Alabama A&M University

Increasing Global Competitiveness Through STEM

STEM DAY 2009

Alabama A&M UNIVERSITY

Office of the President
P. O. Box 1357
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March 25, 2009

Dear STEM Day Participants:

I am pleased to extend my personal greetings and support to the participants of the 3rd Annual Science, Technology, Engineering and Mathematics (STEM) Day at Alabama A&M University. As in the past, this special day provides a wonderful opportunity for students, along with faculty mentors and advisors to showcase the results of the research projects they have undertaken in the various STEM disciplines. These research projects focus on such topics as the growth and analysis of nonlinear optical crystals, fungal pollutants in the environment, food process engineering, soil microbiology and bioremediation and microelectronics fabrication. The theme for this years' competition, **"Increasing Global Competitiveness Through STEM,"** underscores the potential for the students at Alabama A&M University to significantly impact the world through cutting edge science.

Best wishes to each of you in the poster competition and congratulations to all faculty and students for your outstanding accomplishments in advancing the sciences and encouraging our students to involve themselves in such noteworthy research projects.

Sincerely,

Beverly Edmond
Interim President

Alabama A&M UNIVERSITY

Academic Affairs
P. O. Box 287
Normal, Alabama 35762
(256) 372-5275 Office
(256) 372-5278 Fax

April 3, 2009

Dear STEM Day Participants,

It is indeed a pleasure to greet you on the occasion of the third annual STEM Day at Alabama A&M University. Though individual units have held student showcases in the past, STEM Day is an excellent demonstration of collaboration that all of the sciences at the university can now come together to display their students' achievements. Not only is this an excellent opportunity to see what the students are doing, it is a good time for the faculty to pursue possible research partnerships. In this day and age where science crosses boundaries, this type of multidisciplinary display of research effort allows us to seek new pathways across those boundaries.

In keeping with the theme "Increasing Global Competitiveness Through STEM", I am sure the student scientists have prepared posters of their work which will demonstrate the validity of this theme. I have thoroughly enjoyed each of the previous STEM days and look forward with eager anticipation to this one.

I wish the poster presenters good luck in the competition. Though I know that only a few students will be given the top prizes, you are all winners to us.

Sincerely,

Juarine Stewart

Interim Provost and Vice President for Academic Affairs

Office of Institutional Research,
Planning and Sponsored Programs
P. O. Box 411
Normal, Alabama 35762
(256) 372-5675 Office
(256) 372-5030 Fax

April 3, 2009

Dear Participants:

Welcome to STEM Day at Alabama A&M University. We see this day as a fun way for students to be exposed to the world of science and engineering, and to get the opportunity to conduct simple lab experiments and meet faculty, staff and students of our various STEM disciplines.

A major component of the infrastructure needed to make STEM activities successful is the partnership of education with business and industry. This year, as in years past, we have encouraged and invited business leaders, particularly those interested in the development of a technically skilled labor force, to attend these activities.

With the theme, "Increasing Global Competitiveness through STEM," our goal is to share strategies that would promote student success in science, technology, engineering and mathematics from the elementary grades through higher education. We believe that to succeed in this increasingly integrated global economy, we must prepared students who are technologically savvy with the ability to think critically. As such, I am confident that STEM Day 2009 will give you fresh perspectives, knowledge, and enthusiasm for the future.

We encourage your full participation and input in these activities. Again, welcome to STEM Day.

Sincerely,

Teresa Merriweather Orok, Ph.D.
Vice President
Institutional Research, Planning and Sponsored Programs

April 03, 2009

Greetings,

We thank you for attending and participating in the Third Annual Science, Technology, Engineering and Mathematics (STEM) Day at Alabama A&M University. This is a special day to celebrate the accomplishments of our students in research and senior projects. We are proud of all of our students and their accomplishments. These accomplishments are clear indications of the aspirations of our students and their faculty mentors in the STEM disciplines.

The research and senior projects displayed by our young mathematicians, scientists, engineers and technologists at this event are the result of a combination of inspiration, support and hard work by all concerned stakeholders. Experts on best practices in the STEM disciplines indicate that both supplemental instruction (instruction that carries the learner ahead of the teacher's didactic lectures) and positive "out-of-the-classroom experiences" are essential techniques for retention and excellence. The occasion of this celebration is meant to be one such positive experience.

The theme for STEM Day 2009 is "Increasing Global Competitiveness through STEM". Our aim is to form links and collaborations between the various areas of STEM education not only on campus but also with industry. Many of the concepts and techniques that are essential to success in various careers are learned in Alabama AAMU's classrooms and laboratories. Through the STEM Day activities we hope to continue to encourage and sustain our students' critical thinking abilities and enhance their confidence in their ability to produce innovative work. STEM Day rewards hard work, students get recognition, build their resume and network effectively for workforce placement. Through the STEM Day we show and encourage student-faculty partnership in research, teaching, learning and thereby enhance the team working skills of both our faculty and students. We sincerely hope that as you participate in this program, you will be delighted with their accomplishments.

Finally, as many of these students prepare to leave the University and get into an increasingly competitive workforce, we hope that we have imbued them with the work ethic, analytical skills, and scientific and engineering knowledge necessary to succeed. Also, we hope that they become researchers, inventors, entrepreneurs and strong advocates for science, engineering and technology.

Very sincerely yours,

Robert Taylor, PhD
Dean,
School of Agricultural
& Environmental Science

Very Sincerely Yours,

Matthew Edwards, PhD
Dean,
School of Arts & Sciences

Very sincerely yours,

Trent Montgomery, PhD
Dean,
School of Engineering

April 03, 2009

Greetings,

Welcome to the Third Annual Science, Technology, Engineering and Mathematics (STEM) Day at Alabama A&M University. We are proud of all of our students who are presenting their research or senior projects, and encourage you to view their posters. We are especially delighted to have about eighty abstracts for STEM Day 2009. This is a clear indication of the hard work and aspirations of our students and their faculty mentors in the STEM disciplines.

The theme for STEM Day 2009 is "Increasing Global Competitiveness through STEM". The tremendous rate of technological change and globalization has increased the need for our students to keep current on multiple and complex topics in the STEM discipline in order to be productive, innovative citizens. Since we all live in an increasingly integrated global economy with new challenges; at Alabama A&M University, our students are continually encouraged to be innovative and this can only happen through effective integrated teaching curricula and positive out-of-the-classroom experiences. STEM DAY 2009 is meant to be a show case of such positive experience. Many of our STEM undergraduates choose to attend graduate, medical, or law school, while some go straight into the workforce. Classes at AAMU are constantly evolving to include up-to-date information and to integrate new technologies and basic scientific, sociological and psychological concepts. The result is a well-prepared student who can use his or her professional knowledge in a variety of fields including scientific, technical, engineering, or biomedical professions.

The 2009 STEM Day committee would like to thank organizations and various individuals for their financial and 'in-kind' support of STEM Day 2009. We especially thank the faculty for their excellent mentorship guidance of their students, our guest speakers, judges, university administration and support staff. Please go view the posters and enjoy your day.

Sincerely Yours,

Florence Okafor, PhD
Co-Chair, STEM Day 2009
Associate Professor
Department of Biology

Sincerely Yours,

Showkat Chowdhury, Ph.D.
Co-Chair, STEM Day 2009
Professor
Department of Mechanical Engineering

Table of Contents

Alabama A& M University
Third Annual STEM Day
April 3, 2009

Schedule of Events

Presiding Official: Dr. Jeanette Jones, Professor

7:30 – 8:30		Poster Setup Elmore Gymnasium

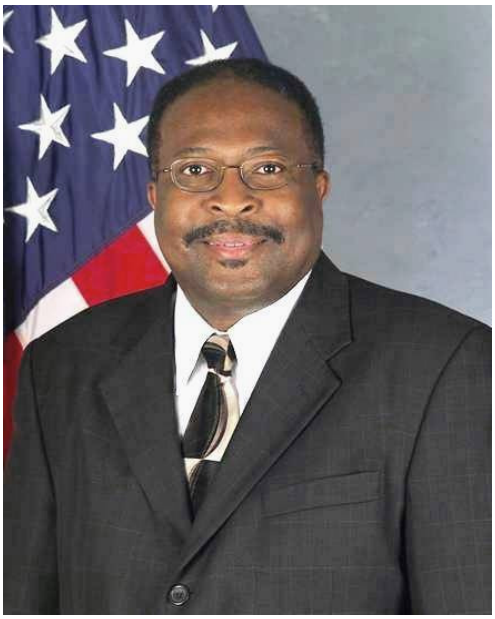
Plenary Session

8:30 – 8:40	Welcome and Occasion	
		Dr. Florence Okafor and Dr. Showkat Chowdhury Co-Chairs, STEM Committee
8:40 – 8:55	Greetings	Dr. Teresa Merriweather Orok Vice President, IRPSP
		Dr. Matthew Edwards, Dean School of Arts and Sciences
		Dr. Robert Taylor, Dean School of Agricultural and Environmental Sciences
		Dr. Trent Montgomery, Dean School of Engineering and Technology
8:55 – 9:00	Introduction of Speaker	Fana Mulu-Moore Ph.D. Student, Physics
9:00 – 9:45	**A Successful STEM Career**	Dr. Paul B. Ruffin
		Senior Research Scientist Micro-Sensors & Systems U.S. Army Aviation and Missile Research, Development, and Engineering Center, Redstone Arsenal, Huntsville, Alabama
9:45 – 10:00	Questions	
10:00 – 12:30	**Poster Viewing**	**Elmore Gymnasium**
10:00 – 12:30		Posters Judging Dr. Monday Mbila, Chair STEM Judging / Awards Sub-Committee

12:30 – 1:20	Lunch	Elmore Gymnasium
1:30 – 1:35	Introduction of Speaker	Danielle Moore Undergraduate Senior, Mechanical Engineering
1:35 – 2:00	**Increasing Global Competitiveness through STEM**	Mr. Claude Oliver Manager 20 Systems Integration Analyst Lockheed Martin Corporation Owego, New York.
2:00 – 2:20	**Awards**	President Beverly Edmond Provost Juarine Stewart Dr. Florence Okafor and Dr. Showkat Chowdhury Co-Chairs, STEM Committee Dr. Monday Mbila, Chair STEM Judging/ Awards Sub-Committee
2:20 – 2:30	Closing Remarks	Dr. Florence Okafor and Dr. Showkat Chowdhury Co-Chairs, STEM Committee
2:30	Poster Removal	Elmore Gymnasium

Biography

Department of the Army



Paul B. Ruffin

Senior Research Scientist (ST)
Micro-Sensors and Systems
U.S. Army Aviation and Missile Research, Development, and Engineering Center
Redstone Arsenal, Alabama

Plenary Speaker: Dr. Paul B. Ruffin

Dr. Paul B. Ruffin is an award-winning, world-renowned scientist and educator. During the past twenty-eight years he has been a prominent research physicist at the U. S. Army Aviation and Missile Research, Development, and Engineering Center (AMRDEC) conducting exploratory and advanced research and development in Fiber Optics, Micro Electro-Mechanical Systems (MEMS), and Nanotechnology. In July 2003, Dr. Ruffin was promoted to the highest rank for a research scientist – senior research scientist (ST) – that anyone could achieve in Government service, making him the first African-American to ever attain such status in the Army.

Dr. Ruffin, a native of Gilbertown, Alabama attended the public schools of Choctaw County (South Alabama). He received the undergraduate degree in physics from Alabama A&M University in 1977. He later became the first African-American to receive advanced degrees in physics from any School of Higher Learning in the State of Alabama when he received a master's degree in physics in 1982 and a Ph. D. degree in physics in 1986 from the University of Alabama in Huntsville, Alabama.

Dr. Ruffin's research has resulted in six patent awards, one book (co-editor), four book chapters, and numerous peer-reviewed journal articles. He has received a number of prestigious awards from major national organizations for his technical

accomplishments. He is a two-time recipient of the Secretary of the Army's Research and Development Achievement Award – the highest honor that the Army gives for research and development, national acknowledgement as the Black Engineer of the Year: Special Recognition Recipient by the Council of Engineering Deans for Historically Black Universities, the Technologist of the Year Award from the National Society of Black Engineers, the Top Ten Army Materiel Command Personnel of the Year Award, the Material Acquisition/Technology Award from the American Defense Preparedness Association, and recognition for a Canadian Patent. Last year, Dr. Ruffin was nominated for the Blacks in Government Meritorious Service Award.

Both Schools of Higher Learning from which Dr. Ruffin matriculated have recognized his technical accomplishments. In May 1997, he was presented the Class Achievement Award from Alabama A&M University Class of 1977 and in May 2005, he was inducted into the Alabama A&M Alumni Hall of Fame in Science. In July 2005, he was presented the William Hooper Council Alumni Award. In April 2003, he was presented the Alumni of Achievement Award from the University of Alabama in Huntsville and in April 2005, the College of Science presented him with the Distinguished Alumnus Award.

Dr. Ruffin has maintained active membership in professional and scientific societies for the past 18 years. He was recently elected to the distinction of Fellow of SPIE International Society for Optical Engineering. He has significantly contributed to the professional and technical communities by his mentoring of high-school and undergraduate students during the Army's summer intern programs, teaching physics and optics courses at Alabama A&M University in his capacity as adjunct professor, and ten years as Education Director for the Huntsville Association of Technical Societies where he has been responsible for designing science enrichment programs for K-12 students. In addition, Dr. Ruffin serves on graduate students advisory committees at the University of Alabama in Huntsville and Worcester Polytechnic Institute in Worcester, MA.

Dr. Ruffin has conducted lectures/seminars to educate/motivate high school students participating in Science Fairs at the North Alabama Science Center and young college-age students participating in the National Science Foundation Workshop/Short Course on Sensor Science and Technology at Alabama A&M for scientific pursuits. In addition, Dr. Ruffin has served as a judge for the State of Alabama Science Fairs.

Dr. Ruffin, who is the pastor of the Forge Temple Church of God in Christ, devotes a great deal of his time providing assistance to the economically disadvantaged in the community and ministering to the downtrodden and brokenhearted. He served as Director of the Dr. Paul B. Ruffin Math Tutoring Academy (named in his honor) – a science and math tutoring support activity initiated to assist K-9 students that reside in public housing in the Huntsville, Alabama area from 2004-2006. He is happily married to his wife of 31 years, Vetrea Slack Ruffin, who is a Department Secretary at Alabama A&M University and a Gospel Recording Artist. Their two daughters, Lacretia Ruffin Conaway and Angel Ruffin, graduated from Alabama A&M. Lacretia's husband, Kellen Conaway, is also an Alabama A&M University graduate. They have two grandchildren.

Closing Speaker: Mr. Claude Oliver

Biography

Claude Oliver is the manager of a department of 20 Systems Integration Analyst at the Lockheed Martin Corporation in Owego, New York. Claude has extensive experience in Project/Program Management in the development and implementation of financial management and accounting systems. He has a wealth of knowledge in a number of large Best Practice migrations from legacy systems. He is known for his strong interpersonal and communications skills.

A graduate of Alabama A& M University, Claude has supported University Relations in recruiting for the Lockheed Martin Corporation for a number of years. He works closely with the AAMU Office of Career Development Services serving on its Advisory Board for YMTF and as one of Lockheed Martin's corporate recruiters. He is instrumental in the hiring of Alabama A&M University students. Claude is a former member of the EBS Diversity Council, which serves as the focal point in championing the Company's efforts in creating and maintaining an environment that naturally enables all employees to contribute to their full potential in pursuit of organizational goals and objectives.

In 2003, Claude was the recipient of the NAACP Religious Affairs Award. In addition to singing in the Faith Temple Church choir, he is the Youth Minister and serves on the Board of Directors. Claude also serves as the Southern Tier District Youth Department President and is a member of the Corning-Elmira Branch of the NAACP, Heritage Park Board of Directors, the Equal Opportunity Program advisor and works closely with the Elmira City School District. In 2007, Claude was the recipient of the Chemung County Distinguished Citizen Award.

Claude and his wife of 21 years, Michelle Marie Oliver, are the proud parents of three children, James Terrance 19, Claudia Michelle 16, and Micah Steven 14. The family resides in Elmira, NY.

Abstract Categories: Civil Engineering
Senior Projects and Undergraduate Students

#1 Design of a Reinforced Concrete Stair Case

Alonzo Washington (Senior Student), T. Chowdhury (Advisor/Mentor), M. McLaurin, G. Turner
Department of Civil Engineering
AlanzoWashington21@yahoo.com

In civil engineering, structural design is a process of applying engineering mechanics and experience to create a functional, economical, and, most importantly, safe structure for the public to inhabit or to use. Using Reinforced Concrete Design Techniques and conforming to design specifications and the local design codes, the design of staircase is a unique structure where the different design of all the components of structural design can be incorporated. In this project a reinforced concrete staircase has been designed where it include a Slab Design, Beam Design, Column Design and a Foundation or Footing Design. The design consists of two slab designs, one for landing slab and one for inclined slab. Two different beams have also been considered, where one is the intermediate beam and other is the corner beam. The load of the beam is transferred to column, so column design has also been performed for corner column and intermediate column. The column transfers load to the footing and the footing to the soil. Foundation or footing of the column has also been designed to complete the staircase design. Live Load has been considered according to the code and requirement, Dead Load of each component has been calculated to integrate them in the design. Detail size of the structure, diameter of the reinforcement, spacing of the reinforcement, temperature & shrinkage reinforcement, spacing of vertical ties for column etc. has been calculated according to ACI (American Concrete Institute) code. All the design detail has been drawn in Microstation Graphics Software. An alternate design for Steel Staircase has also been compared.

#2 Nanotechnology in Water Purification

Racquel Johnson (Senior Student), G. Liaw (Advisor)
Department of Civil Engineering
ra_johnson19@yahoo.com

Water is the most essential element for all life on earth. It covers 70-75% of the earth's surface and only a mere 0.007% of all the water on earth is accessible for direct human uses. The water we drink today is not 100% pure. Hence, household drinking water filters are developed to ensure better quality water throughout the home. What most people are unaware of is that, household water filters are not entirely safe and do not remove every existing contaminant. The modern day household water filters on the market, filters some contaminants, 99% if not less. The other 1% (or more) of the remaining contaminants is still in the water that is assumed to be pure. So how do we address such an extensive issue? Recent developments in nanotechnology (technology at the nanometer scale) in relations to water purification may be the ideal method of purifying water. Various companies have already taken that step by manufacturing nanotechnology-based filters. The question is, are they more efficient, faster, or

economical than the conventional household filters? The purpose of this study is to compare the efficiency of water purification using nanotechnology as oppose to conventional household water filters. If nanotechnology is more efficient in water purification, then we could have a faster process for obtaining better quality water.

#3 New Sports Arena for Alabama A&M

Tarrance Copeland (Senior Student), J. Foreman (Advisor/Mentor)
Department of Civil Engineering
Tarrance.Copeland@mailserver.aamu.edu

The new sports arena will take the place of the Elmore Gym. This project will indeed put to use the programs AutoCAD and Micro station. The arena will be located on Meridian St. between Normal Hills Apartments and J.F. Drake College. The arena will allow basketball, volleyball, and tennis games to be played there. The arena will include (4) ticket booths, chair back seats, (2) high-definition video board with full message/information, a new sky bar, and a new food court. The new arena will definitely provide a new public appeal. It will also allow high schools to have tournaments which will provide funding to the university. Also, it will hopefully increase the school spirit and attendance to the games, which in turn will pep our athletes up and allow them to win more games.

Abstract Categories: Computer Science Senior Projects and Graduate Students

#4 Data Compression Algorithm

DeAnnquntter Bryant (Senior Student), J. R. Gangasani (Mentor/Advisor), F. Allen, and P. Bording
Department of Computer Sciences
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This project examines a variety of data compression methods spanning almost forty years of research, from the work of David A. Huffman in the late 40's to a technique developed in 1986. Huffman coding is an entropy encoding algorithm used for lossless data compression. The term refers to the use of a variable-length code table for encoding a source symbol (such as a character in a file) where the variable-length code table has been derived in a particular way based on the estimated probability of occurrence for each possible value of the source symbol. Huffman coding uses a specific method for choosing the representation for each symbol, resulting in a prefix code (sometimes called "prefix-free codes", that is, the bit string representing some particular symbol is never a prefix of the bit string representing any other symbol) that expresses the most common characters using shorter strings of bits than are used for less common source symbols. The aim of data compression is to reduce redundancy in stored or communicated data, thus increasing effective data density. Data compression has important application in the areas of file storage and distributed systems. Concepts from information theory, as they relate to the goals and evaluation of data compression methods, are discussed briefly. A framework for evaluation and comparison of methods is constructed and applied to the algorithms presented.

Comparisons of both theoretical and empirical natures are reported and possibilities for future research are suggested.

#5 Implementing Parallel Processing in Java Applications

Christopher Sumlin (Senior Student), J. R. Gangasani (Mentor/Advisor), and P. Bording
Department of Computer Science

Parallel computing is often confused with concurrency, where multiple individual tasks are executed simultaneously. Executing more than one application working at the same time on a multi-processor system helps applications to be produced faster, and cheaper. Parallel computing, however, is more involved than simply creating multiple threads in your application. It is the execution of one task on multiple processors (or multiple-processor cores) at the same time, where both the processing and the results are highly coordinated. In this proposal we are implementing applications that require to break up the execution of a single task into pieces that can be executed in parallel and then combined, resulting in faster overall task processing.

#6 A Sample Criminal Investigation of Digital Data Using Forensic Computing

Bryant Golay (Senior Student), and V. Atluri (Advisor)
Department of Computer Sciences
bryant.golay@yahoo.com

With the advances in information technology, there is an equally fast rise in crime perpetrated using computers as a tool. Hence, there is no need to stress upon the importance of or need for forensic computing in the era of digital crime. The techniques in forensic computing will allow us to obtain and analyze digital data as evidence and find the perpetrator. In the present work, a sample digital evidence is obtained, analyzed and a report is created, using forensic computing tools. The report will try to answer questions raised at the beginning of the forensic investigation.

#7 Car Rental Systems

Nisrine Enyinda (M.S. Student), Yujian Fu (Advisor)
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This paper presents a car rental system based on software engineering methodology. The system provides following services to valuable customers: car reservation, membership, searching for cars, location selection, time selection, update policy). The class diagram provides a static design of the system, object interaction is described by sequence diagram, and the state transferring of the system is described by state-chart diagrams. The system has following services: : Rent Car, Make Reservation, Cancel Reservation, Renew Reservation, Return Car, and Change Car, Get membership, Log on, Log off. We are going to use OCL to realize these diagrams. System properties are described by Object Constraint Language (OCL). We will use an implementation of J2EE for development and deployment. This implementation supports requests for servlets and JSP for the server side programming. For data storage and management,

we will use an open source relational data base. For the testing phase, we will use acceptance testing, installation testing. This project provides high quality high performance and reliable car rental management.

#8 User Centric Speedy Car Rental System

ED Pearson III (M.S. Student), J. Fu (Advisor)
Department of Computer Science
ep_3@yahoo.com

This project is to develop a user-centric speedy online car rental system. The user centric design is to ensure the system not only meeting the needs of the customers but the goals of end users as well. Through the use of standard web conventions, user centric design can help leverage what the user already knows about the web, and enable them to find what they are looking for faster. To ensure that the development of the software is precise, software engineering methodologies will be deployed.UML diagrams will be used to show the static and dynamic design of the system. The class diagram with their attributes and relationships is used to describe the system organization and construction. State transferring can be illustrated by the state chart diagrams, and the object interaction can be displayed by the sequence diagram. The system's database will be done in oracle 10g software, and the GUI design will be done in C#. Through the use of software engineering methodologies and the concept of user centric design customer's requirement will be met precisely. The system handles two types of users -- customers and administrators. Customers can search/ browse location, availability, price, and model of a car. Where as the administrators may reset passwords for members, update cars, review or modify user information, and add/delete/suspend members. Administrators at no time while logged in as an administrator will be allowed to rent a car. The application will keep track of all payments and payment information. No reservations will be finalized with out pre-payment with credit or debit card.

Abstract Categories: Electrical Engineering
Senior Projects and Undergraduate Students

#9 The AC Electrical Conductance in Pyroelectric Material

Anthony Moore (Senior Student), C. A. Simmons, M. A. Alim, A. K. Batra,
Department of Electrical Engineering
anthonym704@yahoo.com

The piezoelectric material Triglycine Sulfate (TGS) doped with Aluminum (Al) and Aluminum-Neodymium (AlNd) was investigated using ac small-signal measurement frequency in the range 10 Hz ² f ² 1 MHz at elevated temperatures (20 oC ² T ² 80 oC). The TGS sample was sandwiched between two silver (dag) paste materials with an electrode terminal extended out on each side for the ac electrical measurements. The data collected from each sample were analyzed via four complex plane formalisms and Bode plots that indicated an operative relaxation process. This corresponds to the equivalent circuit modeling extracted from both complex planes and Bode plots. These equivalent circuits can be converted from one another based on the interpreting view point. The relaxation process extracted from the complex capacitance plane is

thermally activated, and is attributed to the underlying operative conduction process.

#10 High Altitude Balloon Team Aces Select

Christopher Miller (Senior Student) J. Piccirillo and K. Cook (Advisor), S. James, Sergio Hicks, and A. Ogunna,
Department of Electrical Engineering

Our teams senior design project is the Amateur High Altitude Balloon. Our team chose the name "Team Aces". Amateur ballooning is the flying of unmanned, high altitude balloons that are mainly used for experimentation purposes or for sport. Our team's balloon is being designed for experimental purposes. The amateur balloon as a whole consists of a latex weather balloon, cut-down package, a parachute, communications package with GPS tracking, and a payload. All these components are strung together with cord to make up the balloon train. An amateur balloon with all its components can rise to altitudes of approximately 100,000 feet before the balloon bursts. The average flight time for an amateur balloon is approximately two hours and it may travel hundreds of miles or only a few miles depending on the winds and the weather. To meet FAA (federal aviation administration) regulation, our balloon train is being designed to weigh less than 12 pounds. To meet this weight budget each component on our balloon train will weigh less than 6 pounds. The objectives of our project are to design and construct a payload that will be sent into the atmosphere and use to record internal and external temperature, record imagery, and measure atmospheric pressure, determine speed of sound at high altitudes, measure dynamic tilt using an accelerometer, and lastly recording solar power using solar panels. A microprocessor will be implemented to document the data received by our pressure sensor and our accelerometer. Among these objectives it is noted that construction of the payload will be designed so that temperature inside it will remain comfortable enough for our devices to continue to operate properly when the balloon reaches the cold temperatures at such high altitudes. In order to meet these objectives our team plans to use an extensive amount of time implementing various tests on each sensor and device to make sure all guidelines and requirements are achieved before launching the high altitude balloon.

#11 Data Processing Tool Development for the Miniature Air Launched Decoy

William Palmer (Senior Student), A. Scott (Mentor/Advisor), T. Ezell
Department of Electrical Engineering
WilliamJ.Palmer@yahoo.com, jabari_ezell32@yahoo.com

This project provides a test data processing tool development service for the Miniature Air Launched Decoy (MALD) project, in support of electronic warfare (EW) operational test and evaluation. Participating students support development and delivery of a Flying Properties Tool for the MALD decoys. Duties include test planning, test evaluation, and test reporting services. Sample Sensor (TSPI) data from completed flights were supplied by the SAIC test team to the Alabama A&M team. The Alabama A&M team used the data to support construction of a three dimensional model or tool which will be able to play back the flight and compare the actual-to-planned route and timing. It is anticipated that the output will take the form of animated video files. The model output (video files) will be used to support future test planning, briefings, and

reports. Subsequent TSPI data sets will be run through the Alabama A&M tool to evaluate the robustness of the tool, and to assess flight accuracy of the MALD. A graphical data analysis tool called MAnTSS was acquired to assist in the construction of animated video files. Students were trained, and gained competency with the tool. Additional capabilities were added to the MAnTSS system to meet the project goals.

#12 Perimeter Alarm Sensor System

Roger Betts Jr. (Senior Student), Andrew Scott (Advisor), Collis Sims (Senior)
Department of Electrical Engineering
rogerbetts@hotmail.com: collis_sims@bellsouth.net

The purpose of this project is to provide a perimeter alarm sensor system for soldiers, personnel, and equipment in any terrain under harsh conditions (high/low temperatures, snow, rain, wind, blowing sand etc.) The sensor system will be comprised of various sensors with different constraints. The system will consist of a sensor system with 360 degree coverage 300 ft away from a CPP RWS (Command Post Platform with Rigid Wall Shelter). Candidate sensors were analyzed to determine the functionality under these unique environments. The design was simulated utilizing LogicPro and Labview software to determine the feasibility of each sensor. Hardware was specified and ordered for proof of concept demonstration.

#13 Ultra Wide Band Radar Intrusion Detection System

ShuRhonda Bradley (Senior Student), S. Massey (Mentor), Brian Beecham (Senior), Eliapenda Kopwe (Senior),
Department of Electrical Engineering
bistaticradar@ymail.com.

Ultra wideband radar intrusion detection system project will require our team to achieve an operational familiarity with both radar hardware and software utilizing Time Domain Corporation's P210 Ultra Wide Band (UWB) bistatic radar system. The UWB system generates a coverage zone in free space, and will be used to detect objects that enter the coverage zone. Our team will become familiar with the setup and operation of the UWB system. Team will design and conduct experiments to demonstrate system performance. New software will be developed code where possible to demonstrate improvements. The project will require our team to design, set-up, and implement a surveillance system using a bistatic ultra wide band radar system to detect intrusions at the perimeter of the radar fence for the following objects: slow moving automobile, a person walking slowly, and a person running. Data will be collected, processed, and displayed results will be represented graphically in real-time for each of the above experiments. Final output will contain description of the UWB radar systems: interconnection to PC and router network, describe how the system operates to detect moving objects, plot of target detections when threshold levels are exceeded for experiment, summary description of each experiment, recommendations to improve system performance based on what has been experienced, upgrades that could be made to existing MATLAB code, and provide any new code developed by the team over the duration of this project.

#14 Balloon Satellite and High Altitude Balloon

Jonathan Montgomery (Senior Student), K. Cook J. Piccirillo (Advisors), M. J. Kenton, J B White
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The high-altitude balloon project encompasses the flight of a latex weather balloon to heights of nearly 100,000 feet. The balloon will travel through the Troposphere, and will reach maximum altitude approximately halfway through the Stratosphere. The balloon will have a balloon train attached to it that consists of a parachute, a communications package a cut-down package, and a scientific payload. The payload consists of sensors and components used for the purpose of atmospheric and scientific measurements. The team is using an array of sensors and measurement tools, and interfacing those components with a microcontroller. The team will also construct a payload container that securely houses these components. The internal and external temperature is measured and recorded by using a small data logger that has onboard storage for the data that it collects. The team will measure the rotation rate of the payload by using a gyroscope. The gyroscope will be wired to a microcontroller. The use of a solar panel will be implemented for current and voltage measurement, as well as a secondary power source for the components. Steps will also be taken to ensure the operability of these sensors in case the solar panel is rendered inoperable. The solar panel will also be interfaced with the microcontroller. In order to measure the amount of light that is acting on the solar panel, a light sensor will be used. Similar to the gyroscope and solar panel, the light sensors will be interfaced with the microcontroller. The microcontroller is essentially the brains of the payload. It processes and stores the data that is obtained by the sensors. The team also plans to take in-flight photo and video. In-flight photos will be obtained by the use of a digital camera that can be set to automatically capture images during a specified interval. Video will be obtained by the use of a simple camcorder. The balloon will be launched in April 2009. The payload will be recovered, and the results will be reported soon thereafter.

Abstract Categories: Mechanical Engineering Senior Projects and Undergraduate Students

#15 Analysis of the Negative Effects and Possible Contingencies of the Northeastern Black Out in 2003

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The Northeastern black out of 2003 demonstrates what will keep occurring in the future, if the electrical grid is not understood in more detail. In order to address this issue, the physics limitations as a result of infrastructure failures must be understood and automatic settings continuously updated. We intend to understand parameters of the dynamics of the grid and explore numerical understanding and bases determining the effectiveness of grid command and control. The study was completed using the

North American Electrical Reliability Corporation Technical Report (NERC) as the basis, to gain understanding pertaining to the events leading to and causing the black out. An analysis of the report, formal texts on electricity flow in the United States and other resource tools to see at what key points the electrical grid began to fail and then to understand interactive effects of those failures. The analysis of the NERC report with information from different sources such as: text books, internet sources, and research reports allowed for a better understanding of the systems involved with the eventual cascade. Furthermore, this allowed for different conclusions to be drawn. After assessing the report, key events leading to the black out were narrowed down to the critical few of several different events. These few events should or could have been prevented but there is a lack of understanding in Ohio and by the Independent Systems Operators and the NERC region personnel of the affected infrastructure architecture, its limits, Supervisory Control and Data Acquisition (SCADA) systems not collecting the right information often enough the events were either ignored, not known to operators, or not understood to the point where mistakes were made. Thus, it can be hypothesized that an important key problem is that there is an inherent misunderstanding of how the physics of the electrical grid operates in different instances. Which lead to black out be regulated improperly and operated through poor standards and procedures.

#16 Design of a Reusable Rocket with One Mile Apogee Capability

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The students at Alabama A&M University (AAMU) are involved in the NASA Undergraduate Student Launch Initiative (USLI) competition. The objective of the competition is to design and build a competitive rocket and its payload. The project involves undergraduate students in the design, construction, testing, launching, and recovery of reusable rockets with associated scientific payload. The initiative is intended to encourage students to pursue careers in engineering or science related fields. The vehicle should carry a science payload (instrumentation) during flight and should be developed so that it delivers the science payload to a specific altitude of 5,280 feet (1 mile) above ground level (AGL). The activities involve diverse aspects such as: scheduling, purchasing, performing calculations, financing the project, coordinating logistics, arranging press coverage, and design reviews. The students are involved in the following:: (1) Solid Propulsion System: Students are exposed to APCP motor design and testing, (2) Hybrid Propulsion System: Students are exposed to the liquid rocket engine performance and design, (3) Software Simulation: Rocksim simulation software is used to verify design parameters and analyze altitude predictions for various motors, (4) Computer Aided Design. Solid Edge is used to develop 3D models and ANSYS is used to perform structural analysis, (5) Rocket Instrumentation. Students use flight computers to determine rocket position, apogee, temperature, and velocity, (6) GPS System: The GPS System will be used to graph flight trajectory from take off to landing via Google Earth, (7) Launching and retrieving the rocket and its scientific payload.

#17 Effect of Mixed Loading on the Failure of Woven Composites

Danielle Moore (Senior Student), S. J. Chowdhury (Advisor/Mentor), M. A. Seif (Advisor/Mentor), W. Lawson , T. Edwards
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This work studied the mechanical performance of GFRP woven composites under combined tension-bending loading. Special fixtures were used to apply the bending moments through offset shims of various thicknesses placed between the specimen and the loading axis. Different experimental setups were performed to determine failure stresses, strains at different locations, out-of-plane displacement, and stress-strain relation. The experimental results showed that failure occurred near the fixture where maximum bending stress existed. In addition to the experimental study, theoretical analysis and finite element modeling of the specimen and the loading condition were also carried out. The out of plane displacement of the specimen under combined tension-bending loading as determined from the theoretical and finite element model had very good matching with the experimental data. The out of plane deflection of the specimen at the center increased rapidly with loading until it reached the limiting value, the eccentricity. The stress distribution computed by the finite element model showed that the maximum resultant stress occurred near the fixture, where the failure had been observed experimentally. In addition, the stain computed by the finite element model had very good agreement with the experimental data. Hence, the finite element model is capable of simulating the performance of the composite under different loading conditions.

#18 Moon Buggy Enhancement

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The main goal of this year's moon buggy project was to enhance the performance of last year's moon buggy. The previously used moon buggy encountered several problems such as weight, unsafe steering, and drive train issues. Also, the moon buggy's folding feature reluctantly fit into the required 4 x 4 x 4 box. The solutions that we have formulated to resolve the problems are milling holes into the I-beam, designing new tubular A-arms, designing a new center hinge for the folding feature using aluminum to conserve weight. One of the most important change in design was the new Chain-Hub interface. This insures that the chain hub and gear are centered and will not come off while driving.

Abstract Category: Mathematics – Senior Projects

#19 Least Square Model Averaging Comparison

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In linear regression, a researcher wants to find the relationship between a dependent variable and several independent variables. This situation gives rise to several different model choices that involve different independent variable combinations. Out of these choices comes the claim that there are several models that may be the most effective one. To settle this controversy, many statisticians have proposed model averaging procedures which take a weighted average of all possible models. In this paper, three different model averaging techniques are evaluated and they are Simple Model Averaging, Bayesian model averaging, and Mallow's Model averaging. A program was written on SAS to generate data and perform the model averaging process multiple times taking the average of all the mean squared error (MSE) for each data set. This step is repeated for each model averaging technique and then the average MSEs are compared as a measurement of the accuracy of the technique.

#20 A Discussion and Application of Discriminant Analysis Theory

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Students wonder how universities decide between which students are accepted or rejected into various programs. Universities usually develop a classification rule based on students that were previous accepted into the program than applies the classification rule to the incoming students decisions are then made to accept, reject, or conditional accept a student into the program. The classification rule is derived from the multivariate statistical technique, discriminant analysis. This is expository paper discuss the theory of discriminant analysis from the univariate case to the multivariate case. Discussion of how to find sample estimates of population parameters when they are unknown and how to judge the classification rule can also be found in this paper. Lastly in this paper is an example of how a university applies discriminant analysis to decide which students are accepted, rejected, or conditionally accepted into the program.

#21 Risk Management: An Assessment of Bottle Rocketry

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This work studied the ways to manage risks involved with using bottle rocketry based on real life applications such as various NASA spacecrafts. The project is designed to assess the weight imposed on a spacecraft and the likelihood/probability of those

effects happening which may cause risk, which is defined as the rate of occurrence multiplied by the impact of the event. The objective of this project is to identify the risk in the selected domain of interest, plan the remainder of the process, map out the social scope of risk management and the basis upon which risks will be evaluated, define a framework for the activity and an agenda for identification, develop an analysis of risks involved in the process, and mitigate the risks using available technological, human, and organizational resources such as Mathematics.

#22 A Statistical Study: Methods of Moments vs. Maximum Likelihood Retonya

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In this paper, we will investigate the method of moments and the maximum likelihood method. We know that the maximum likelihood method provides a more accurate estimation. In order to find out how much more accurate the maximum likelihood estimation is, we will apply both maximum likelihood and method of moments to the same problem and then analyze the results.

Abstract Categories Physical Sciences (Physics, Chemistry & Space Science) Undergraduate and Graduate

#23 Determining How the Sun's Corona is Heated by Examining the Light Curves of Coronal Loops

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The solar corona is a region surrounding the sun that is around one million kilometers above the sun's surface. The solar corona can reach temperatures of more than one million degrees Celsius. Within the sun's corona there are coronal loops. Active regions on the solar surface, regions of strong magnetic field, take up small areas but produce the majority of activity and are often the source of flares and Coronal Mass Ejections due to the intense magnetic field present. When studying the solar corona one question is constantly attempted to be answered throughout the astrophysics community: "How is the solar corona being heated when the surface of the sun is so much cooler than the corona?" In this research we are analyzing individual coronal loops at different temperatures and at different days by using an XRT. We find the intensity of coronal loops as a function of time and then determine the temperature as a function of time. From this information, we will attempt to describe the coronal heating mechanism.

#24 Isomeric Stability and Properties of Poly-Nitrogen MoleculesGeanee

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Several isomers of poly-nitrogen molecules ranging from N26 through N60 were constructed and calculations carried out. The computational approach involves a quantum mechanical method to determine their stability and properties. The most stable conformation for each of the poly-nitrogen clusters is determined by geometry optimization and confirmed by frequency calculations using a DFT method (B3LYP) with the 6-31G(d,p) basis set. 6-311+G(3df,3pd) is used to calculate the single point energy for each optimized structure.

#25 Synthesis and characterization of O, O-Dialkyl and alkylene dithiophosphate cyclo pentadienyl zirconium chloride.

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O,O'-Dialkyl/alkylene dithiophosphoric acids react with Bis (cyclopentadienyl) zirconium(IV) chloride hydride in 1:1 molar ratio in refluxing benzene to yield Cp2ZrHP(OR)2 (R = Et, Pr-n, Pr-i, Bu- and Ph) and Cp2ZrHPOGO (G = –CH2CMe2CH2–, –CH2CEt2CH2– and –CMe2CMe2–). The complexes are pale yellow solids, soluble in common organic solvent and monomeric in nature. These compounds have been characterized by elemental analyses as well as spectroscopic methods (IR, 1H, 13C and 31P NMR). The aim of this experiment is to prepare dithiosphosphate complexes, elucidate the structure of the expected compounds and to see the mode of bonding of dialkyl/alkylene dithiophosphoric acids.

#26 Theoretical study of tautomerism of 2,8-dioxo-6-methylpurine

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2,8-dioxo-6-methylpurine is the product of the enzymatic action of xanthine oxidase on 2-oxo-6-methylpurine, a very slowly reacting substrate of xanthine oxidase. Eleven tautomeric forms of 2,8-dioxo-6-methylpurine were studied by using a hybrid Hartree-Fock density functional theory (DFT) method at B3LYP/6-31+G(d,p) level. Two of these tautomeric forms, tentatively named domp279 and domp179, were found to be much more stable than the others, suggesting that this compound exists primarily in one of these two tautomeric forms. The stability of the tautomers in gas phase and in aqueous solution is discussed.

#27 Thermodynamic Analysis of Rubberlike Elasticity

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Rubber like elasticity is a physical chemistry laboratory experiment with diverse applications in polymer chemistry, biology and engineering. The utility of this simple stretching of a rubber band experiment is derived from the application of statistical thermodynamics to the study of macromolecules which may be natural, synthetic or biological. Data in the form of stress versus strain is presented which yielded an average molecular weight per network strand of 152,000 grams per mole that is in agreement with literature values of 100,000 to 1,000,000 grams per mole. Numerical and graphical analysis of data with Mathcad software is emphasized.

#28 Phase Conjugate Mirror for Laser Beam Combining

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We are investigating Phase Conjugate Mirror (PCM) recordings in a ferro-electric lithium niobate (LiNbO3) crystal doped with iron, by laser radiation. Coherent monochromatic laser light is generated by a Helium Neon (HeNe) laser. The beam is intensified as it passes through the light amplifier. The lens is used to focus the beam into the LiNbO3 crystal which exhibits phase conjugation properties. Refer to figure 1. It means that, after hitting the crystal, the beam heads back in the opposite direction along the same path until it reaches the beam splitter which directs it towards the light detector that is connected to an oscilloscope. The oscilloscope graphically measures the intensity of the light. Conclusive research data exemplifies that the LiNbO3 crystal may work as PCM. As the first beam of light hits the crystal and is reflected until it hits the light detector, the oscilloscope proves that the beam intensifies slowly grows over time until it reaches a maximum intensity.

#29 Single-Beam Phase Conjugation for Lasers Phase Locking and Image Formation

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Single-beam phase conjugation (self-phase conjugation, or SPC) was observed in the ferroelectric crystal LiNbO3:Fe using CW HeNe laser (wavelength 632 nm power 10- 36 mW). Effective “out/in” reflection coefficient of phase conjugation (defined as the ratio the output phase-conjugated beam to the input laser beam measured before optical elements) was about 30%. For some crystals efficient phase conjugation was followed by the simultaneous generation of Fabry-Perot modes. Phase locking of two HeNe lasers and imaging of the amplitude objects with the help of self-phase conjugation

was demonstrated. Appearances of additional beams (in transmission and reflection) have some analogy with the predicted behavior of the "negative-index materials".

#30 Ultra-Thin Chemical Conversion Layers

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We propose to develop robust Ultra-Violet coatings by converting, metallic, and/or dielectric materials into durable dense, ultra-thin films that have acceptable optical properties in the UV range. Properties such as film thickness and reflectance will be controlled by pressure, temperature, chemical species, and flow rate. Also, a post-annealing step will be utilized to further optimize the optical and material properties. The process is a modified physical vapor deposition (PVD) and chemical vapor deposition (CVD) process. Advantage will be taken of the combination to develop robust UV coatings.

#31 Investigation of Dynamical Voltage Build Up

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Ejection of polystyrene spheres off the surface of LiNbO3 and LiTaO3 materials was observed during heating/cooling cycles of the materials. Both LiNbO3 and LiTaO3 materials are ferroelectric. From basic E&M physics, it is accepted that this is caused by a buildup of voltage on the surface of the crystal. This voltage is partly contributed by the pyroelectric effect, , which is caused only by a change in temperature. Current experiments show that the polarization and voltage buildup on the surface of the materials are not uniform. This may be due to Point Defects and as a result Space Charge in the crystal structures (Grain Boundaries, etc.) of the LiNbO3 and LiTaO3 materials. Polarization by the pyroelectric effect is not enough for ejections of the polystyrene spheres. As a consequence a form of photogalvanic current or domain reversals may be a contributing cause to the dynamical polarization of LiNbO3 and LiTaO3 materials. Future experiments will probe the dynamical charging phenomena of various other ferroelectric materials and for confirmation of contributing physical processes.

#32 Characterization in Mechanical Properties of Glassy Polymeric Carbon

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The TRISO fuel that is planned to be used in some of the Generation IV nuclear reactor designs consists of a fuel kernel of UOx coated in several layers of materials with different functions. Pyrolytic graphite is considered for some of these layers. In this study we investigate the possibility of using glassy polymeric carbon (GPC) as an

alternative to pyrolytic graphite. GPC is used for artificial heart valves, heat-exchangers, and other high-tech products developed for the space and medical industries. This lightweight material can maintain dimensional and chemical stability in adverse environment and very high temperatures (up to 3000C). Here we are looking to explore the properties of GPC as a function of radiation defects to determine its viability as a substitute for PyC. Several instrumentation were used to characterize our sample which includes Rutherford backscattering spectroscopy, Particle Induced X-ray emission, Raman Spectroscopy, Auger Electron spectroscopy and X-ray photon spectroscopy. These tests were done at the center for irradiation of materials at Alabama A&M University. We will also show the results for transmission electron microscopy which was done at the University of Michigan.

#33 Fabrication and Characteristics of Organic Vapor Sensors Based on Binary Metal Oxides

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Gas sensors based on wide band semiconductor metal oxides are playing an important role in the detection of toxic pollutants (CO, H2S, NOx, SO2, etc) and combustible gases (H2, CH4 and flammable organic vapors, etc.). Metal oxide materials such as SnO2, ZnO, TiO2, WO2, Ga2O3, and others have been examined for gas sensing applications and for control of industrial processes. In this presentation, details of fabrication of sensors and testing set-up designed are presented including characteristics of sensors. The thick film sensors of binary mixtures of metal oxides: tin dioxide/zinc oxide; tin dioxide/indium oxide; and tin dioxide/tungsten oxide for isopropanol vapor detection were fabricated on alumina substrate via screen printing technique. The tin oxide/ tungsten oxide thick films showed superior sensor properties (sensitivity and response time) at lower operating temperature

#34 Electric Redshift in Jordan and Einstein Frames

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Three well-known mechanisms for a light that is emitted from an object to be shifted toward the red are the Doppler redshift due to the object motion, the Einstein gravitational redshift due to the object gravity, and the cosmological redshift due to the universe expansion. Recently, Zhang (2006, ApJL, 636, 61) developed a new redshift mechanism called electric redshift, which is due to the object electric charge, in accord with the five-dimensional (5D) fully covariant Kaluza-Klein (K-K) theory with a scalar field, which unifies the four-dimensional (4D) Einstein general relativity and the Maxwell electromagnetic theory. The result indicated that a dense, massive, and charged object can significantly shift the light that is emitted from the object toward the red as compared with the Einstein gravitational redshift. A compact electrically charged object with density and mass comparable to those of a neutron star can impart a redshift as great as quasars have. This study converts the 5D K-K solution

from the Jordan frame to the Einstein frame. It is shown that, for a neutral object, the K-K solution in the Einstein frame reduces to the Schwarzschild solution and thus agrees with the four tests of the Einstein general theory of relativity. The electric redshift in the Einstein frame is generally less significant than that in the Jordan frame. But, if the charged compact object is super-massive, the electric redshift in the Einstein frame can still be large as quasars have.

#35 The Preferential Heating of Heavy Ions by Parallel Propagating Electromagnetic Ion-Cyclotron Waves in Solar 3He-Rich Events

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Solar 3He-rich events are solar energetic particles in which the abundance ratio 3He/4He is enhanced by a factor of 1000 relative to the coronal abundance. Heavy ions are also enriched in solar 3He-eich events. To explain these fundamental solar phenomena, a complete two-stage acceleration model was proposed by Zhang. The first stage involves a preferential heating process of 3He and heavy ions and in the second stage the preheated 3He and heavy ions above the threshold are further accelerated to high energy. The resonant heating of 3He and heavy ions was extensively studied with the electrostatic ion-cyclotron (EIC) waves. Recently, we have studied the preferential heating of 3He by the parallel propagating electromagnetic ion-cyclotron (EMIC) waves. The result indicated that the H-branch EMIC waves can be efficient at heating 3He through the first harmonic resonance over ten times more than the heating of 4He by the 4He-branch EMIC waves. In this study, we are investigating the preferential heating of heavy ions such as oxygen (O) and iron (Fe) by the parallel propagating EMIC waves. The preliminary result shows that the 4He-branch EMIC waves can be efficient at heating these heavy ions through the first harmonic resonance. In this poster, we will present the detail.

#36 Temperature Sensor Based On Luminescence Lifetime Measurement

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Accurate temperature measurement is a requirement in many laboratories and industries. Inexpensive conventional thermometers have limited applications. Resistive thermometers are susceptible to electromagnetic interference, liquid thermometers are not suitable for high temperature measurements and thermocouples and resistive thermometers are not useful in corrosive environments. There is no ideal device that works in all types of environments for temperature measurement. Therefore there is a need to develop high temperature sensors for specific applications. Our interest is to design a system that predicts temperature with better accuracy and also suitable for wide temperature range. We investigated fluorescence lifetime sensing of temperature (alternative sensor concept) using rare-earth ion doped crystals. We chose rare-earth ion doped crystals because some of them possess very high melting points when compared to glasses. In this technique lifetime measurement is performed as a function of sample temperature to develop the calibration plots using different

materials. We have studied several materials and only four materials: Er3+ doped LaF3, Ho3+ doped LaF3, Ho3+ doped CaF2 and Pr3+ doped YAG exhibited linear variation of lifetime in a limited temperature range. Though some of the crystals have high melting points of the order of 1800 o C we could not extend the calibration plot beyond 1000 o C because the upper limit is set by the furnace used in these measurements. In a solid media excited rare-earth ions relax radiatively and nonradiatively. The radiative relaxation is independent of temperature. Nonradiative relaxation includes multiphonon relaxation, phonon-assisted energy transfer, energy transfer upconversion, and phonon-coupled transitions. All these phenomena exhibit temperature dependence because the density of phonon states increases with temperature. The nonradiative relaxation increases with temperature and consequently the lifetime (inverse of relaxation rate) of the excited level decreases at higher temperature.

#37 Electrical Properties of Silver Nanoparticles Reinforced LiTaO3:P(VDF-TrFE) Composite Films

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Pyroelectric infrared Lithium tantalite [(LiTaO3), LT] ceramic particles and silver nanoparticles have been incorporated into a polyvinylidene fluoride-trifluoroethylene [P(VDF-TrFE) 70/30 mol%] copolymer matrix to form composite films. The films were prepared using solvent casting method. Electrical properties such as the dielectric constant, dielectric loss, conductivity and pyroelectric coefficient have been measured as a function of temperature. In addition, materials' figures-of-merit have also been calculated to assess their use in infrared detectors. The results show that the fabricated lithium tantalite: polyvinylidene fluoride-trifluoroethylene composite films may have a good potential for uncooled infrared sensor applications.

Abstract Categories: Life Sciences Undergraduate and Graduate

#38 Survey of Students Knowledge of Biology Laboratory Safety Measures

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Laboratory safety is an important issue in any science curriculum. It is important to train students in the science labs and make sure that they know and put into action these necessary safety regulations. Our objective was to determine if the students possess and comprehend basic safety knowledge as it pertains to scientific laboratory experiments. In an attempt to do this, we carried out a safety survey which was administered to three introductory and three upper level courses. The survey comprised of 15 multiple-choice questions developed to assess basic laboratory safety knowledge. The survey questions were focused on knowledge of the following:

hazardous materials labeling system, emergency response procedures and standard microbiological practice. The results of our survey show an increase in the amount of safety knowledge gained as students are exposed to various topics in laboratory safety through their academic courses; upper class students had a score of 68-82% while students in introductory classes had scores between 35-78%. We consider these scores low, we therefore recommend that a formal laboratory safety course be developed and required of all Biology majors.

#39 The Antimicrobial effects of Herbal Extracts on Microbial Biofilms

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In nature microorganisms attach to surfaces and develop biofilms. These microorganisms (bacteria and fungi) live in a self-organized cooperative community attached to surfaces and or each other and embedded in a matrix of extracellular polymeric substance (EPS). A biofilm is defined as an association of microbial cells that is irreversibly attached to a surface and enclosed in a matrix of mainly polysaccharide material. Biofilm-associated microorganisms can be differentiated from their planktonic counterparts by altered growth rates and gene transcription and so these biofilm-microorganisms are usually resistant to conventional antimicrobials and disinfectants. The main objective of this study is to determine the efficacy of herbal extracts on the clearance or inhibition of biofilms formed by the bacteria Pseudomonas aeruginosa, Escherichia coli and the yeast Candida albicans. We used extracts from the herbs: Black cohosh (*Actaea racemosa* or *Cimicifuga racemosa*) and African Udala (*Chrysophyllum albidum*). Herbal extracts were produced using the standard Soxhlet and evaporation method. The extraction was undertaken with 10 g of powdered plant material and 300 mL of ethanol in a Soxhlet apparatus for 18 h. The final extract was filtered and air-dried and further suspended in methylene chloride, chloroform or ethyl acetate as solvents. The extract was filtered and the solvent was evaporated. The test microorganisms were exposed individually to the herbal extracts using the 24-well format, control wells were included in each exposure regiment and then stained after 24 and 48 hours with crystal violet. Our results indicate that the Udala extracts were bactericidal to *E. coli*, inhibited the formation of *Candida* and *Pseudomonas* biofilms. The black cohosh extracts appeared to enhance the formation of biofilms by *Candida* and had little or no effects on the biofilms of *E. coli* and *Pseudomonas aeruginosa* based on visual analysis and cell counts. In conclusion, we suggest that extracts from *Chrysophyllum* albidum should be studied further and possibly used to prevent biofilm formation on medical prosthesis and that caution must be exercised in using black cohosh in the treatment of menopausal symptoms since it may enhance yeast infections.

#40 A Preliminary Study of the Effects of Silver Nanoparticles Embedded in Polyvinyl Acetate (PVA) on Select Bacteria and Yeasts

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Nanoparticles are very tiny in size and they behave as a whole unit in terms of transport and properties; they have the ability to easily penetrate an organism through the cell membrane. Silver nanoparticles have the ability to kill or inhibit the growth of harmful bacteria. Polyvinyl Acetate (PVA), a non- toxic adhesive which is insoluble in water and stable at various temperatures, is also known for its ability to inhibit the growth of bacteria. Our objective was to test the antimicrobial effects of bio-produced silver nanoparticles (Ag-NPs) embedded in PVA on *Salmonella*, *Pseudomonas aeroginosa*, *Escherichia coli*, *Bacillus thuringiensis* and *Candia albicans*. PVA was prepared using 5ml of distilled water added to 1ml of PVA and placed in the spin coater. The slides were either coated for 50 seconds at 0.32 RPM or for 30 seconds at 1.42 RPM. This same procedure was used for slides with the PVA-silver nanoparticles mixture. Once the slides were prepared each test microorganism was smeared on the appropriate slide. The set-up was incubated at 350C. After 48 hours, the mixtures of microorganism-Ag-NPs were examined for viability. *Salmonella*, *Bacillus* and *Pseudomonas* grew in PVA; although Pseudomonas grew in the presence of the Ag-NPs-PVA mixture with an average of 49cfu/mL, this was an inhibitory effect as compared to the control without PVA and AgNPs. It was observed that the mixture of PVA and AgNPs killed *Salmonella*, *E. coli* and *Candida* species. Since the mixture of PVA and silver nanoparticles were both bactericidal and fungicidal, this mixture can be used to keep most surfaces germ-free.

#41 Long Term Storage Effect on Winter Canola Seed with Respect to Nitrogen and Seeding Rates in Canola

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Agronomic practices and environmental factors do influence quality of seeds. Therefore, seed and laboratory studies were conducted to determine the influence of long term storage on the quality (vigor and viability) of winter canola seed with respect to nitrogen and seeding rates in canola. The quality of harvested and stored seeds was evaluated by using standard germination and germination index.

Results showed that long term storage significantly reduced the quality of canola seed. The germination percentage and germination index in 2009 decreased by 51% and 77% respectively. Even though there was significant reduction in the total seeds that had normal germination and the rate at which those seeds germinated in 2009, nitrogen and seeding rates did not influence the deterioration of the canola seed quality.

#42 Things that Affect the Heart Rate

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Throughout previous research, studies have proved that many factors can have an

effect on heart rate. This study proposes to examine factors that are normally used in society's everyday lifestyle. Heart rate can be managed in two different ways: intrinsically and extrinsically. Intrinsic aspects allow the heart rate to alter naturally and extrinsic aspects require chemicals to cause fluctuations in heart rate. Research from the British Medical Journal publication 'Heart' suggests that different tempos of music have an influence on heart cycles, which serves to activate intrinsic control mechanisms for heart rate management. Significant studies from The American Journal of Cardiology and The Journal of Sports Science have both shown that one of the most popular chemicals in today's society that can affect heart rate is caffeine, which provides an example for extrinsic modulation. This study will look at the effect that both variables have on heart rate. Studies have also shown that most extrinsic factors are used before athletic events by athletes, because it is known to enhance their performance. Although the heart rate value may be affected by many variables, research advocates that heart rate monitoring should be a continual process due to the sensitivity of the heart to intrinsic and extrinsic factors.

#43 The Production and Cellular Effects of Gamma Interferon during Stimulation of Intestinal Epithelial Cells with Salmonella typhimurium and Candida albicans

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The emergence of drug-resistant microorganisms has become a major public health problem. Researchers have estimated that there will be approximately 1.41 million cases and resulting in more than 500 human deaths annually of Salmonellosis. Ongoing research has shown the ability of gamma-interferon to be used as a therapy against viruses and other microorganisms. Epithelial cells are an important defense barrier against bacteria, chemicals, and other physical substances that could result in injury to surrounding cells and are able to secrete a variety of pro-inflammatory cytokines. To observe the biological activity of gamma-interferon intestinal epithelium was exposed to gamma-interferon and later challenged with *Salmonella typhimurium* 14028, *Candida albicans*, and *Salmonella typhimurium* DT104. We hypothesize that the exposure of intestinal epithelial cells with gamma-interferon will inhibit cytoskeleton rearrangement and internalization of *Salmonella typhimurium* 14028, *Salmonella typhimurium* DT104 and the internalization of *Candida albicans*.

#44 Determination of the Anti-Microbial Effects of Metal Nanoparticles and Herbal Extracts on Biofilm-Forming Microorganisms

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Biofilms are surface attached microbial communities with characteristic architecture, phenotypic, and biochemical properties distinct from their free-swimming, planktonic counterparts. The yeast, *Candida albicans* and *Pseudomonas aeruginosa* (bacterial species) are widely known to cause infectious diseases of humans especially as biofilms on in-dwelling medical devices. Microorganisms in biofilms are more deadly than their planktonic counterparts due to the biofilmsÕ resistance to conventional

antimicrobial agents; therefore, there is an important need to test the efficacy of unconventional antimicrobials such as Nanoparticles and herbal extracts in eradicating biofilms. The main objective of our study is to test the efficacy of bio-produced silver/gold Nanoparticles and herbal extracts (black cohosh & udala) in the clearance of biofilms formed by *Candida* species and *Pseudomonas*. The microorganisms were exposed to nanoparticles and herbal crude extracts using the Bioscreen C¨ Automated Microbiology Growth Curve Analysis System which directly measures microorganism growth. Growth was determined by measuring the turbidity of the growth media over time, optical density (O.D.) curves were generated which reflect the growth of the microorganisms. Preliminary results have shown that the % kill for Ag nanoparticles exposed to *P. aeruginosa* is 20.2% microorganisms killed on average with a standard deviation (SD) of 14.69 . The udala herbal extract showed an average % kill of *C. albicans* to be 43.2% with a SD of 3.83 ; and when exposed to *C. lypolytica* there was an average % kill of 42% with a SD of 5.70 . The minimum inhibitory concentration (MIC) calculated for *C. albicans* exposed to Ag NP was 103l/ml and *C. lypolytica* exposed to Ag NP was 102 l/ml. It was also observed that Ag nanoparticles have a greater antimicrobial effect than the Au nanoparticle on the tested microorganisms. The udala herbal extract also showed greater antimicrobial effect than the black cohosh herbal extract. When the nanoparticles and herbal extracts were combined, a synergistic effect was observed; basically the Ag nanoparticles combined with either or both of the herbal extracts showed greater antimicrobial activity than that of Ag nanoparticles or herbal extracts alone. In conclusion we suggest a combination therapy for the eradication or prevention of microbial biofilm formation.

Abstract Categories: Food and Animal Sciences/ Nutrition Science Undergraduate and Graduate

$45 Dietary Tomatoes reduced Azoxymethane (AOM) Induced Aberrant Crypt Foci in Fisher 344 rats

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Tomato meal (TM) and tomato juice (TJ), rich sources of lycopene and other carotenoids which are potent antioxidants were investigated for their potential chemopreventive effects on azoxymethane (AOM) induced aberrant crypt foci (ACF) formation in Fisher 344 rats. Maintaining a balance of oxidants and antioxidants within the intracellular and extracellular environment is essential for optimal metabolism and health. Fisher 344 rats were divided into five groups. Group 1 served as control (C) and was fed AIN-93G diet. Groups 2, 3, 4 and 5 received AIN- 93G diets containing TM (2% and 4%) and TJ (2% and 4%) for 13 wk. To induce ACF, AOM (16 mg/kg body weight) was injected subcutaneously at 7th and 8th wk of age. Rats were killed at 17wk of age by CO2 asphyxiation and samples (colon, liver and cecum) were collected. Number of ACF per colon (proximal and distal) and their multiplicity (number of crypts per focus) were recorded. Glutathione-S-Transferase (GST) and antioxidative enzymes Catalase (CAT) and Superoxide dismutase (SOD) activities were

also determined. Feeding TM (2% and 4%) and TJ (2% and 4%) resulted in significant ($p<0.05$) reductions (25-50%) in colonic ACF compared to C. Rats fed 4% TM and 4% TJ had greater reductions compared to their 2% counterparts. Number of foci with four crypts was significantly ($p<0.05$) lower in rats fed treatment diets compared to C. GST (48-74%), CAT (39-90%) and SOD (2 fold) activities were significantly ($p<0.05$) higher in rats fed treatment diets compared to C. These findings suggest that dietary administration of tomato meal and tomato juice suppressed AOM induced ACF in rats, inhibition may be associated with suppression of cell proliferation in colonic mucosa. Consumption of tomato and tomato products may offer protection against various chronic diseases due to the synergistic or additive effects of phytochemicals.

#46 Effect of Shiitake Mushroom (*Lentinus edodes*) on Precancerous Lesions in a Rat Model

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Shiitake mushroom (*Lentinus edodes*) contains several bioactive compounds with various medicinal properties. The objective of this study was to evaluate the effect of feeding shiitake mushroom (SM) on Azoxymethane (AOM)-induced aberrant crypt foci (ACF) in Fisher 344 male rats. Effects of SM on oxidative and detoxification enzymes (Glutathione S Transferase (GST), catalase (CAT) and superoxide dismutase (SOD)) activity were determined. SM were grown on oak logs and fruiting bodies were lyophilized and powdered. Rats were divided into 4 groups following a 1 wk acclimatization period and fed AIN93G as control (C) and treatment diets (2%, 4% and 8% SM). At 7 and 8 wk of age all rats received 16mg/kg body weight of AOM s/c dissolved in saline. The assigned diets were administered until CO2 asphyxiation at 17 wk of age. Colon and liver samples were collected. ACF which are precancerous lesions were counted and activity of hepatic detoxification and antioxidative enzymes were determined. Total numbers of ACF in treatment groups (2%, 4% and 8% SM) were significantly ($p<0.05$) lower compared to group fed C. Total ACF reductions (%) compared to C in rats fed 2%, 4% and 8% SM diets were (22.7), (32.8) and (48.2), respectively. Feeding SM significantly ($p<0.05$) increased GST (2-4 folds), CAT (12-15 fold) and SOD (50-56%) activities compared to C. There were no significant differences ($p<0.05$) in weight gain among rats fed 2%, 4% and 8% SM and C. These results demonstrate that feeding SM to rats significantly ($p<0.05$) reduced formation of ACF and modulated critical enzyme activities and may have potential in chemoprevention if consumed regularly. The observed effects may be due to lentinan, other fiber constituents, or components of the mushroom soluble fraction, such as mycochemicals. The potential implications of such compounds in chemoprevention clearly warrant further study.

#47 Modulatory Effects of Peaches (*Prunus persica*) on the Formation of Azoxymethane Induced Aberrant Crypt Foci.

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Peaches (*Prunus persica*) are a rich source of bioactive compounds such as flavonoids and carotenoids and may have implications against development of chronic diseases. The aim of the study was to investigate the putative effects of peaches (P) on Azoxymethane (AOM) induced aberrant crypt foci (ACF) and its effect in modulation of critical detoxification and antioxidative enzymes. Fisher 344 male rats were randomly divided into 3 groups (6/group) following a 1-wk acclimatization period. One group was fed a control (C) diet (AIN-93G), while remaining two groups were fed treatment diets (C+2.5% P and C+5% P). Subcutaneous injections of AOM were administered in saline at a dose of 16mg/kg body at 7 and 8 wk of age. At 17 wks of age rats were killed by CO2 asphyxiation. Liver, colon and cecal samples were collected and stored at -80 C until analysis. ACF were enumerated using a standard protocol. Effect of peaches on development of preneoplastic lesions (ACF) and selected detoxification (glutathione S-transferase (GST)) and antioxidative enzymes (superoxide dismutase (SOD), and catalase (CAT)) activities were also assessed. A higher number of total ACF (139) accompanied by lower GST, SOD, and CAT activities were observed in rats fed C. Administration of treatment diets (2.5% and 5% P) significantly ($p<0.05$) reduced number of ACF (20-50%) with increase in GST (60-80%) , SOD (30-42%), and CAT (50%) activities in a dose dependant manner compared to C. Results suggest that feeding peaches significantly ($p<0.05$) reduced incidence of AOM induced ACF and significantly ($p<0.05$) enhanced detoxification and antioxidative enzymes. Consumption of peaches may therefore have significant implications in humans with preneoplastic lesions. With peaches being seasonal fruits, food product development may increase regular consumption of peaches with significant benefits in prevention of chronic diseases such as colon cancer.

#48 Feeding Value of Peanut Skins for Sheep

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The objective of the study was to determine the effect of feeding increasing levels of Peanut skins (PS) on sheep feed intake, body weight, and carcass characteristics. Twelve Gulf Coast ewes similar in age and weight were used in an experiment that lasted twelve weeks. Lambs were blocked by weight and randomized within blocks to three treatments. Initial body weight was used as the blocking criterion. The three treatments of PS fed to lambs were 0%, 20%, and 40%. Lambs were allowed 7-day adjustment period in the stalls and 7- day transition period to the PS diets followed by 90 d feeding period. All treatments were mixed of 50% hay and 50% feed mixed with PS. Feed intake of lambs fed 40% PS, 2.55 lb/day did not differ ($P<0.05$) from the feed intake of lambs fed 0% and 20% PS (they consumed an average of 2.51 lb/day, and

2.43 lb/day, respectively). However, weight gain was greater (P<0.05) in lambs fed 40% PS, 9.6 lb, than weight gain in lambs fed 0% and 20% PS (6.11 and 8.53, respectively). Although weight gain was greater (P<0.05) in lambs fed 20% than weight gain in lambs fed 0% PS, there was no significant difference (P>0.05) in feed intake of lambs fed 0% and 20% PS. Carcass characteristics, including hot and cold carcass weight (HCWT & CCWT), body wall thickness (BW), the 12th rib fat, and Kidney, pelvis& heart fat (KPH) where all similar in lambs fed the three treatments. However, the rib eye area (REA) was greater (P<0.05) in lambs fed 20% PS than the REA in lambs fed 0% and 40% PS. Similarly, REA was greater (P<0.05) in lambs fed 40% than in lambs fed 0% PS. These results demonstrate that feeding increasing level of PS to sheep significantly impacted weight gain, and the RAE. PS needs to be seriously considered as a potential low-cost feedstuff for ruminants.

#49 Dietary Bitter Melon Alters Antioxidant and Detoxification Enzymes and Reduces Precancerous Lesions in Fisher 344 Male Rats

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Bitter melon, (BM) also known as *Momordica charantia* or Karela contains biologically active phytochemicals including triterpenes, saponins, and alkaloids and has been reported to regulate blood glucose levels. However studies on its chemopreventive effects are scarce. This research was conducted to investigate the chemopreventive properties of bitter melon on azoxymethane (AOM)-induced aberrant crypt foci (ACF) which are preneoplastic lesions in rats. We also assessed the effect of bitter melon on oxidative stress by analyzing the activities of selected antioxidant enzymes; Catalase (CAT), Glutathione-S-Transferase (GST), Glutathione peroxidase (Gpx) and levels of Glutathione (GSH). Rats were divided into 3 groups after a 1 wk acclimatization period and fed AIN-93G diet as control (C) and treatment diets containing 2% and 4% BM. To induce ACF, two s/c injections of AOM were administered at 7 wk and 8 wk of age. The assigned diets were administered until CO2 asphyxiation at 17 wk of age. Number of ACF in proximal and distal colons were 35, 26 and 21; 116, 54 and 38 in rats fed C, 2% and 4% BM, respectively. Total ACF reductions (%) compared to C in rats fed 2% and 4% BM were 46 and 61, respectively. CAT (µmol/mg) and SOD (µmol/mg) activities (µmol/mg) were significantly (p<0.05) higher in treatment groups; 2% BM (0.293 and 0.30) and 4% BM (1.82 and 0.29) compared to C (0.04). GST (µmol/mg) activity and GSH (µmol/mg) levels were significantly (p<0.05) lower in C (10.55 and 0.17, respectively) compared to treatment groups (16.89 and 0.49 in rats fed 2% BM and 21.57 and 0.68 in rats fed 4% BM). Results of this study showed that bitter melon reduced the incidence of AOM-induced ACF formation and may have implications as a chemopreventive agent. The Bitter melon (fruit and juice) may have applications in food product development.

#50 Feeding Almonds and Pecans Lower the Development of Azoxymethane Induced Precancerous Lesions in Fisher 344 Male Rat

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Nuts are a rich source of protein, monounsaturated fatty acids, Vitamin E, phenolic compounds, selenium, fibre, folic acid and phytoestrogens. The objective was to test chemopreventive potential of two nuts; Almonds and Pecans on Azoxymethane (AOM) induced aberrant crypt foci (ACF). Following a 1wk period of acclimatization, 25 rats were randomly divided into 5 groups. One group was fed AIN93G (Control-C) diet, and 4 groups were fed almond (A) and pecan (P) (C+5% and C+10%) containing diets. Biweekly body weights and daily feed intakes were recorded. For ACF induction, all rats received (2) AOM injections at 7 and 8 wks of age at16mg/kg body weight. At 17 wk of age, rats were euthanized by CO2 asphyxiation. Colon, liver and cecal samples were collected. Cecal weight, cecal pH, number of crypts/foci, and glutathione-s-transferase (GST) activity were determined. Weight gain (g/13 wk) and feed intake (g/day) were similar in all groups. Cecal weight was higher and cecal pH was significantly ($p<0.05$) lower in rats fed A and P compared to C. ACF incidence (total) in rats fed P (5 and 10%) was 69 and 66 and A (5 and 10%) was 53 and 50, respectively. Rats fed nuts (A and P) had significantly ($p<0.05$) lower (46-60.9%) ACF, compared to C (128). Liver GST activity (mmol/g) in rats fed P (2.5 and 5%) was 103 and 114 and those fed A (2.5 and 5%) was 127 and 132, respectively compared to rats fed C (61.5). Results indicate that feeding almonds and pecans significantly ($P<0.05$) reduced incidence of AOM induced ACF which are precancerous lesions. Consumption of nuts rich in phytonutrients and omega 3 fatty acids may play a beneficial effect against various chronic diseases.

#51 Determination of Selected Phytochemicals and Antioxidant Capacity in Fruits

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Fruits are a major dietary source of antioxidative compounds and may reduce risk of diseases associated with oxidative stress. This study aimed to determine selected phytochemicals (catechin, ellagic acid, pelargonidin and quercetin) in fruits (apples, grapes, plums, peaches and cranberries- 2 varieties each) using High performance liquid chromatography (HPLC). Antioxidant activities of fruits were also evaluated by DPPH radical scavenging assay, Vitamin C equivalent antioxidant capacity assay (VCEAC), and superoxide anion radical scavenging assay. Phenolic extracts of fresh fruit samples were obtained using MeOH/H2O (80:20, v/v). Samples were eluted using a C18 column (mobile phases-acidified water containing formic acid and acetonitrile/ acetic acid). Wavelength detection was set between 240 and 517nm, and retention times and spectra were compared to those of pure standards of catechin, ellagic acid, quercetin, and pelargonidin. All experiments were carried out in triplicate. Catechin

(mg/100g) was identified in all fruit extracts and ranged from 2.6-12.9 with highest levels seen in plums, whereas lowest quantities detected in apple cultivars. Ellagic acid (3.6-10.6 mg/100g) was detected in 3 fruits (apples, grapes and plums). Quercetin (2.8 to 7.8 mg/100g) was quantified in apples, cranberries and plums. Pelargonidin was detected in high amounts in plums, peaches and cranberries. White Cranberry resulted in highest reduction in DPPH (90.7%) and lowest reduction was observed by granny smith apples (64.5%). Scavenging of ABTS radical (VCEAC) ranged from a low of 90.29 in California Peaches to 172.61 (Purple Plum). Scavenging of superoxide anion ranged from 11.4% in Gala Apples to 47. 6% in Red Plums. Catechin (2.9 to 12.9 (mg/ 100g) was the most abundant phytochemical in fruits assayed. Our results indicate that fruits can be considered as a source of dietary antioxidants. Regular incorporation of fruits/fruit products in diets may lead to a reduced risk of oxidative stress/damage.

#52 Fermentation Effects on Total Phenolics, Flavonoids and Anthocyanins in Cranberries During Wine Making

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Cranberry (*Vaccinium macrocarpon*) is a prominent agricultural food crop produced in many areas of North America. They are rich sources of polyphenols such as anthocyanins and proanthocyanidins which play a major role as antioxidants in the human body when consumed. The objective of the study is to determine the effect of fermentation on total phenolics (TP), total flavonoids (TF) and total anthocyanins (TA) in cranberries during the process of wine making. Frozen cranberries were obtained from Decas Botanical Synergies MA. Cranberry juice was extracted from frozen cranberries and subjected to fermentation at pH 3, 4 and 5 and temperatures 25, 27 and 30 °C. Cranberry juice was ameliorated by addition of cane sugar to increase the total soluble solids (20° brix) to achieve desirable ethanol yield for wine. Results showed highest values for TP (1150.43 mg GAE/L) and TF (313.40 mg CE/L) at pH 3 and 30°C after 5 days of fermentation. Highest value for TA (3.77 mg cyanidine-3-glucoside equivalent/L) was observed at pH 3 and 30°C on day 0 of fermentation. For all treatment parameters, there were significant ($P < 0.05$) increases in TP and TF with increase in days of fermentation. There was a significant ($P < 0.05$) decrease in TA with increase in days of fermentation. The alcohol content of the cranberry wine ranged from 6%-8% w/v. The phytochemical content of cranberry wine is affected by fermentation parameters. Cranberry can be used for making wine commercially by addition of cane sugar and by modifying pH of the juice and temperature of fermentation process.

#53 Chemoprevention of Colon Carcinogenesis by Cranberry and Sorrel Calyx Meal in Fisher 344 Male Rats

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Colon cancer is a common cancer in the U.S. Sorrel and Cranberry are rich sources of anthocyanins and other phytochemicals which may have chemopreventive properties. This study investigated the potential of Sorrel and Cranberry (meal-M and juice-J) in reducing Azoxymethane (AOM) induced colon tumors and the mechanisms of action underlying their chemopreventive effects. After a 1 wk period of acclimatization, rats were divided into 9 groups and fed AIN-93 diet (control-C) or AIN-93 diet (modified) with 2.5 or 5% Cranberry (CB) and sorrel (S) (M and J). Tumors were induced by 2 AOM (16 mg/kg body weight) injections (7 and 8 wk). At 46 wk of age, rats were killed by CO2 asphyxiation and colon, cecum and livers were collected. Biomarkers included: number and characterization of tumors, hepatic CYP2E1 (phase I detoxification), antioxidative (Catalase (CAT) and Superoxide dismutase (SOD)), and Glutathione S-tranferase (GST) (phase II detoxification) enzyme activities. Tumor incidence (%) was 40 (CM) and 50 (SM), and 10-55 (CBJ) and 30 (SJ), lower compared to C. Tumors/tumor bearing ratio was significantly ($p<0.01$) higher in C (5.37) compared to rats fed SM (2.62, 1.37), SJ (2.5, 2), CBM (2.62, 1.87) and CBJ (2.12, 1.37) at 2.5 and 5% levels. Tumors (mm) were significantly ($p<0.01$) smaller in treatment groups (1.37-2.62) compared to C (5.37). A 3 to 6 fold increase in activity (units/mg) of selected enzymes (CAT, SOD, GST was seen in rats fed CB and S compared to C. However, CYP2E1 (nmol/mg) activity was significantly ($p<0.01$) lower in treatment groups (0.58-0.64) compared to C (0.91). These results imply a protective role of cranberry and sorrel in colon carcinogenesis and suggest multiple mechanisms of action. Increased consumption of sorrel and cranberry may have health benefits if consumed regularly by incorporating them in commonly consumed food products.

#54 Factors that Influence the Dietary Behavior of African American Adolescents from Single Parent Households

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The primary purpose of this study was to assess the relationship of dietary behavior and socioeconomics among African adolescents who are raised in a single parent home. The instrument used was a questionnaire, which consisted of scales designed to determine food frequency, food habits, factors that influence eating habits, obtaining adequate meals, and food insecurity as well as single item measures of age and gender. The study employed a quantitative research design to test the food insecurity, food habits, food behavior, and influences of food selection of African American Adolescents. The sample was drawn from students participating at the Sparkman Club Boys and Girls Club. The population consisted of teenagers, all African American. The sample consisted of male and female between the ages of 13 Ð 16 years of age. The instrument used to collect data was the Nutrition Knowledge Attitude Behavior Questionnaire. Statistical Package for Social Sciences (11.5) was used to

obtain a frequency distribution, mean, median, and standard deviation for each item in the questionnaire. A composite score of 3.0 was used to determine if a participant was experiencing food insecurity. If the score was 0 to 1.5 the participant was not experiencing food insecurity. If the score was 1.6 to 3.0 the participant was experiencing food insecurity. The results of this study indicate that socioeconomics can have an affect on individuals eating habits. Based on the finding of this study the following conclusions: There is a relationship between students who face food insecurity and their dietary behavior.

#55 Chemopreventive Potential of Apples (*Malus domestica* Borkh) and Apple Juice against Chemically Induced Colon Tumors using a Rodent Model

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The use of fruits in dietary chemoprevention has become a subject of heightened interest. Apples contain a variety of phytochemicals such as quercetin, catechin and phenolic acids which have been reported to have potential health benefits. We evaluated the chemopreventive potential of 2 apple varieties and commercially processed apple juice on Azoxymethane (AOM) induced colon carcinogenesis. Total polyphenolic content and antioxidant capacity of apples and juice used feeding trials were also analyzed. Following a 1wk period of acclimatization, 40 rats were randomly divided into 4 groups (n=10). One group was fed AIN93G (control diet-C), 2 groups were fed a modified C + 2.5% lyophilized apples [Red Delicious (RD) and Granny Smith (GS)]. One group was allowed access to apple juice (AJ) ad libitum at 5.0% level and fed a modified C diet. For tumor induction, all rats received 2 injections of AOM at 7 and 8 wk of age s/c at16mg/kg body weight. At 45 wk of age, rats were euthanized by CO2 asphyxiation. Colon, liver and cecal samples were collected. The DPPH and FRAP antioxidant capacity assays were conducted on the apple juice and apple extracts used in the feeding trials according to standard protocol. Tumors/tumor bearing rat ratio was 66% lower in rats fed apples and apple juice compared to rats fed C diet. Liver detoxification and antioxidative enzyme activity [Glutathione-S Transferase (GST), Catalase] in rats fed apples 2.5% RD, 2.5% G.S((158.67±22.84, 146.00±10.97; 237.48±24.14, 153.87±4.87) and AJ 5.0% (175.67±22.54; 147.87±1.76)was significantly ($p<0.05$) higher than rats fed C (61.50±0.31; 21.13±11.71) respectively. The results of this research illustrated that apples and apple juice reduced the number of colon tumors. It may be therefore necessary to conduct clinical trials for further conclusive results on the chemopreventive potential of apples and apple products.

#56 Processing Effects of Navy Beans (*Phaselous vulgaris* L.) in Suppressing Azoxymethane-induced Aberrant Crypt Foci in Fisher 344 Male Rats

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Navy Beans (NB) contains numerous components such as protein, fiber, phytic acid, phenolic compounds, protease inhibitors and oligosaccharides which may have health benefits. The aim of our study was to determine the effects of feeding selected processed (germinated (NBG), fermented (NBF), cooked (NBC), and toasted (NBT)) Navy beans at 5 and 10% levels on Azoxymethane induced aberrant (AOM) crypt foci (ACF) in Fisher 344 male rats. Selected hepatic enzymes glutathione S-transferase and superoxide dismutase (GST and SOD) were determined using standard protocol. Following a 1wk period of acclimatization, rats were assigned to 8 (n=6) groups. Control (C) were fed AIN-93G and treatment groups received diets containing processed navy beans (NBC, NBG, NBF, and NBT) (C+ 5% and C+ 10% (NB). At 7 and 8 wks of age rats received AOM (s/c) at 16mg/kg body weight. Rats were killed at 17 wks of age by CO2 asphyxiation. AOM induced ACF in proximal and distal colons were enumerated. Total ACF in rats fed processed NB were significantly lower ($P<0.05$) than rats fed C. ACF in rats fed NB ranged from a low of 43 in the rats fed 10% NBF to a high of 94 in the rats 5%NBF. Total number of ACF in rats fed C was 143. Numbers of ACF were higher in the distal colon than in the proximal colon. Rats fed C diet had significantly higher ($P<0.05$) total crypts (479) compared to rats fed processed 5%NBC, NBT, NBF, NBG and 10% NBC, NBT, NBF, NBG where total crypts were 112, 74, 179, 97, 78, 121, 154, and 82 respectively. SOD activity was 15 to 53% higher in the rats processed NB compared to C. The results of this study showed that dietary beans may have significant implications in chronic diseases such as colon cancer and therefore regular consumption can be encouraged and enhanced by development of innovative bean products by the food industry.

#57 Extraction of Pectin From Palmyra Palm

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Palmyra palm (*Borassus aethiopium* Mart) is a major Borassus palm in Africa. Despite the large production and use worldwide, majority of the fruit produced is wasted. Palmyra palm fruit could be a good source of pectin. Pectin is a polysaccharide found in fruit and vegetables. It is widely used in many food industries as fat replacer, and as a gelling agent or stabilizer in jams, jellies and acidic milk products. Pectin is also used in dentistry, cosmetic and pharmaceutical products. Commercial pectin is obtained from waste citrus peels and apple pomace. Due to its importance, there has been a growth in research to find others sources for pectin production. There is no known study on the extraction and characterization of pectin from Palmyra palm, despite its high fiber content. The objective of this study was to determine extraction conditions for pectin from Palmyra palm fruit. Pectin was extracted from the alcohol insoluble material obtained from palmyra palm fruit at pHs of 5.5 (natural pH of

slurry), 2.5 and 7, temperatures of 70, 80 and 90¡C, and extraction times 30-120 min at 10 min intervals. Results showed that pH, temperature, and extraction time had a significant ($p < 0.05$) effect on pectin extraction. For all conditions tested, pectin yield increased with extraction time initially and then decreased after reaching a maximum level. The highest yield was obtained after 60 min of extraction at 80¡C and pH 7.0 (14.87% ± 0.002). Similar yield (14.75% ± 0.007) was obtained at pH 5.5 at the same temperature. The lowest pectin yield was obtained at pH 7.0 and 90¡C (5.975% ± 0.0) at an extraction time of 110 min. Compared to citrus peel (25-30% on a dry weight basis) Palmyra palm fruit contain a lower amount of pectin but its content is comparable to the values reported for apple pomace (10-15%).

#58 Chemopreventive Potential of Basil (*Ocimum basilicum* and *Ocimum tenuiflorum*) against Azoxymethane Induced Colon Tumors in Fisher 344 Male Rats

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Basil (*Ocimum basilicum* and *Ocimum tenuiflorum*) is one of the oldest herbs and contains phytochemicals that may offer protection against several chronic diseases due to anti-inflammatory and antioxidant properties. The objective of this study was to determine the effects of three varieties of *Ocimum tenuiflorum* (Holy Basil) (Denmark (HBD), Cuba (HBC), India (HBI)) and one variety of *Ocimum basilicum* (Culinary Basil) (CB) on Azoxymethane (AOM)-induced colon tumors in Fisher 344 male rats. After a 1 wk period of acclimatization, rats were divided into 5 groups. Group 1 was fed a control (C) diet (AIN-93 G); and remaining groups were fed C+1% CB, HBD, HBC and HBI. Rats were injected with AOM (s/c injections at 16 mg/kg body weight in saline) at 7 and 8 wk of age to induce colon tumors. Rats were killed by CO2 asphyxiation and samples (colon, cecum and liver) were collected. Colon tumors were characterized according to number, size, location and tumors per tumor bearing rat ratio. Hepatic Glutathione-S-Transferase (GST), Catalase (CAT) and Superoxide Dismutase (SOD) enzyme activities were determined. Weight gain (g/41 wk) and feed intakes (g/day) were significantly ($p<0.05$) higher in treatment groups compared to control. Feeding Basil (1%) resulted in significantly lower tumor incidence (30 to 50%) compared to rats fed the control diet (100%). Tumors/tumor bearing rat ratio was reduced by 78% in rats fed Basil diets compared to rats fed control diet. Tumor size (mm) was significantly ($p<0.05$) smaller in rats fed treatment diets (CB: 1.20, HBD: 0.8, HBC: 0.8, HBI: 0.6) compared to control (3.72). A two to five fold increase in selected enzyme activities (units/mg enzyme) (GST (6 to 22), CAT (21 to 103) and SOD (2.9 to 6.5)) was seen in rats fed 1% Basil diets compared to control. Feeding Holy and Culinary Basil significantly ($p<0.05$) reduced number of AOM-induced colon tumors in Fisher 344 male rats and therefore may have implications as a potential chemopreventive agent with possible applications in the food industry.

#59 Chemopreventive Potential of Select Herbs and Spices in Azoxymethane-induced Aberrant Crypt Foci

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Herbs and spices have been used for medicinal purposes and to enhance flavor and aroma of foods and contain phytochemicals such as eugenol, rosemarinic and cinnamic acid which may have beneficial effects in disease prevention. The purpose of this study was to test the effect of feeding cinnamon (CM), cloves (CL), coriander (CR), fenugreek (FG), rosemary (RM), and oregano (OR) at 150ppm and 300ppm levels on azoxymethane (AOM)-induced aberrant crypt foci (ACF) in Fisher 344 male rats and to study its effect in modulation of a crucial detoxification enzyme. Following an acclimatization period of 1 wk, rats were divided into 7 groups and fed 6 treatment diets and 1 control (AIN93G)-C. All rats received 16mg/kg body weight of azoxymethane s/c dissolved in saline at 7 wk and 8 wk of age. Biweekly bodyweights and daily feed intakes were recorded. Assigned diets were administered until CO2 asphyxiation at 17 wk of age. ACF, number of crypts/ACF, and glutathione-s-transferase (GST) activity were determined. Total ACF reductions (%) in rats fed 300 and 150ppm diets of CM, RM, CL, OR FG, and CR, diets were 78, 68, 57, 56, 49, 47, and 39, 34, 29, 29, 25, 24, respectively compared to C. GST activity (U/mg) in rats fed herb/spice diets at 300 and 150 ppm was 132, 104 (CM), 125, 125 (RM), 113, 93 (CR), 107,101 (FG), 98, 95 (CL), 83, 93 (OR) compared to C (61.5). The results indicate that the herbs/spices (CM, RM, CL, OR, FG, and CR) reduced preneoplastic lesions and enhanced GST, a crucial detoxification enzyme activity. However, their uses may be beyond adding flavors and/or taste to foods, because most herbs and spices used for culinary purposes may have potential biological effects on human health.

#60 Effects of Processing on Total Phenolics, Flavonoids and Anthocyanins in Red Grapes

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Red grapes are a rich source of antioxidants such as phenolic compounds which are beneficial to health on consumption. Fresh produce is perceived by the consumer as the best source for nutrients and phytochemicals, but common postharvest processing treatments such as freezing, freeze-drying, vacuum oven drying and air-drying may have an impact on their phytochemical composition. The objectives of this study were to determine the effect of processing on total phenolics (TP), total flavonoids (TF) and total anthocyanin contents (TA) in red grapes. Red grapes obtained from local market were subjected to oven drying (60°C), vacuum drying (60°C), freeze drying, freezing (-20°C) and deep freezing (-80°C) for 24 hours. Treated red grapes were extracted with acidified methanol (0.1% HCl). Extracts of red grapes were analyzed for TP, TF and TA. Results showed no significant difference between freezing and deep freezing for TP content (750.93 ± 2.04 mg GAE/100g and 744.35 ± 3.42 mg GAE/100g, respectively).

However, TP for frozen grapes were significantly ($P < 0.05$) higher than that of fresh (727.80 ± 3.09 mg GAE/100g) while the dried grapes (oven, vacuum oven, and freeze dried) had significantly ($P < 0.05$) lower TP content (138.01 ± 2.95 mg GAE/100g, 131.30 ± 0.62 and 139.06 ± 0.58 mg GAE/100g, respectively). Deep frozen grapes had the highest TF content (76.66 ± 0.88 mg CE/100g). However, fresh grapes had significantly ($P < 0.05$) lower TF content (67.34 ± 0.51 mg CE/100g) than frozen grapes but had higher TF content than dried grapes. Similar trends were observed for TA. Fresh grapes TA content (65.05 ± 1.54 mg /100g) was 5-fold higher than dried grapes. However, frozen grapes (69.20 ± 2.59 - 72.93 ± 0.75 mg /100g) were significantly higher than fresh. Freezing preserves phenolic compounds in fresh grapes better than drying.

#61 Combinational effects of Synergy1¨ and Soybean Against Chemically Induced Colon Carcinogenesis In-vivo

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Bioactive compounds present in foods may offer greater protection due to their additive or synergistic effects. Prebiotic Synergy1¨ is a non-digestible carbohydrate with numerous health benefits. Soybean is a rich source of phytonutrients such as isoflavones. The objective was to evaluate the chemopreventive effects of Synergy1¨ (ORAFTI) and soybean (SM) at 5%, 10% singly and in combination on azoxymethane (AOM) induced colon carcinogenesis. After a 1 wk of acclimatization, Fisher 344 male rats (N=90) were randomly assigned to 9 groups (n=10). Control rats (C) were fed AIN-93G/M and treatment rats fed C+ Syn1¨ (5%, 10%), C+ SM (5%, 10%), Syn1¨ + SM (5% +5%), (10%+10%), (5%+10%) and (10%+5%). Two s/c injections of AOM were administered to rats at 7 and 8 wk of age @ 16 mg/kg body weight. At 45 wk of age, rats were killed by CO2 asphyxiation. Colon, liver and cecum were collected. Selected hepatic enzymes (Glutathione-S-Transferase, Catalase and Superoxide dismutase) were determined. Cecal weight (g) was significantly ($p<0.05$) higher in rats fed Syn1¨ singly (7.1) and in combination (5.1 to 7.2) compared to C (3.7). Tumor incidence (%) in treatment groups ranged from 40 to 75 compared to 100 in C. Reductions (%) in tumors/tumor bearing rat ratio (TBR) in rats fed treatment diets ranged from a low of 62 (SM-5%) to a high of 74.2 (Syn1¨ + SM- 10% + 5%) compared to rats fed C. GST activity (U/mg) was 3-4 fold higher in rats fed treatment diets. Hepatic anti-oxidative enzyme activities (U/mg) were significantly ($p<0.05$) lower in C compared to treatment groups. Results indicate that feeding Synergy1¨ and soybean in combination significantly ($P<0.05$) reduced incidence of AOM induced colon tumors. Consumption of Synergy1¨ and soybean in combination may have implications in colon cancer prevention with possible applications for the food industry in product development.

#62 Enhancement of Butylated Hydroxyanisole Efficiency in Ground Turkey Meat Using Encapsulated BHA

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Our previous study has shown that the use of phosphatidylcholine liposomes as a delivery system for the antioxidant butylated hydroxyanisole (BHA) resulted in shelf life extension of ground turkey meat. One advantage of using encapsulated BHA is that it reduces the recommended amount (FDA) of the unencapsulated BHA form without compromising the desired outcome. The objective of this study was to maximize the efficiency of the BHA in ground turkey meat. Encapsulated BHA was incorporated into ground turkey meat standardized to 20% total lipids. The treatments were: control, unencapsulated BHA (0.1%), encapsulated BHA 0.00625% (A), 0.0125% (B), 0.025% (C), 0.05% (D) and 0.1% (E). Mixing time was held constant at 5 min. All samples were refrigerated and then analyzed for rancidity measured as Thiobarbituric Reactive Substances (TBARS) at 2-day intervals for up to 8 days. The results indicated that encapsulated BHA at levels B, C, D and E significantly reduced the onset of rancidity after 2, 4 and 6 days of storage compared to the control and A. However, at 8 days, there were no significant ($P>0.05$) differences in TBARS among control (0.1021mg/kg), unencapsulated BHA (0.0985 mg/kg), A (0.0987 mg/kg) and B (0.0972 mg/kg). Encapsulated BHA at higher concentrations E (0.0754 mg/kg) and D (0.0793 mg/kg) showed a significantly ($P<0.05$) lower lipid oxidation than other treatments. The samples treated with the encapsulated BHA at 0.025% (0.0874 mg/kg) showed a reduction in rancidity at 8 days, which could be a threshold for encapsulated BHA incorporation. Encapsulated BHA levels of 0.025% and 0.05% provided similar benefits to using 0.1% without altering meat quality.

#63 Identification of Parameters Influencing *Agrobacterium*-Mediated Transformation of Peanut

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Peanut (*Arachis hypogea* L.) is an annual oil seed belonging to the Leguminosae family. It is a native from South America, and today, it is largely cultivated in many tropical and subtropical areas worldwide because of its high nutritive and economic values. Several peanut cultivars have been developed using plant breeding techniques. However, new technologies in genomics are poised to improve peanut for better productivity as well as to eradicate safety concerns due to peanut allergy. Efficient recovery of fertile transgenic peanut is one of the prerequisites to achieve peanut improvement via genetic manipulation. The objective of this research is to identify parameters susceptible to improve the transformation efficiency of peanut. Hypocotyl explants from 5-6-day-old seedlings of Georgia Green were infected with *Agrobacterium tumefaciens* harboring the pDK30 plasmid, driven by CaMV35S promoter. After explant infection, followed by a 5-day co-cultivation period, kanamycin-resistant plants were regenerated on the selection medium. PCR, quantitative Real time PCR

(qRTPCR) and Southern Blot were used to assess the transgenic status of the plants. Higher number of transgenic plants was obtained when the application of the selection pressure was delayed to 2 weeks (18 plants) and 3 weeks (23 plants) compared to transferring explants immediately after the co-cultivation period (12 plants).

Abstract Category: Natural Resources & Environmental Sciences—Graduate

#64 Assessment of Heavy Metal Pollution in Surface Soils of the Flint Creek and Flint River Watersheds: An Index Analysis Approach

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Sedimentation due to erosion is a significant problem in Northern Alabama's rivers which leads to the contamination of the water and sediment with heavy metals and other pollutants. The overall surface water quality within the Flint Creek (FC) and Flint River (FR) watershed has been designated "fair" to "poor". An Index Analysis approach such as Geo-accumulation Index (Igeo), Enrichment Factor (EF), Pollution Load Index (PLI) and Ecotoxicological Risk Assessment for sediment dwelling organisms using consensus-based sediment quality guidelines was used to assess the heavy metal pollution in surface sediments of the watersheds. No previous comprehensive study, to the author's knowledge, has outlined hazardous inputs of total recoverable elements from these polluted watersheds. The soil / sediment samples were analyzed using the EPA analytical method SW-6010B for total recoverable elements for environmental contaminants of concern (Al, Fe, Mn, As, and Pb). All metals analyzed for this study at both watersheds were statistically significant (at $P \leq 0.05$). The selected heavy metals were also studied to determine the presence of contaminants and extent of anthropogenic and lithogenic inputs from urban (FR) and rural (FC) activities.

#65 Forecasting the Reservoir Level for Lake Sidney Lanier by Using a Multilayered Feedforward Artificial Neural Network

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Lake Sidney Lanier is a reservoir that is impounded from the Chattahoochee River and Chestaree River by Buford Dam. The lake, which is located north of Atlanta, GA, encompasses 38,000 acres (154 km2) and is used for hydroelectricity generation, flood control, river navigation, water supply, and recreational use. This research introduces the problem of controlling the release of water from the reservoir at Buford Dam. It showed that without proper controlled water release, the level of Lake Sidney Lanier was falling to historical low levels. At these levels, the intended purpose of the reservoir could not be met. The research proposed an artificial neural network to predict the rivers inflowing water rates into the reservoir. Using historical river flow data and reservoir level data, a multilayered feed-forward artificial neural network model was trained and tested. The neural network model was able to predict the rivers inflowing water rates with a relative error of 1.2% five days in advance.

 # 66 Mobil Bay Ecodynamics and the Role of Freshwater Flow

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The Mobile Bay watershed includes the majority of Alabama and parts of Mississippi, Georgia and Tennessee. The watershed supplies freshwater into Mobile Bay which is a rich environmental resource comprised of estuaries, oyster reefs, and numerous species of fish and birds. The objectives of this project are to examine the physical geology, land use and hydrology of the study are, discuss the importance of Mobile Bay estuary resources along the Gulf Coast and evaluate the extent of climate variability in the region and the potential impact on estuary resources. Data on climate variability was collected from the National Oceanic and Atmospheric Administration (NOAA), Mobile Regional Airport weather station, United States Geological Service (USGS) flow Stream-flow gauges and Landsat derived Land Cover Land Use (LCLU) used to develop the Coastal Change Analysis Program (C-CAP) dataset. The climate data were collected for a study period of approximately 50 years and the LCLU and stream-flow datasets for the last 10 to 15 years. Results indicated significant LCLU decreases in Evergreen Forest, Palustrine Forested Wetland, and Mixed Forest classes. Recent Stream-flow decreases were significant and an overall warming temperature trend was found. A continuation of the warming trend identified will have significant future impacts on salt marshes, wetlands and other coastal resources.

#67 Seasonal Fluctuations and Pest Management Strategies for the Control of Cabbage Seedpod Weevil [*Ceutorhynchus obstrictus* Marsham (Coleoptera: Curculionidae)] and Other Insects on Winter Canola

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There is an increased interest in canola as feedstock for biodiesel production. This resulted in significant increase in acreage planted to canola in Alabama in the last year. Feeding by insects could significantly reduce yield of canola. The cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Coleoptera: Curculionidae), is the most dominant and destructive insect pest on winter canola (*Brassica napus*) in north Alabama. Secondary pests that also warrant monitoring include diamondback moth (DBM) (*Plutella xylostella*), tarnished plant bugs (TPB) (*Lygus lineolaris*), false chinch bug (Nysius sp.), thrips (*Frankliniella* sp.), aphid complex, flea beetles (*Phyllotreta spp.*) and root maggot (*Delia sp.*). Aphids have been reported to severely damage canola in other areas in the southeast; however, they have not presented any major problem in our evaluation plots. The efficacy of bifenthrin applied at different phenological stages of canola was evaluated at Alabama A&M University's Winfred Thomas Agricultural Research Station in Hazel Green, AL. Changes in population levels of cabbage seedpod weevil (CSPW) and other destructive insect species on conventional and early maturing canola lines were determined. Results showed significant temporal variation in insect abundance. Early maturing canola lines reached physiological maturity about two weeks ahead of conventional canola. Using early maturing canola lines as potential trap crop is also discussed.

#68 DNA Source Tracking of Methicillin Resistant *Staphylococcus aureus* and *Listeria monocytogenes* From the Indian Creek and Spring Branch Watersheds in Northern Alabama

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Water, a natural resource that all living species need to survive is, however; more important because human survival is dependent on water quality. As such, this project has considered microbial pollution in watersheds surrounding Madison County. The research has been made as specific as possible by considering the Indian Creek (IC) and Huntsville Spring Branch (HSB) watersheds. The existence of Methicillin Resistance *Staphylococcus aureus* (MRSA) and *Listeria monocytogenes* (L. monocytogenes) have been known to cause human health risks. As such, these two specific microbial pollutants have been investigated as hazardous waterborne pathogens for the two watersheds in this project. In this project, Bacterial Source Tracking (BST) and DNA Fingerprinting were conducted to objectively address the problem of MRSA and *Listeria* polluting the IC and HSB watersheds. The main objective of this research is to discover what living sources are carrying the MRSA or *Listeria* strain as a form of fecal coliform that is being released and eventually matriculating into the IC and HSB watersheds.

#69 Organochlorine Pesticide Concentrations in Water, Soil, and Sediment of the Indian Creek and Huntsville Spring Branch Watersheds

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The persistence of pesticides in terrestrial and aquatic ecosystems of the Indian Creek (ICW) and Huntsville Spring Branch Watersheds (HSBW) is a major concern for North Alabama. This particular study entailed the collection of 54 soil and sediment samples from upland, bank and in-stream depositional areas within these two watersheds. Concentrations for 22 pesticides were determined through dual-column analysis using GC-ECD. The most predominant occurrences were observed for DDT (dichlorodiphenyltrichloroethane), DDE, DDD, heptachlor and various endrin compounds. Pesticide concentrations ranged from undetectable to 5080 µg/kg-dw. An obvious spatial trend was observed for DDT and its metabolites, DDT>DDE>DDD, respectively. OCP concentrations tended to be higher in the upland areas and in the HSBW, especially at site 9. Overall, ICW showed more consistent detections for many of the compounds. Many of the OCPs also exceeded established water and soil quality criteria. These findings were attributed to variations in absorption, volatilization, plant uptake, microbial degradation, and other processes affecting the retention of these pesticides at the various locations.

#70 Land Use/Land Cover Change in Urbanizing Watersheds of North Alabama 1990-2000 Using Remote Sensing and GIS

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Rapid urbanization is currently occurring in North Alabama, specifically in the Flint River, Indian Creek and Huntsville Spring Branch sub watersheds of Wheeler Lake Basin. Population in this area is increasing rapidly and considered as main driver for urbanization. This created the need for an overall close monitoring of the basin. Time sensitive data from Landsat MSS, TM, ETM+, aerial photos of different spectral/spatial resolution, were used to detect the land use changes in the watershed. Developed area in the study area increased from 1990 to 2000. In future the established geodatabase will be integrated with Land Transformation Model (LTM), which integrates Geographic Information System (GIS), remote sensing techniques, and Artificial Neural Networks (ANN) to study the land use change and forecast the future land use changes of Wheeler Lake watershed.

#71 Sustainable Organic Production of Tomato and Pepper: Effects of Tillage and Fertilizer

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Tillage and fertilizer management are critical to sustain cash crop yields in organic production system. A replicated trial was conducted at Winfred Thomas Agricultural Research Station, Alabama A&M University to evaluate the effects of no-till (NT) and raised beds (RB) tillage with three pre-plant nitrogen (PPN) fertilizer (NatureSafe 8-5-5) rates 0, 14 and 24 Kg ha-1, on tomato cv. Amelia and pepper cv. Hungarian hot wax arranged in a randomized complete block design with four replications. The crops were managed with composted cotton-jin waste mulch, MultiBloom® liquid fertilizer, manually weeding and OMRI (Organic Material Review Institute) approved pesticides. Leaf area index (LAI), intercepted photosynthetically active radiation (PAR), plant biomass and fresh fruit yield of both crops were determined. All data were analyzed using SAS to determine treatment effects and coefficient of correlation among different growth and yield parameters. The method of tillage showed a significant affect on growth and yield of both crops and the effects were more pronounced on pepper crop. Application of pre-plant N did not significantly affect tomato drop, but affected pepper yield at the highest level. Both crops produced a significantly higher LAI when grown on raised beds, intercepted a greater proportion of the incoming PAR and produced greater biomass than crop in no-till treatment. Increased biomass appeared to have resulted in significantly greater number of heavier fruits in pepper crop but not in tomato. Pepper crop grown on raised beds produced 21% higher LAI, intercepted 13% more PAR and produced 50% more aboveground biomass. The results showed that raised bed tillage may be superior to no-till system in sustainable organic production of tomato and pepper. The effects of tillage vary with crop species.

#72 Analysis of Phenotypic Characteristics of Biparental Cross of Sweetpotato Genotypes

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Lack of cultivars with resistance to multiple stresses, particularly insects is limiting sweetpotato (*Ipomoea batatas* L. Lam.) production in the southeastern US. The identification of quantitative trait loci (QTLs) associated with resistance to insects, agronomic and storage root quality traits could help develop superior cultivars of this important crop. As a part of the identification of QTL, phenotypic characteristics of 94 F1 population from a cross between Excel and SC 1145-19 were studied in the year 2007 and 62 selected genotypes in 2008 with the purpose of identifying the phenotypic variations in the segregating F1 generation. Tissue culture plantlets obtained from USDA ARS Vegetable Research Station, Charleston, SC were raised in pots containing soilless potting mix in a greenhouse at Alabama A&M University and planted in single rows at Auburn University Horticultural Research Station, Cullman, AL. In 2008, stem cuttings of potted plants were planted in raised beds in plots arranged in randomized

complete block design with three replications. Data on plant morphological traits were recorded and visual symptoms of drought tolerance and insect damages on foliage were scored. Storage root fresh yield was recorded and, insect damages scored. There was significant genotypic variation for phenotypic and storage root quality traits. Five lines gave Jumbo and No.1 Grade storage root yields between 60 and 66 Mg/ha. About five lines produced only culls and no marketable yield. There was considerable variation in the magnitude of insect damage to storage roots. The damage was the highest in genotypes J14 and J54, followed by genotypes J16, 30, and J44. Most of the genotypes had low insect damage with a score of 1. Among insect pests, the most damaging pests were wireworm and white grubs. Most of the lines appeared to be tolerant to heat and drought stress. Three lines, J106, J98, and J92, showed higher level of wilting and leaf curling symptoms. When stored at normal room temperatures (25-28 °C), nine lines maintained good storage root quality after 14 weeks. These wide genotypic variation for phenotypic and storage root yield in this study indicates the possibility of breeding cultivars with desirable traits.

#73 Air Quality Dynamic Across Alabama from 2005-2008

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Air quality is important for maintaining high quality of environment and life. Regional air quality is related to land use change, industrial development and also climate. We conducted a study of comparing air quality change in the state of Alabama from the United States Environmental Protection Agency (USEPA) by using the Air Quality Index (AQI) to compare spatial and temporal changes across different scales. Measured hourly data included concentrations of ozone, particulate matter PM10 from 2005-2008. The general trend of air quality and also the dynamics for each pollutant was analyzed.

#74 Response of Ground Layer Vegetation to Burning and Partial Overstory Removal on the Southern Cumberland Plateau

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Prescribed burning and thinning cause changes in the cover, richness, and diversity of ground layer vegetation by altering light levels and forest floor properties. The ground layer is especially important due to its high levels of biodiversity, importance to wildlife, and interaction with tree regeneration. This study examined the response of ground layer vegetation's cover, density, and richness to four treatments including prescribed burning, thinning, a thinning and burning combination, and an untreated control. We collected data from three replicates (blocks) of each treatment. The study area is located in the William B. Bankhead National Forest (BNF) in northeastern Alabama and consists of 20-50 year old pine-hardwood stands dominated by planted

loblolly pine (*Pinus taeda*). Vascular plants ≤1.4 m in height were sampled in the second and third growing seasons after treatment. We sampled a total of 80 m2 in each of three stands at five permanently marked vegetation plots per stand. In each of the five plots we determined percent foliar cover for all vascular plants occurring below 1.4 m over an area of 16 m2. The sample areas consist of 1.0 m2 subplots located at 3.0 m and three 1.0 m2 subplots located at 15.0 m from plot center in each cardinal direction. We recorded foliar cover for every vascular plant present in the subplot regardless of whether or not it was rooted in the subplot. We also estimated area occupied for ground-level characteristics such as pine and broadleaf litter, down woody debris (where the diameter >2.5cm), tree bole, mineral soil, nonvascular plants, and logging roads. Preliminary results concerning the effects of the treatments on the diversity, cover of all species, herbaceous cover, and graminoid cover will be discussed. Results from this study will be useful for forest managers in the BNF seeking to understand and influence the dynamics of the ground layer vegetation.

#75 Air Quality Patterns Across Citronelle, AL

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The purpose of this study was to analyze air quality patterns for air gas concentrations of CO2, SO2, O2, H2S, CO and CH4, which were monitored as part of an ecological monitoring program established to assess the impact of CO2 – mediated enhanced oil recovery (EOR). Air gas levels were measured at approximately one month intervals over a one year period using a portable meter at 70+ sites in Citronelle, AL. This data was analyzed using geostatistical methods to create a distribution of concentration map for each measured gas based on extrapolated values. Contributions of land use and elevation were examined to understand variations in air gas concentrations. By examining the influences of land use and elevation on gas concentrations, increases attributable to the industrial process of EOR may be differentiated from expected patterns associated to land use and topography.

#76 Effect of Herbicide Application Timings on Weed Populations Dynamics in Winter Canola (*Brassica napus* L.)

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Weeds and their population intensity in field crops are one of the major constraints in crop production causing loss in yield even up to 50 percent. Control of weeds in general and effects of herbicide application timings on weed intensity in particular on crops especially in winter canola has not been well documented. Therefore, research experiments were conducted during 2005 to 2007 crop growing seasons to evaluate the effects of herbicide application timings for weed control in winter canola cv Jetton. Results showed that pre-emergence timing of trifluralin at 1 kg ai ha-1controlled 51% of primrose (*Oenothera laciniata*), and 85% of hop clover (*Trifolium campestre*) in 2005. Pre-emergence timing of trifluralin at 1 kg ha-1 controlled 67% of primrose and 56% of hop clover in 2006 whereas it controlled 58% primrose and 73% of plantain (Plantago

major) in 2007 as compared to weedy plots. Differences in control of population of these weeds was observed each year by use of pre-emergence application of trifluralin and it produced 184%, 203% and 82% higher canola yield in 2005, 2006 and 2007 respectively in comparison to weedy plots. Research results revealed that herbicide application timing significantly reduced weed population of different species caused differences in canola yield.

#77 Development of Species-Specific Primers for the Molecular Diagnosis of the Reniform Nematode

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The reniform nematode (*Rotylenchulus reniformis*) is among the most economically important cotton pathogen in the United States. It is known to cause 10 Ð 50 % yield loss in Alabama depending on the severity in the region. The objective of this study was to develop species-specific molecular diagnostic tools to identify the reniform nematode. The 18S rRNA gene of *R. reniformis* was amplified by PCR from the nematode genomic DNA, cloned and several independent clones were sequenced. Alignment of various clonal sequences revealed two sequence regions that are divergent between the reniform nematode and other nematode species. The sequence differences in the 18S region were used to design four sets of primer pairs to specifically detect *R. reniformis*. The primers were assessed for reliability by screening populations of *R. reniformis* from Alabama. The expected fragment size (222-244 bp) was produced for all the populations tested. When challenged with nematode communities typical of soil (*Helicotylenchulus dihystera*, *Criconemoides xenoplax*, *Meloidogyne incognita*, *Bursaphelenchus xylophilus*, *Ditylenchus dipsaci*, *Pratylenchus penetrans*), no PCR product was amplified. The specificity, sensitivity and reliability of these diagnostic primers position them as a future diagnostic tool for the detection of reniform nematode. Efforts are underway to further refine this tool to quantitatively measure the reniform nematode in the soil samples

#78 Long Term Carbon Dioxide and Energy Exchange of No-tilled Soil

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Soil is one of the world's largest natural reservoirs of organic and inorganic carbon; as such it comprises the major portion of the terrestrial carbon (C) sink. Estimate indicates that about 50% of all greenhouse gases (GHGs) emission into the atmosphere is from soil. In recent years, there has been an increased interest in promoting soil based sequestering strategies as way to mitigate atmospheric CO2 emission. However, the determination of soil carbon sequestration magnitude and long-term influence on the atmospheric CO2 are less understood. Here we report results from measurements of CO2 and energy flux above soybean and winter wheat canopies established under no-till since summer of 2006. The exchange of CO2 and energy was determined with data generated using the eddy covariance technique. Results show that noticeable CO2 uptake was observed by the soybean canopy

compared to winter wheat. Variation in daytime exchanges of CO2 is mainly controlled by photosynthetically active radiation (PAR) and soil moisture availability. During the summer of 2008, peak CO2 uptake by soybean canopy was -18 mmol m2 s-1 (negative values indicate sink for C). In contrast, winter wheat canopy reached a maximum of -13 mmol m2 s-1 in month of April, 2008. The overall daily and monthly energy partitioning (latent, sensible and soil heat flux, W/m2) trend is primarily controlled by soil water and available net radiation for both 2007 and 2008 growing seasons. Because of the unusually dry summers of the past two years, most of the available heat was dissipated via sensible heat.

#79 Location impacts of the Mercedes-Benz Plant in Tuscaloosa Alabama of rural land and the roadway networks.

Karen Nanton (MURP Student) Dr. C. Wilson, Dr. B. Herbert, Dr. M. Wagaw (Advisors)
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In recent years state and local economic growth initiatives have supported the expansion and development of large contiguous parcels of rural properties, in the State of Alabama, for the building of automotive manufacturing plants. In recent years three major automotive plants have been located in Alabama; two of which are in distinct rural areas. These large development projects induce new dynamics into the socioeconomics and transportation infrastructure of the whole state and /or surrounding cities. An investigation of the pre and post development characteristics of the road infrastructure and the land use changes are important factors in an assessment of how these areas have changed and offer some predictive factors for future locations with the ultimate goal of supporting sustainability and smart growth. The use of primary and secondary data will be utilized for quantitative determination of major roads and highway development undertakings since the 1990 (pre-Mercedes) with special attention given to the traffic dynamics after the new establishment of the Mercedes Benz auto production plant.

#80 Benthic Macroinvertebrate Surveys in three North Alabama watersheds

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Benthic macroinvertebrate communities are commonly used as biological indicators for long term water quality studies. Biological assessments in the Wheeler Lake Basin in north Alabama have been conducted since 2006. The Flint River, Indian Creek, and Flint Creek watersheds were sampled seasonally in 2007 and 2008 along 3 reaches. Sampling methods were modified from the EPA (1996) Rapid Bioassessment Protocols using leaf packs, kick, surber, and dip nets to collect benthic macroinvertebrates from multiple habitats. Biological indices used to determine the community composition and structure included % EPT abundance and richness, total taxa richness, and community diversity. Taxa presence and absence data was analyzed for all three years to find any changes have occurred. Comparisons of community abundance and

richness were also analyzed for all three years. Stream water quality parameters such as dissolved oxygen, turbidity, water temperature, and pH did not significantly change over time. Other habitat characteristics were examined for each watershed.

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Dear Alabama A&M STEM student:

Poster presentations will be accepted from any STEM related research project or Senior project, including current on-going projects at AAMU, or projects completed off-campus through summer research experiences. There will monetary awards along with a certificate from the University. All presentations will be in poster format.

The following explains the abstract categories and the required format.

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Civil Engineering – Senior Projects and Undergraduate Research

Computer Sciences – Undergraduate and Graduate

Electrical Engineering – Senior Projects and Undergraduate Research

Engineering Technology – Senior Projects and Undergraduate Research

Life Sciences – Undergraduate, Graduate

Mathematics – Senior Projects

Mechanical Engineering – Senior Projects and Undergraduate Research

Natural Resources & Environmental Sciences – Graduate

Nutritional Biochemistry/Food science – Undergraduate and Graduate

Plant/Food Biotechnology – Graduate

Physical & Space Sciences – Undergraduate and Graduate

Wildlife Studies/Forestry – Graduate

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Please indicate if you are an undergraduate or graduate student. Each student is limited to one poster. To be accepted for program inclusion, an abstract must have an advisor/mentor named as a coauthor. All abstracts are to be received in electronic format by **March 23, 2009** (no late abstracts will be accepted).

Type the Title of the poster in **Title Case and Bold** (Times New Roman, 12 point). Skip one line and type the author(s) name(s) and advisor/mentor name(s), with the presenting author listed first, as shown in the Sample Abstract Format (next page). After the authors name, give the authors classification in parenthesis (i.e. Freshman, Sophomore, Junior, Senior, Masters, Ph.D. student). On the next line type the address of the presenting author i.e. academic unit, institution in regular upper/lower case format. Include e-mail address.

Skip one line and type the word ABSTRACT in UPPER CASE. Skip one line and insert the body of the abstract. The abstract should be informative but concise, containing all relevant scientific information and must be no more than **350 words** in length. The complete abstract must be single spaced with paragraphs separated by a blank line. Paragraphs should not be indented. Please use **Microsoft Word 1997-2003**. Photographs, line drawings or tables will not be accepted. Please send your abstract to **stem.day@aamu.edu**. The final selection will be the responsibility of the STEM committee.

Sample Abstract Format:

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Mechanical Engineering – Undergraduate

Effect of Mixed Loading on the Failure of Woven Composites

Danielle Moore (Senior Student), S. J. Chowdhury (Advisor/Mentor), and M. A. Seif

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ABSTRACT

This work studied the mechanical performance of GFRP woven composites under combined tension-bending loading. Special fixtures were used to apply the bending moments through…

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