies in making and carrying out ordering and pricing decisions in terms of shorter or longer delay days. The model demonstrates that the more efficient business experiences much less fluctuation in inventory, ordering, price, and sales than its competitor, thus it can greatly reduce its business cost. By observing all of these factors, it will be possible to determine exactly how much time is how much money.

Student: Ms. Angelitta Britt, Norfolk State University, Department of Mathematics, Sophomore

Mentor: Dr Jiashi Hou, Norfolk State University, Department of Mathematics, Assistant Professor

SYNTHESIS OF RING OPENING METATHESIS POLYMERIZATION (ROMP) MONOMERS

As the need for a renewable, clean energy source is expanding, a promising technology based on organic or polymeric materials may offer a lightweight, flexible, cost-effective renewable solar energy solution.[1] Conducting polymers like PPV (poly(1,4-phenylenevinylene)) functioned as donors and C_{60} derivatives as acceptors have been widely used for photovoltaic cell applications. However, composite films made by mixing PPV and C_{60} usually leads to phase separation because C_{60} tends to form crystalline which makes the donor and acceptor molecules incompatible in composite films. It results in poor homogeneity and low optical quality of the films leading to inefficient intramolecular and intermolecular energy or electron transfer in solar cells. The objective of this investigation is to synthesize polymeric materials where donors and acceptors are covalently linked to polymer backbone, which presumably can avoid phase separation problems. In addition, these polymeric materials can be dissolved in common organic solvents, "wet" methods such as spin coating can be used for device fabrication. Most PPVs have wide molecular weight distribution, making them less applicable to control morphology in the solid. A synthetic procedure for the preparation of PPV reported by Kretzschmann and Meier[2] is adopted in this research plan because the synthesized PPV shows low polydispersity index (PDI).

Student: Ms. Taina D. Cleveland, Norfolk State University, Department of Chemistry, Senior

Mentor: Dr. Suely M. Black, Norfolk State University, Department of Chemistry, Associate Professor

WIRELESS SENSOR NETWORKS

The future is here! Wireless technology has replaced the hassle of long wires. Wireless Networks have impacted various aspects of technology and has given us cell phones, GPS (Global Positioning System) navigation, and even wireless internet. Wireless sensors are used in fire tracking applications, earthquake detection, traffic analysis, and more. The research performed in this project involves deploying 10-15 nodes in different locations at Norfolk State University and establishing communication between the nodes. Once this is done, light/temperature signals will be detected from the nodes and the results will be displayed. The application for this project will be to provide the ability to detect malfunctions in both the air conditioning units and lighting for the areas in which the sensors are deployed. The project programming of the Mote 2400 Wireless Sensor kit manufactured by Crossbow Technology. This is done using the NesC programming language in the TinyOS environment developed by the University of Berkley.

Student: Mr. John Marcus Coker, George Mason University, Department of Engineering Junior

Mentor: Dr. Rasha Morsi, Norfolk State University, Department of Engineering, Assistant Professor

CONTRIBUTING FACTORS OF COEXISTENCE OF *ESCHERICHIA COLI* STRAIN 0157:H7 AND ANTIBIOTIC RESISTANT *STAPHYLOCOCCUS AUREUS* ISOLATED FROM VIRGINIA BEACH COASTAL WATERS

Pathogenic bacteria found in recreational beach water is a major environmental and public health concern. This investigation examines environmental factors that contribute to the coexistence of *Escherichia coli* strain 0157:H7 and *Staphylococcus aureus* isolated from the coastal waters of Virginia Beach, VA. The research has a two-fold purpose: to identify the *E. coli* strain 0157:H7 and to examine resistance of antibiotics to isolated *Staphylococcus aureus* from the coastal waters. High levels of fecal coliform bacteria, e.g. *Escherichia coli* strain 0157:H7, may have health risks to tourists and the environment. Fecal coliform is passed through the fecal excrement of humans, wildlife, and livestock, and is spread by direct waste discharge, precipitation, agricultural, and sewage run-off (Fecal, 2000). The most common member of the fecal coliform bacterial group is *Escherichia coli*, simply referred to as *E. coli*, a rod-shaped, gram-negative, non-spore forming bacteria. Most *E. coli* strains are relatively harmless, causing diarrhea only when consumed in exceeding high numbers. The exception to this is the particular strain studied in this experiment, which is E. *coli* strain 0157:H7. This strain produces a powerful toxin and can cause severe illnesses including bloody diarrhea, kidney damage, and occasional death. The increased occurrence of elevated coliform bacteria in recreational waters, e.g. beaches, compared to acceptable amounts published by the Environmental Protection Agency has caused several beach closing. The standard according to the Virginia State Water Control Board 9 WAC 25-260 published February 12, 2004 for Virginia Water Quality Standards is that recreational salt waters should not exceed 519 *E. coli* colonies per 100ml of water (Beachcast, 2005).

Additionally, this research examines resistance of antibiotics to isolated *Staphylococcus aureus* from the coastal waters. Ten narrow spectrum antibiotics were used to test for resistance. Environmental factors that are observed in this study are precipitation and the pH and temperature of the ocean water. The research examines beach water samples taken from May 26, 2005 to July 4, 2005 by utilizing the membrane filtration test. This will determine the levels of *E. coli* bacteria by examining the number of bacteria per 100 ml of water by performing a coliform bacteria count using a Dark Field Colony counter. MacConkey Sorbitol Agar is used to isolate *E. coli* 0157:H7 because these organisms do not ferment sorbitol and produce pink colonies while other organisms appear colorless (Difco Manual 1998). Tryptic Soy Agar is used to grow the *Staphylococcus aureus*. Tryptic Soy Agar plates are plated with the filter paper from the membrane filtration test and ten antibiotic susceptibility disks are placed onto the plate. Sample plates were examined for growth and antibody susceptibility every 24 hours for 2 days.

Student: Ms. Talia Fletcher, Norfolk State University, Department of Biology, Junior
Ms. Ranese Freeman, Norfolk State University, Department of Biology, Junior
Mentor: Mrs. Maureen Scott, Norfolk State University, Department of Biology, Instructor

CLUSTERING HETEROGENEOUSLY DISTRIBUTED DATA SETS

Cluster analysis is a key technique in which measures similarity or dissimilarity that classifies and extracts knowledge or useful information from data. Data from engineering, scientific, or commercial applications is often intrinsically heterogeneous high dimensional and stored partitioned into distributed data sub-sets kept at distinct sites that are only connected by a network. The long term project consists of the implementation of a hierarchical algorithm to cluster such data sets, and obtain the corresponding "global" dendrogram. The approach is to cluster the whole distributed data set using the "local" dendrograms built by clustering the data sub-sets locally at the sites where they are stored. The first phase of the project is to implement and test new hierarchical clustering algorithms for the "local" data sets using the new "sine" dissimilarity measure which was designed for high dimensional data. To master the techniques and use in the project, C++ programs computes the similarity or dissimilarity matrices using the Euclidean distance, the cosine similarity measure, and the sine dissimilarity measure will be implemented and tested. An algorithm to synthesize test data for the sine dissimilarity measure will also be implemented and tested.

Student: Mr. Phillip Hayes Jr., Norfolk State University, Computer Science, Sophomore

Mentor: Dr. Eduardo A. Socolovsky, Norfolk State University, Department of Mathematics, Associate Professor

FABRICATION AND STUDY OF COLOSSAL MAGNETORESISTANCE LSMO THIN FILMS

Colossal Magneto resistance (CMR) thin films of $La_{2/3}Sr_{1/3}MnO_3$ (LSMO) were grown on $LaAlO_3$ substrate using pulsed-laser deposition. High temperature deposition ensured a flat and smooth film surface. The films were grown at different thicknesses to observe how the properties of the films change with change in film thickness. The films were characterized with x-ray diffraction to analyze the composition of the films. Film topography was characterized with Atomic Force Microscopy. The magnetic properties of the films were studied via Electron Spin Resonance (ESR) method. These LSMO samples were compared with LBMO films and other CMR materials.

Student: Mr. Maxim Noginov, Cornell University, Department of Engineering/Physics, Sophomore

Mentor: Dr. Aswini Pradhan, Norfolk State University, Center for Materials Research, Research Associate, Dr. Rakhim Rakhimov, Norfolk State University, Department of Chemistry, Associate Professor

THEORETICAL STUDIES OF RANDOM LASER IN DIFFUSION APPROXIMATION

Random laser is a simple source of stimulated emission, with feedback provided by scattering of light particles inside of amplifying medium. Therefore, unlike regular lasers, it does not need mirrors for its operation. This characteristic has been known as a major advantage of random lasers. However, recent studies have shown that placing mirrors in vicinity of random lasers improve its effectiveness. In a previous work, our group has numerically and experimentally demonstrated the improvement in performance of random laser by adding mirrors in rear and in front of a medium and investigating random laser behavior in a 1-D numerical model of lasing cells with front mirror. In this Monte-Carlo simulation, we study the dependence of random laser threshold and slope efficiency on reflectivity of the front mirror.

In other research, our group focused on studying the anti-Stokes GaAs random laser, where the emission wavelength is higher than the pumping wavelength. One possible explanation of this effect is that one pumping photon is required to produce one higher-energy emission photon. The result is a cooling effect in such a system because the energy difference is drawn from the photons. The necessary condition for this effect is the one-photon absorption. Another possible explanation is the two-photon absorption in the medium; the energy of emitted photon is same as the energy of two pumped photons, thus the cooling effect is not present. We intend to compare theoretical predictions with experimental results. The two-photon absorption in diffusive medium has not been theoretically investigated. Therefore, we plan to study the absorption as it depends on pumping intensity, scattering length, and the cross-section of two-photon absorption.

Student: Mr. Jakub Novak, Norfolk State University, Department of Management and Information Systems, Senior

Mr. Zenawi W. Kabato, Norfolk State University, Department of Chemistry, Sophomore

Mentor: Dr. Mikhail A. Noginov, Norfolk State University, Department of Physics, Associate Professor

EXACT SOLUTIONS OF CUBIC EQUATIONS

Mathematicians have discussed the solutions of cubic equations as far back as 440 BC. In 1494, Luca Pacioli, an Italian mathematician, referred to the solutions of cubic equations, in his book "Summa Arithmetica, Geometria, Propertioniet Propertionalita", as impossible to find at that time. Pacioli must have been pleasantly surprised when his countryman, Scipione Del Ferro, offered a method for solving a restricted class of cubic equations within the next decade. Yet another Italian mathematician, Tartaglia, improved Del Ferro's work a few years later. Tartaglia managed to derive a formula, known as the Cardan's Formula, to solve all cubic equations. Although Tartaglia offered his famous formula in the early 1500's, mathematicians' fascination with solving cubic equations never diminished. The quest for deriving new formulas continued on to even today. In this paper, we intend to closely study methods of solution introduced by Omar Khayyam, Tartaglia, Viete, Dickson, and Landen. The Newton's method of approximating real zero(s) of cubic functions and cube root functions will be discussed. The Newton's method fails to converge for certain functions if the initial approximation is not selected from a particular interval containing the zero. A modified version of the Newton's Method will be introduced to improve the convergence.

Student: Ms. Angela Sims, Norfolk State University, Department of Mathematics, Senior

Mentor: Dr. Shahrooz Moosavizadeh, Norfolk State University, Department of Mathematics, Associate Professor

MANUFACTURING WITH COMPUTER NUMERICAL CONTROL (CNC)

The purpose of this research is to improve educational methodology and experience in Manufacturing with Computer Numerical Control (CNC) machines. The rising labor cost and lacking of skilled workers shift tremendous work offshore. To stay competitive, the machine tools used to produce parts computer numerically controlled (CNC). The benefits of CNC machines are saving money, time, accuracy, repeatability, as well as the reliability of the products. It is very important to prepare our students with advanced skilled in manufacturing filed with CNC knowledge. To familiarize the participant with CNC machines, sample CNC projects are used to show the various functions of CNC programming; i.e.; G- Codes and M-codes. Then participant uses these projects to master the CNC machines operations by input and revising the programs to the CNC machines and produce the parts. Lastly, the participant will utilize the knowledge learned in the process to design, program and produce parts with CNC machines. Currently, CNC courses taught at Norfolk State University is a stand- alone module and not utilized the CAD. This project will investigate the method to transfer turning models from directly to Boxford Lathe.

Student: Ms. Ashley Turner, Norfolk State University, Department of Technology, Senior

Mentor: Dr. Jeenson Sheen, Norfolk State University, Department of Technology, Associate Professor

THE THEORETICAL STUDY OF THE MAGNETIC PROPERTIES OF QUINOIDAL OLIGOTHIOPHENES

Traditionally inorganic materials have been used in the fabrication of semiconductors. Inorganic materials are not easily modified and somewhat expensive to fabricate. Organic compounds, on the other hand, can easily be tailored to display the desired properties, and are cost effective. It has been recently reported that the quinoidal form of oligothiophenes presents magnetic properties, which does not agree with the expected electronic structure of the molecule. The display of magnetic properties reflects the presence of unpaired electrons and potential for semiconductor use. Unpaired electrons are charge carriers, useful in electronic devices, The purpose of this research is to determine the influence of the number of thiophene units in a quinoid oligothiophene on the stabilization of its magnetic aromatic form. The study was performed considering two different oligothiophene structures: aromatic oligothiophenes and quinoidal oligothiophenes. The procedure consisted in obtaining the optimized geometry of the quinoidal form, both closed shell singlet and open shell triplet, and the aromatic form of the oligothiophene. The same systems, with added cyano end groups were also studied. Maestro 3.0 and Jaguar 4.0 were the computational chemistry software packages used to study the systems. All structures were entered into Maestro 3.0, via its graphical interface. Afterwards, a geometry optimization calculation at the DFT-B3LYP level was performed for each structure and spin state, using the basis set of 6-31G*. This study will discuss the energy differences trend, as well as the bond lengths patterns, as we add thiophene units to each of the systems, with and without added cyano end groups.

Students: Ms. Latonya Waller, Norfolk State University, Department of Chemistry, Sophomore, Ms. Trina Fletcher, University of Arkansas at Pine Bluff, Department of Industrial Technology, Sophomore , Ms. LaTrese Wilder, Norfolk State University, Department of Chemistry, Sophomore

Mentor: Dr. Suely M. Black, Norfolk State University, Department of Chemistry, Associate Professor

THE EFFECTS OF GROWTH HORMONES ON GLUTATHIONE REDUCTASE (GR) ACTIVITY IN *PISUM SATIVUM* L., CV. ALASKA

The purpose of this project is to understand stress responses in *Pisum sativum* L., Alaska pea plants. We are investigating the effects of the growth hormones, gibberellic acid which is used to accelerate growth in intact plants, and B-Nine, which causes dwarfing in plants. Our research seeks to answer the question "what is the relationship between the glutathione reductase (GR) mechanism and the stress response in plants? The specific goal is to see what effect these hormones have on GR activity. The approach that we will take for this project is to use the GR enzyme assay to test for GR activity using the spectrophotometer, SDS-PAGE and column chromatography. We will also use SDS-PAGE to observe any changes in protein profile that may occur in response to our treatments.

Student: Ms. Adrianne Wiggins, Norfolk State University, Department of Biology, Sophomore

Mentors: Dr. Camellia Okpodu, Norfolk State University, Department of Biology, Department Head, Ms. M. T. Abdullah, Norfolk State University, Department of Biology, Advisor

INVESTIGATING THE IMPACT OF TECHNOLOGY ENHANCED LEARNING IN THE CHEMISTRY CURRICULUM

Chemistry Scene Investigators (CSI): CSI is a technology enhanced chemistry unit designed to increase the knowledge and understanding of college students on the topics of Chemical Reactions and Balancing Equations. This project targets both the cognitive domain and the affective domain. It is our contention that students should increase learning skills from the online interactive module, and show a preference for this type of learning, especially when dealing with abstract and difficult concepts.

The work is being done as part of the Technology Enhanced Learning in Science (TELS) Center. This NSF-funded Center unites university, research, and school partners to increase the numbers and diversity of secondary science teachers who are using innovative, proven, technology-enhanced science curricula to impart key scientific concepts and methods to their students. The *CSI* project explores ways that interactive visualizations and insightful prompts using Molecular Workbench software can indeed enhance students' understanding of chemical equations. Preliminary results indicate that the CSI technology enhanced curriculum with some prior instruction significantly contributed to a more integrated understanding of the topic of chemical reactions and balancing chemical equations.

Students: Ms. Marcia Mena, Norfolk State University, Department of Chemistry, Senior , Ms. Sherita Wilson, Norfolk State University, Department of Chemistry, Senior

Mentor: Dr. S.R. Chaudhury, Norfolk State University, BESTLab, Director

INVESTIGATION OF BEAM DIAGNOSTICS ON VARIOUS COHERENT SOURCES

Key Words: Beam Diagnostics, Beam Profiling, Beam Analysis, Coherent Sources

Beam diagnostics is a procedure incorporating beam profiling and beam analysis. The objective of beam diagnostics is to manage and maintain the quality of a coherent source. The quality of a coherent source is dependent upon spatial parameters of beam propagation and the influence of outside factors on the beam propagation. The quality of the beam is represented in the signal-to-noise ratio, which affects the graphical presentation of the beam.

This investigation will clarify the correlations between the spatial parameters of the beam profile and the outside factors, particularly the optical components, responsible for resizing the beam and causing reflection and polarization. The main coherent source being investigated is the HeNe laser beam of wavelength 628nm. Likewise, to further investigate the spatial parameters of coherent sources, a laser pointer will be diagnosed and compared to the HeNe laser beam profile. The diagnostics will be performed using the Spricon Laser Beam Analyzer 300PC.

Student: Mr. Kyal Wright, Norfolk State University, Department of Engineering, Junior

Mentors: Dr. Kyo Song, Norfolk State University, Department of Engineering, Professor, Dr. Sean Jones, Norfolk State University, Department of Engineering, Professor

POSTER PRESENTATION

PROCESS AUTOMATION USING PHP AND MYSQL

The manual authentication and verification of arrival and departure times recorded in a paper register has become an outdated and tedious process to manage. This process still exists in the Science and Technology Academicians on the Road to Success (STARS) Program office. Automation of the sign-in process is needed to correct the following issues. Man hours are being wasted verifying and authenticating registries. Also, manually tallying calculations can result in many errors. A new technique was also needed for recovering lost paperwork and validating false sign-ins.

The necessary requirements were gathered in order to automate this process by using the basic steps of software engineering. Research was done to discover which type of programming language and database would be the best to help implement the tool. This research led to the conclusion of using PHP and MySql as opposed to ASP and Microsoft Access. After all of the requirements were gathered, the solution was formed. A web application tool was created to automate recording the arrival and departure times of the STARS tutors. The tool also totals the time durations for all who use the tool. Using this tool as a replacement for current procedures will lighten the workload and increase efficiency of the overall process. The paper trail left using the paper registry will be eliminated and inaccuracies due to human error will have been eliminated as well.

Student: Mrs. Erica M. Brown, Norfolk State University, Department of Computer Science, Senior

Mentor: Ms. Yvette Boone, Norfolk State University, School of Science and Technology Information Technology Specialist III

MEASURING THE PHOTO-INDUCED ABSORPTION OF PHOTOVOLTAIC POLYMERS

Photovoltaic cells are very useful in today's world. Due to the high cost in energy sources and its undeniable fate of exhaustion, other means of providing or creating power and energy have to be discovered and researched. Photovoltaic cells absorb light, to create electron and holes that are negative and positive charges that can be stored as energy to do work. There are three polymers, a CD3 diphosphonate (Dialdehyde = 9:8) block polymer, which acts as the donor; CA5, Diphosphonate (Dialdehyde = 9:8) block polymer which acts as an electron accepto; and a block copolymer composed in the CDA5 and CD3 blocks. These polymers have been previously synthesized and supplied to the research group. Using absorption, emission and photoinduced absorption, the fate of the photo-induced electron hole pair will be monitored in each polymer. As a result, efficiency of converting the light into mobile high energy charge carriers will be determined.

Student: Mr. Stephen Charter, Norfolk State University, Department of Physics, Senior

Mentor: Dr. Carl Bonner, Norfolk State University, Department of Chemistry Professor

STUDY OF SURFACE PLASMONS BEHAVIOR THROUGH SUBWAVELENGTH HOLES USING A MICROWAVE

The purpose of this research is to study surface plasmons' behavior through a single aperture, and/or hole array, of subwavelength size using a microwave radiation. Surface Plasmons are quasi-two-dimensional waves supported at the interface of the vacuum and a metal with an index of refraction less than negative one. These waves are of great interest in the effort to produce integrated micro-optical elements at the intersection of micro electronics and micro optics. The motivation for this study is a result of the unusual transmission properties of metal films first observed by Ebbesen in 1998 [1]. In his study, the enhancement of the transmission using subwavelength hole arrays was observed within optical ranges of light sources. Our study will investigate the surface plasmons' behavior in the range of microwaves, with an emphasis on the x-band range. The surface plasmons' behavior will be assessed in the microwave spectrum of 12-18GHz, which corresponds to wavelengths of 20-30mm. Both copper and aluminum films will be used to construct the samples.

Student: Ms. Sharisse Felton, Norfolk State University, Department of Engineering, Junior

Mentor: Dr. Kyo Song, Norfolk State University, Department of Engineering, Professor

CHARACTERIZATION OF CONDUCTING POLYMERS

Conducting polymers in a donor/acceptor configuration offer tremendous potential as organic semiconductors, specifically as photovoltaic devices. A photo induced electron transfer occurs at an interface between a semi-conducting polymer donor layer (MEH-PPV [poly(2-methoxy-5-(2'-ethyl-nexyloxy)-paraphenylene vinylene] and MDMO-PPV[poly[2-methoxy-5-(3',7'dimethyl-octyloxyl)-1,4-phenylenevinylene]) and an acceptor layer (CN-PPV[a CN-substituted poly(*para*-phenylene vinylene]). By controlling/altering the morphology of a compound, we can create an interpenetrating network which results in the increased efficiency of the electron transfer. We are altering the morphology of our donor-acceptor compounds by varying fabrication parameters such as preparation (liquid solution and thin films), variation of solvents as well as other methods. We then seek to characterize both the solid and liquid preparations of conducting polymers in order to identify those parameters at which the most efficient electron transfer occurs. We will characterize the preparations using UV-Visible Spectroscopy, Fourier-Transform Infrared Spectroscopy, Spectroscopic Ellipsometry and X-ray Diffraction.

Student: Ms. Andrea Ferebee, Norfolk State University, Department of Physics, Senior

Mentor: Dr. Kang I. Seo, Norfolk State University, Center of Materials Research, Research Associate

CONTROLLING A POWER ALLOCATION AND DISTIBUTION (PAD) CIRCUIT USING A VISUAL BASIC PROGRAM

A power allocation and distribution (PAD) circuit is a circuit that provides direct current (DC) power from a rectenna patch into actuators. This circuit can also control individual actuators depending on their requirements of the electric power using dual-gate Metal Oxide Semiconductor or Silcon Fields Effect Transistor (MOSFETs). In this research, a flexible Visual Basic program will be used for a PAD circuit to control individual actuators. This program has previously developed for a 4x4 actuator. The goal of this project is to extend the program to enhance the capacity to control multi-actuator unites such as 8x8 actuators and beyond.

Student: Ms. Adama Gegbe, Norfolk State University, Department of Computer Science, Senior

Mentor: Dr. Kyo D. Song, Norfolk State University, Department of Engineering, Professor

SOLVING PARTIAL DERIVATIVES USING THE FINITE DIFFERENCE METHOD

Composites are objects consisting of several elements. Composite beams are made up of pultruded reinforced plastic which is just layers of small fibers and glue. Advantages of composite beams are their high strength, light weight, and insulating strength. Although composite beams are strong, they are also prone to damage. We solve partial differential equations using the central finite difference method to find the instability of composite beams. Also in the process we will attempt to create a program which computes finite difference operators of high order.

The finite difference method is a classical and simple way to solve partial differential equations and is the most commonly used approximation scheme. We will use the Taylor series[1] to find the first, second, third, and fourth derivatives. Upon completion of finding the derivative, this information will be used to compute the stability of the Composite beams.

Student: Mr. Kelly D. Hopkins, Norfolk State University, Department of Mathematics, Junior

Mentor: Dr. Mojtaba Sirjani, Norfolk State University, Department of Mathematics, Associate Professor

REPLACEMENT OF WILDTYPE/MUTANT CAT CONSTRUCTS WITH LUCIFERASE CONSTRUCTS

Several characteristics of the Human Cytomegalovirus (HCMV) make it a virus in need of innovative and abundant research. Infection rates are copious in children and with its ability to lie latent in its host indefinitely; HCMV may be considered a silent predator. UL98 is one gene responsible for the synthesis of HCMV viral DNA, and it is therefore imperative to understand its endo/exonuclease activity. To do this, an environment that is optimal for this study must be achieved. Currently, studies involving the UL98 promoter are done using chloramphenicol acetyltransferase (CAT), a gene that cannot be tracked without the use of costly and potentially harmful radioisotopes. The bioluminescent gene luciferase (LUC) is not only a cost effective replacement, but it also provides a safe environment for an undergraduate laboratory. The objective of this study is to remove the putative UL98 promoter region from the pUL98CAT construct and replace it in a construct containing the LUC gene. Once the new plasmid is constructed, it will be manipulated via mutation and deletion in order to characterize how viral factors, specifically IE86 and IE72, bind to the promoter and affect gene expression. Methods: The UL98 fragment within the pUL98CAT construct was cut with HindIII, leaving a recircularized pSVoCAT plasmid in tact. The pGL3Basic plasmid was cut at the unique HindIII site, thereby linearizing it. The isolated UL98 fragment was then replaced in the LUC plasmid, thereby creating the pUL98LUC construct. The UL98 fragment within the pUL98CAT construct was isolated via acrylamide gel electrophoresis and the resulting 421bp band was cut out and purified to remove residual ethidium bromide. The pGL3basic plasmid was cut with HindIII and a ligation reaction ensued to allow or UL98 to bind to the newly linearized sticky ends. The new pUL98LUC construct was amplified for 48 hours then assayed and sequenced to verify that the insertion was successful. Replacement of the CAT gene with the LUC gene has provided the foundation upon which to study the viral factors affecting UL98 gene expression. The new biolilluminescent gene construct may now be used to track how viral factors, such as IE86 and IE72, bind to the promoter region and affect gene expression without the use of costly and potentially harmful radioisotopes.

Student: Ms. Kira Howell, Norfolk State University, Department of Biology, Junior

Mentor: Dr. Tabmitha Jervey, Norfolk State University, Department of Biology, Assistant Professor

THE CONSTRUCTION OF THE RESEARCH EXPERIENCE FOR UNDERGRADUATE (REU) WEBSITE

The creation of the Research Experience for Undergraduates (REU) website at Norfolk State University will be accomplished by using the Microsoft Dreamweaver Environment. Dreamweaver is software that will allow users to create websites without using standard HTML code. This site is needed to provide visitors with sufficient information on seminars, workshops, and research activities that the program offers. This website will also create a means for students to network with other REU programs. The creation of this website will be done in hopes to increase the number of REU applicants and showcase the faculty/student research activities.

Student: Mr. David James, Norfolk State University, Department of Technology, Junior

Mentor: Dr. Camellia Okpodu, Norfolk State University, Department of Biology, Department Head

FM STEREO TRANSMITTER

Transmitters have been around for ages, transmitting data to receivers everywhere. Over time new and faster transmitters have been designed. The Ramsey FM10A Model has low power broadcasting that can be heard around the house, the neighborhood, and within a one-mile radius. The prefix FM in FM10A stands for frequency modulation, which is the encoding of information in either analog or digital form into a carrier wave by variation of its instantaneous frequency in accordance with an input signal. With frequency modulation, a larger bandwidth is needed; in turn FM10A has a large bandwidth range of 88-108 MHZ, standard operating frequency for most radios and transmitters in the United States. Other countries have different bands, such as Japan that operates on a 76-90 MHz bandwidth. The main component of the transmitter is the BA1404 integrated circuit. This IC chip contains a stereo modulator, an FM modulator, and an RF amplifier, which is essential for all stereo transmitters and other wireless transmission devices.

Student: Mr. Dwight Jarrett, Norfolk State University, Electronics Technology, Senior

Mentor: Mr. Munir Sulaiman, Norfolk State University, Department of Technology, Instructor

GLUATHIONE REDUCTASE ACTIVITY IN *GALDIERIA*

Glutathione reductase (GR) is found to be a very stable enzyme and has numerous functions in all living species studied. GR is an enzyme that catalysis the NADPH-dependent reduction of oxidized glutathione. It is also one of the enzymes to function in the antioxidant scavenging cycle, which plays a major and key role in the defense against oxygen-radical toxicity.

The focus of my research has been to understand the regulation and biochemical characterization of glutathione reductase in Galdieria *sulphuraria*. *G. sulphuraria* is acidophilic red algae that grows in the springs and colonize surrounding rocks. The first objective has been to compare enzyme activity from culture cells grown under two different growth conditions (i.e., continuous light and continuous dark). We have analyzed GR activity using both Native and SDS-PAGE. We also quantify the protein using the Pierce BCA method.

Student: Ms. Tiara Kersey, Norfolk State University, Department of Biology, Junior

Mentor: Dr. Camellia Moses Okpodu, Norfolk State University, Department of Biology, Department Head

STUDY OF NANOSTRUCTURED MATERIALS BY MAGNETIC RESONANCE METHODS

Magnetic resonance methods were used to investigate the effects of particle size and magnetic impurities in nanostructured solid state materials. ^{27}Al NMR spectra, and nuclear spin relaxation have been studied in powder samples with different size of particles with and without ferromagnetic nanoparticles, and compared to those in single crystals. Proton NMR and spin dynamics were also studied in liquid and solid suspensions of Fe_2O_3 nanoparticles and analyzed together with ESR data in the same materials. Significant changes in the shape of the line and relaxation kinetics were observed with decrease of particle size and explained by taking into account the effect of the surface distortions. Studies of the spectra and spin dynamics in solid and liquid suspensions with magnetic nanoparticles in different concentrations allow us to estimate local fields and parameters of nanoparticles interactions.

Students: Ms Marsha King, South Carolina State University, Department of Engineering, Senior
Mr. Donald White, Tuskegee University, Department of Chemistry, Junior

Mentor: Dr. Natalia Noginova, Norfolk State University, Department of Physics, Assistant Professor

MATHEMATICAL MODELING OF A COMBAT

A mathematical model of outcome of two forces in combat under various circumstances is presented. Due to richness and beauty of mathematics involved in this model, it has drawn attention of mathematicians for nearly a century (Lanchester 1916). With the advent of technology and powerful computing capability this model has become more important lately. As the rates of change in strength of the forces depend on several situations, the model involves a system of differential equations. This particular model is an autonomous system and the rate of change at which the strengths of the forces vary is independent of time. For this simple model, analytical and graphical solutions are obtained. To interpret the graphs method of phase plane analysis is utilized. Depending on the initial conditions and the rate at which the forces replenish the combat is either a win out or ends in a draw.

Student: Mr. Marius Knowlin, Norfolk State University, Department of Mathematics, Sophomore

Mentor: Dr Renuka Verma, Norfolk State University, Department of Mathematics, Associate Professor

MOISTURE UPTAKE OF THIN POLYMER FILMS

Thin films are layers of either conductive or non-conductive films that are added to the top surface of wafers. These films may be used to form interconnects between devices or insulators between interconnects layers. A variety of materials can be deposited on a wafer. Three main categories of thin films materials are conductors, insulators, and semiconductors. In this research a polymer "insulator" is used as the thin film. This polymer film is used and tested to see how much moisture it absorbs under different circumstances. These films can later be used to coat microchips for computer, cell phones etc.

A slide of quartz crystal with a gold electrode on each side is used in this project. After coating the quartz with a thin polymer film on one side, the quartz crystal is attached in a sealed glass cell. The cell is connected to nitrogen to test the moisture absorption. The nitrogen enters into the cell in two forms: wet nitrogen and dry nitrogen. The nitrogen that has been condensed with water is called wet nitrogen, and the direct nitrogen flow is dry nitrogen. While using dry nitrogen, the relative humidity is zero, which means that there is no water at all in the cell. When a voltage is applied to the quartz, it vibrates and the frequency is proportional to the mass of the film. Once the mass of the film is changed by moisture uptake, the frequency reflects that change. The more moisture the film absorbs the heavier the film will be causing the frequency to be lower. The theory behind this is the higher the condenser temperature, the higher the moisture content inside the cell, which increasing the relative humidity. The higher the relative humidity, the more moisture the polymer film will uptake, which increases the mass of the thin polymer film.

There has not been much progress in this research as of yet due to inaccurate data. The data recorded show that there was a 2.5% increase in weight when changing from dry nitrogen to wet nitrogen and a 2.21% decrease in weight when changing back from wet to dry. This tells us that all the moisture is not being reabsorbs. We believe the frequency values are inaccurate due to the fact that the nitrogen flow is not constant. The nitrogen flow rate constantly fluctuates when changing from wet to dry and dry back to wet. A way to stabilize the nitrogen flow at a slow steady rate is needed before this research can be continued.

Student: Mr. Ephraim Lucas, Fort Valley State University, Department of Engineering, Junior

Mentor: Dr. Suely M. Black, Norfolk State University, Department of Chemistry, Associate Professor

THE CONCEPTUAL DESIGN OF RECTENNAS FOR AIRSHIP APPLICATIONS

Energy harvesting is an important concern in modern society due to the scarce of natural resources. In the same time, national security from terrorists and natural disasters are significant issues in our country. For this study, a conceptual design of rectennas in order to harvest energy from a microwave onto an airship for homeland security as well as surveillance of weather will be performed. In addition of using a microwave as a power source, a solar cell will be mounted on the airship, running in the daytime, while the rectennas will be used for the nighttime. Micro-air vehicles (MAVs) will be attached under the airship to perform the mission. From this study, design parameters will be provided for the mother airship's concept in association with MAVs for the mission.

Student: Ms. Brandi Matthews, Norfolk State University, Department of Engineering, Junior

Mentor: Dr. Kyo Song, Norfolk State University, Department of Engineering, Professor

ABET ACCREDITATION FOR THE NORFOLK STATE ENGINEERING DEPARTMENT

The purpose for this research is to create a working, convenient and useful student survey designed for selected engineering courses available during the fall and spring semesters of 2005. Specifics needed for this research to be successful are inquisite software, current class syllabi and effective writing skills. The survey will include questions that are relevant to ABET accreditations and useful in improving the engineering courses. The goal is to achieve a response rate of 50% or greater. Practical applications of this research project consists of program evaluation and assessment as required for ABET accreditation, investigation of pre and co-requisites, and tutorials on the inquisite software. Research methods used in this effort include background research on ABET accreditation, acquired and learned inquisite software to leverage what was learned in a spring pilot survey, pilot testing and accumulating specific information about courses and student interviews. This survey will allow students to voice their opinion about the classes they have completed. Through their experience, they will be able to offer constructive criticism or compliment regarding class policies, structure, procedures, exams and material. The survey will also pose as the framework for the development of a parallel faculty survey. This research is being carried out in support of Norfolk State's engineering accreditation activities in an effort to improve each semester by way of this inspection.

Student: Ms. Carrie Matthews, Norfolk State University, Department of Engineering, Sophomore

Mentor: Dr. Patricia Mead, Norfolk State University, Department of Engineering, Professor

AM/FM RECEIVERS

Receivers based on the super heterodyne principle are standard in one form or another in most types of communications systems and are found in familiar systems such as standard broadcast radio, stereo and television. The Elenco Superhet 108 AM/FM Radio is a seperheterodyne receiver of the standard AM (amplitude modulation) and FM (frequency modulation) broadcast frequencies. The Elenco Superhet has nine different sections. Such as, the audio amplifier; it amplifies the detected audio signal and drives the speaker to produce sound. It's also deals with the detector and the AGC (automatic gain control). The purpose of the detector is to change the amplitude modulated IF (intermediate frequency) signal back to an audio signal. The AGC is use to maintain a constant level at the detector. The frequency band for AM broadcast receivers is 540 kHz to 1640 kHz, and the frequency band for FM broadcast receivers is 88 MHz to 108 MHz. This means AM/FM receiver can be tuned to pick up a specific carrier frequency that lies in the frequency band range.

Student: Mr. Cameron Melton, Norfolk State University, Department of Technology, Senior

Mentor: Mr. Munir Sulaiman, Norfolk State University, Department of Technology, Instructor

EMPLOYEES PERFORMANCE PORTFOLIO RECORDING SYSTEM

In this project, we will design the Employees Performance Recording (EP2R) System. Using this system, a company's employee will be able to record their achievements and accomplishments as they occur. Permission may be given to the employer to access EP2R System. The portfolio can be used by management of companies to evaluate employees for individual projects as well as for annual performance. The EP2R system will be designed using C#, an object-oriented language. C# (C-Sharp) is a new exciting programming language that is a modern version of the OOP (object-oriented programming) language. OOP language can be easily described as a way for a program to interchange or share information from software to software. The research is divided in two major steps; learning the C# language on the Microsoft .NET Framework and creating a user interface that designs a form. In the final product, the user interface will use a backend software engine to perform various tasks of opening/closing files, invoking editors/word processors and storing and networking files and printing and generating reports.

Student: Mr. Ranard Miller, Norfolk State University, Department of Computer Science, Sophomore

Mentor: Dr. Aftab Ahmad, Norfolk State University, Department of Computer Science, Professor

ENHANCED HEAT DISSIPATION SUBSTRATES FOR ORGANIC SEMICONDUCTOR DEVICES

Many electronic devices are susceptible to overheating which can result in failures of the device. This can be exemplified through electronic chips located inside a computer. To address these failures, much research has been performed to develop thermal management solutions for microelectronic devices. These solutions have generally been geared towards Si-based microelectronics and have achieved cooling capabilities of 100 W/cm^2 or greater. While such power densities are not expected in organic semiconductors, these devices have unique thermal management challenges arising from their inherent low thermal conductivity (results in high thermal resistance), the use of thermally resistive substrates for flexible electronics, and the need to have transparent materials for photon transfer. Thus, new concepts for both active and passive thermal management of organic semiconductor devices (OSD) must be explored.

The focus of this project is developing new schemes for the removal of thermal energy through both active and passive mechanisms by "thermally connecting" the OSD to high thermal conductivity substrates. The thermal connection will be based on carbon nanotubes (CNTs) which will act as a thermal interface material (TIM) with superior properties to conventional TIMs. These CNTs possess a very high thermal conductivity (900-10,000w/mk). I will investigate the use of multilayer catalysts to produce highly aligned CNTs on metal substrates and the creation of actively cooled PMMA and Si (gold coated) substrates using various bonding techniques. There is a severe lack of attention on the thermal characterization and heat dissipation in OSD. Much of what I do here will be new and provide much needed contributions to the challenges of thermal management in OSDs. In addition, with overheating of chips stalls the advancement of better electronic devices.

The multilayer catalysts deposition onto metal substrates has proven successful in producing some CNT growth. Some affecting factors that contribute to this growth are the type of catalyst deposited onto the metal, the maximum temperature during the procedure, and the length that the sample is exposed to the gases. By changing these factors I am hoping to produce a recipe that will generate better quality CNT growth with fewer defects. Also, success was achieved at bonding Si (gold coated) and PMMA. Using the heat furnace, Si bonding can be accomplished at 460 degrees Celsius for 5 minutes. Concerning polymers, the hydraulic press successfully bonded PMMA at 250 degrees Fahrenheit while maintaining 4lbs of force for 5 minutes. Future work will involve finding a feasible bonding method for PET (idea polymer use for companies) and to continue to produce CNT growth onto metal substrates with the least amount of defects.

Student: Mr. Aaron Montgomery, University of Virginia, Department of Mechanical Engineering, Sophomore

Mentors: Dr. Samuel Graham, Ashante Allen, Erik Sunden, Adam Christensen, Georgia Institute of Technology, Georgia Institute of Technology and Center for Materials Research Program

DEVELOPMENT OF COMPUTATIONAL METHOD FOR SIMULATION AND ANALYSIS OF OPTICAL PROPERTIES OF LARGE ORGANIC MOLECULES

The purpose of this research is to develop computational methods for optical properties simulation of large organic compounds: Urea and Rhodamine 6G (Rh 6G). Data of these molecules will be analyzed. Urea is of interest to material scientists since it is useful in electroptics applications, and Rhodamine 6G is useful for laser applications. Optical absorption of urea and Rh 6G will be simulated using the commercial software package Material Studio (MS) for numerical simulation of optical properties. This software package, which uses density functional theory to provides atomic-level predictions of optical properties of materials and molecules, will be used to run test program for simulation of optical absorption. Aluminum Arsinide (AlAs), a semiconductor compound, will be used as a model system to study the crystal structure of a material by MS modeling using quantum mechanical methods. The test project for simulation of optical absorption of a single urea molecule will be composed and run. The same procedure will be carried out on the project for simulation of optical absorption of Rh 6G molecule. The results will include Density of States (DOS) and optical absorption for urea and Rh 6G respectively.

Student: Mr. Raul Peters, Midwestern State University, Department of Physics & Mathematics, Senior

Mentor: Dr Vladimir Gavrilenko, Norfolk State University, Center for Materials Research, Research Associate

FINDING THE APPROPRIATE PRESSURE MODEL

Terrain vehicles are a very popular type of transportation. They are primarily used for recreation and over rugged terrain. A major problem that terrain vehicle operators have is mud because it is easy to get the vehicle's tires stuck in the mud. A Polish-American engineer named M.G. Bekker wrote a few books dealing with terrain vehicles and mud, and is also responsible for coming up with a an equation to find the amount of pressure p required to sink a circular plate of radius r a distance d in soft soil, where a hard base soil lies a distance $D > d$ below the surface:

$p=k_1e^{k2r} + k_3r$

During experiments, three relationships were observed between the pressures and the radii. Using this information, a nonlinear system involving k_1, k_2, and k_3 is formed. My project requires me to find the constants k_1, k_2, and k_3 so that a general model can be used to predict the pressure given a radius. In order to solve this system, I must understand how to solve nonlinear systems of equations numerically. The Maple software will be used to write programs that will solve nonlinear systems of equations.

Student: Mr. Derrick B. Robinson, Norfolk State University, Department of Mathematics, Junior

Mentor: Dr. Michael Keeve, Norfolk State University, Department of Mathematics, Department Head

THE FABRICATION AND OPTICAL CHARACTERIZATION OF Ag NANOPARTICLES

The preparation (synthesis), characterization, and optical properties (including change in refractive index, two-photon absorption, photoluminescence, etc.) of quantum-confined silver nanoparticles will be described. With these silver nanoparticles, it is necessary to synthesize a material that has an inert core (nucleus of the nanocrystal remains stable), but at the same time possesses a chemically reactive outer shell (can ultimately interact with other elements and functional groups). The synthesis process involves reacting $AgNO_3$ with a saturated solution of $NaBF_4$, which is a reducing agent. Upon verifying that silver was indeed synthesized from the reaction (using the X-Ray Diffractometer; this will also serve to characterize the size of the silver nanoparticles), the nanocrystals will be tested for their absorption properties in nonpolar solvents using the UV-VIS Spectrophotometer. If time permits, the silver nanocrystals will also be tested for two-photon absorption (Z-scan technique), fluorescence (emission), and spincoating (creating thin-layer films). The overall goal is to find out that by cross-linkage of various functional groups, such was alcohols (--OH) and thiols (--SH), can the synthesized Ag nanoparticles have properties similar to these functional groups?

Student: Mr. Eric J. Robinson, Norfolk State University, Chemistry, Senior

Mentor: Dr. Carl E. Bonner, Jr., Norfolk State University, Center for Materials Research, Assistant Director

Simulation and Analysis of Adsorption of Organic Molecules On Silver Surface In Order To Understand Catalytic Properties

This investigation will manipulate the Material Studio computer application, in order to analyze the adsorption of a multitude of organic molecules, specifically Carbon Dioxide (CO), and Palladium 110 (Pd(110) on silver (Ag) surfaces. The Material Studio program possesses an internal application known as CASTEP. This program is a software package which uses density functional theory to provide good atomic-level description of all matter of materials and molecules. Through this program the research team will run test programs for the simulation of adsorption of CO onto Pd(110) surface. The research team will also compose and run the test project for the simulation of adsorption of CO onto Ag(111) surface. The results will include the density of states of the above samples.

Student: Mr. Markeith Royster, Norfolk State University, Department of Mathematics, Senior

Mentor: Dr. Vladimir Gavrilenko, Norfolk State University, Center of Materials Research, Research Associate

MEH-PPV BLEND

The optical properties of poly[-2-methoxy-5-(2-ethylhexyloxy)-pheneylene vinylene] (MEH-PPV) using polymeric blends with tetrahydrofuran (THF). The photoluminescence (PL) spectrum of MEH-PPV present three emission peaks correlating to the electronic transition at 480,460,440, and 500 nm. Photoluminescence and wavelength-dependent excitation indicate that MEH-PPV forms aggregate with absorption and luminescence spectra that are red-shifted from the intrachain exciton. An addition of THF in MEH-PPV films induces a red shift in the absorption spectrum and in the PL spectrum presents a new peak at high energy at about 500 nm. The control interchain interaction has been studied by changing molecular conformation in solutions and film processing. Eight concentrations of the solutions were prepared: 4mg/ml, 2mg/ml, 1mg/ml, 0.5mg/ml, 0.25mg/ml, 0.125mg/ml, 0.0625mg/ml, and 0.0312mg/ml with the compositional weight ratios between THF and MEH-PPV are 1:5, 1:1, 5:1.

Student: Mr. Norman Starks, Norfolk State University, Department of Chemistry, Senior

Mentor: Dr. Soobum Choi, Norfolk State University, Center of Materials Research, Research Associate

BIOCHEMICAL ANALYSIS OF SUPEROXIDE DISMUTASE ACTIVITY AND EXPRESSION IN RAT REPRODUCTIVE AND NON-REPRODUCTIVE TISSUE

The purpose of the present study was to determine whether the epididymis, an organ that is part of the mammalian male reproductive tract, exhibits an elevated level of superoxide dismutase (SOD) (**EC 1. 15.1.1**) when compared to non-reproductive tissue such as the liver. SOD is one of several enzymes that participate in reducing or eliminating the compounds which cause cellular oxidative damage, particularly to the DNA. While cancer has been reported to occur in almost every organ of various animals, including man, a recent and current search of the literature has revealed no known reported cases of cancer associated with the mammalian epididymis. Possibly the most important source of potentially mutagenic alterations in the cellular DNA of an animal that could lead to an increased incident of cancer of an organ is oxidative cellular damage. Excited-oxygen species such as hydrogen peroxide, hydroxyl radicals, and super oxide radicals can arise during "stressful" physiological events or can be the by-products of normal cellular aerobic metabolism. Given the unique physiological function of the mammalian epididymis, which is to transport, store, and mature sperm cells containing the DNA needed for normal fertilization and production of progeny, Dr. Hall has proposed the following hypothesis for test: *"Protection of the epididymis against cancer may be due to elevated activity level (enzyme activity) and/or gene expression (actual enzyme protein) of enzymes involved in reducing or eliminating oxidative radicals such as SOD."* Using the rat as the experimental animal model, SOD activity was measured by determining the rate of superoxide radical inhibition of cytochrome and following the change in absorbency at a wavelength of 550 nm. The expression of SOD polypeptide subunits was monitored by one- and two-dimensional sodium dodecyl sulfate (SDS) polyacrylamide gel electrophoresis (PAGE) followed by Western blot analysis. In comparison to non-reproductive tissue (e.g., heart, kidney, and liver tissues) and the testis, the highest activity level of SOD was associated with the epididymis. Although further experimental studies are warranted, the results of this preliminary study provides support for the hypothesis that elevated levels of SOD may participate in reducing or eliminating compounds that cause oxidative damage, particularly to the cellular DNA, and thereby may significantly reduce or eliminate the incidence of cancer associated with the mammalian epididymis [*This study was supported, in part by funds from the REU and STARS Summer Research Programs at Norfolk State University and awarded to Dr. Joseph C. Hall, Ph.D.*].

Student: Ms. Monique Thomas, Norfolk State University, Department of Biology, Junior

Mentor: Dr. Joseph C. Hall, Norfolk State University, Department of Chemistry, Associate Professor

AN FTIR INVESTIGATION OF α–CRYSTALLIN

Alpha-Crystallin is a globular protein found in the lens of eye. It acts as a chaperone protein, responsible for the conformation maintenance of other specific proteins. This action allows for the maintenance of the refractive index, keeping the lens transparent. When crystallin loses its ability to act as a chaperone protein, the other specific proteins are allowed to change their conformations and to aggregate. This is how cataracts are formed. This study was designed to investigate the ionic strength effects of crystallin in aqueous solution. It will test the hypothesis that CA^{2+} binding triggers conformational changes in crystallin, and also how these changes in conformation may compromise the protein's ability to remain a chaperone protein. Samples of crystallin will be in phosphate buffer with a pH of 7.4. Fourier Transform Infrared (FTIR) spectroscopy and deconvoluted peak data will be used to yield information regarding alterations in the protein's secondary structure. The observed conformational variances of crystallin with regards to temperature regulation will also be determined. This allows us to test the temperature range at which the crystallin can maintain its chaperone responsibilities and still have the ability to maintain its original conformation.

Student: Mr. Kelvin E. Turner II, Norfolk State University, Department of Biology, Senior

Mentor: Dr. Kenneth W. Hicks, Norfolk State University, Department of Chemistry, Professor

BIOFILMS WITHIN OUR ENVIRONMENT

Biofilms are a group of interconnected microorganisms that form a matrix on living or nonliving surfaces within a nutrient-rich aquatic environment. The purpose of this study is to see what microbial organisms will undergo a transition from planktonic cells (free floating) to members of a biofilm matrix in response to a nutrient-rich media. In the medical field, biofilms can cause infections pertaining to implants, catheters, and many other medical devices. Biofilms are also responsible for different types of diseases which include Otitis media, Endocarditis, and Cystic Fibrosis. Environmentally, biofilms can cause pipe corrosion and blockage and water contamination. In contrast, biofilms can also treat environmental wastes, break down soil-bound contaminates, and inhibit air pollution (Stoodley 2002). Biofilms will only form in nutrient-rich environments. The presence of biofilms can therefore indicate good environmental quality and the separation back into planktonic cells indicates poor quality. Biofilm presence could serve as a gauge of environmental quality. Biofilms attached to particles of contaminated soils and aquatic sediments help degrade soil-bound contaminants occurring from accidental chemical releases into the environment. They also attach to the plant roots of some crops to help cycle nutrients to and from the plant which results in increased agricultural productivity (Watnick 2000). This research will identify some of the initial colonizers of biofilms and the relatedness of these microbes to each other. The samples will be taken from the Elizabeth River and Chesapeake Bay tributaries. These locations should provide sufficient microbial diversity. A compact disk (CD) rack constructed of a (PVC) pipe with secured CDs serves as the attachment site for the biofilms. The CDs are the placed in sterile deionized water and transported to the laboratory for analysis. The biofilms will then be characterized by using basic microbial techniques.

Student: Ms. Brandie Vickers, Norfolk State University, Biology Major, Junior

Mentor: Dr. Carollyn Boykins-Winrow, Norfolk State University, Biology Department, Assistant Professor

UNIVERSITY OF DISTRICT COLUMBIA

Computer Science
Web Delivered Exam System

Web delivered exams are becoming an accepted way of testing at many Universities. With this trend come issues of authentication and security. Administrators need to know that the proper person is taking the test in a secure manner. This application uses Radio Frequency identification (RFID) as a means of authentication. The Application is designed to read information about a student from a RFID tag and generate a test based on that information. The application itself has three major roles: authentication and logging, exam generation, and sever page deployment. The authentication part of the program is designed to read the Transponder ID from a RFID tag through a Texas Instruments S350 midrange RFID Reader. Upon a successful read the ID is checked against a database of users. Once authenticated the program writes a timestamp to a log in a database and also to the RFID tag. The user is then given the opportunity to choose one of the available exams to be taken. At the end of this process a webpage is generated with the appropriate exam. The exam generation part of the program is maintained solely by the instructor. The system provides an interface for the generation and editing of exams. Once the generation of an exam is complete, it is saved temporally as an XML file then converted into entries in a database. The final phase of the application gets the request from a user and generates an Active Server Page containing the desired exam. Upon the completion of the exam, it is scored and the result is written back to the database.

Altogether the program provides a user-friendly, authenticated and secure way for developing and deploying web-delivered exams.

Students: Dion John, Enoila Awofodu, Gerald Emamali, Huan Li Etete Ibok

Mentor: Lavonne Manning

Synthesis, structures and anti-tumor activities of a series of new ionic organotin compounds

Organotin compounds are compounds that have at least one carbon tin bond. Organotin compounds have major applications in various industries such as agrochemicals, PVC stabilizers, catalysts, glass coatings and biocides. Di and triorganotin compounds have long been known for their effective biological activities. The biological activities of di and triorganotins depend on the R groups attached to the tin atom. The antitumor activity of di and triorganotins has been developed as potential antitumor agents. For example diorganotin analogies of cisplatin and carboplatin have antitumor activity against MCF-7, a mammary tumor, and WiDr, a colon carcinoma, and triorganotins carboxylates have been found to be very active *in vitro* against the same two human cell lines. However, their drawback is their insolubility in water. Addition of a quarternary ammonium moiety onto the triorganotin would reduce this problem. Therefore a series of ionic di and triorganotins will be synthesized by reacting triphenyltin chlorides(Ph_3SnCl)/triphenyltin hydroxides(Ph_3SnOH) with diprotic acids (thiolactic acid, thiosalicylic acid, 3-(2-phenyl)-2-sulphanylpropenoic acid, 3-(2-thienyl)-2-sulphanylpropenoic acid and 3-(2-pyridyl)-2-sulphanylpropenoic acid) in the presence of an amine. The purity of the products will be determined by their melting points and elemental analysis. The structure of the desired products will be characterized by using various analytical methods, including IR, Mössbauer and multinuclear NMR (^{1}H, ^{13}C and ^{119}Sn) spectroscopies. X-ray chrystallography will be performed for suitable crystals to confirm their structures. Anti-tumor activity against certain tumor cell lines will also be conducted as potential anti-tumor agents.

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RENEWABLE ENERGY: WIND-SOLAR HYBRID ENERGY SYSTEM

Over the years there has been the craving to replace the use of fossil fuels to work our machines and to generate power with the use of renewable sources of energy. The wind-solar hybrid energy system is a project that was set up to further enhance the development of renewable energy combining wind and solar (sun) energy in a single system. With the research on this hybrid system, a renewable energy system is put in place whereby, the wind compliments the efforts of the sun in generating electricity and vice versa.

The project integrates a 400 watts wind turbine with an existing 30 watts solar system to generate an average seasonal wattage of 9.3 kWh. The project allows for the addition of wind energy inputs in conjunction with the solar panel for fuel saving. In this view, a battery bank is introduced to manage the load demand during peak hours. Moreover, it is shown that combinations of wind turbine and photovoltaic arrays are more effective than either one alone over the estimated seasonal resource. The project demonstrates how wind-solar hybrid energy system is used as ways by which devices, machineries, and tools are powered to bring ease to humanity and aid human in performing day to day activities. The basics of these (wind and solar) sources of energy, how they are formed and used to generate electricity are explained in this study. The merits, demerits and also the factors affecting the location of the hybrid system were discussed.

In addition, this report includes future development that can be carried out in constructing a bigger hybrid system which might include a hydro system. The project talks about ideas that can be expanded extensively to help reduce or completely eradicate the pollution of the environment. It also gives an outlook of how electricity can be generated, and made cheaper than the already existing cost of electrical power. The data collected, their importance and the complexities encountered in accomplishing this project are discussed in details. Finally, the economic dispatch of the wind turbine and the solar panel were analyzed for the hybrid system.

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Synthesis and Evaluation of Vitamin E Conjugates

The aim of this project is to conjugate antitumor nucleosides to major vitamin E components α-tocopherol and δ-tocopherol. The mode of action for these nucleosides dictates that they must first be phosphorylated by cellular enzymes in a stepwise manner to the triphosphate level in order to become activated. Thus, there is an advantage in introducing these drugs in the 5'-monophosphorylated form since the first the first phosphorylation step is probably the most difficult. The highly charged nucleotide would not, however, be able to readily penetrate the cell membrane. To avoid this problem, the highly lipophilic tocopherol unit can be attached to the 5'-mononucleotide form of the drug via a phosphodiester linkage that would tremendously increase the membrane transportability of these compounds. Finally, upon entry into the cell, the conjugates would be cleaved by cellular phosphodiesterases.

Preparation of the nucleotide-tocopherol conjugates would involve first converting the nucleosides to the corresponding nucleoside phosphodichloridate by treatment with phosphoryl chloride. Tocopherol would then be added to the reaction mixture after stirring for four hours in an ice bath. Displacement of a chloride by the phenolic group would yield the phosphodiester conjugate. The reaction will be observed by thin layer chromatography.

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