

2013

Program and Abstracts of the Annual Meeting of the Georgia Academy of Science, 2013

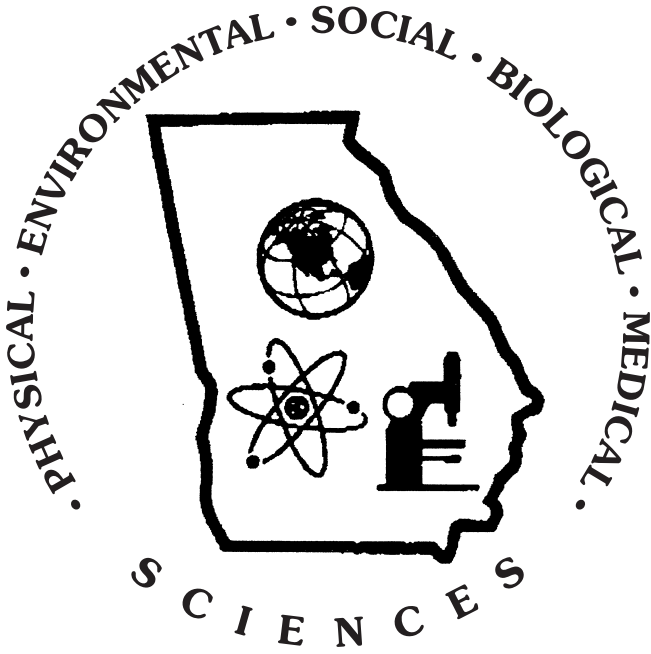
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**Georgia
Academy of Science**

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GEORGIA JOURNAL OF SCIENCE

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GEORGIA JOURNAL OF SCIENCE

Volume 71

2013

Number 1

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GAS PRESIDENT'S WELCOME, COMMENTS AND REPORT FROM THE ACADEMY COUNCIL

Dear Academy Members:

Welcome to the 2013 annual meeting of the Georgia Academy of Science!

The Academy thanks Dr. William J. McKinney, President of Valdosta State University, for the invitation to meet on this campus.

The Local Arrangements Committee (chaired by Dr. James Nienow) has planned an outstanding meeting. Dr. Barry Hojjatie, Technical Program Chair, and the section officers have prepared an interesting and informative program of papers and posters.

The Council has accepted the invitation from Augusta State University (now Georgia Regents University) for the annual meeting in 2014 and from the Georgia College and State University for the annual meeting in 2015. The Academy welcomes invitations to host future meetings in 2016 and beyond.

New people will assume leadership roles in the Academy at the annual meeting after being nominated and elected as Academy officers or section officers. Thank you for your service to those whose terms are ending as well as to the new office holders.

Do you have colleagues who are not members of the Academy? Please tell them about the Georgia Academy of Science and encourage them to join.

Thank you for the privilege of serving as President of the Georgia Academy of Science for the last two years. My association with the Academy began in April, 1968, when I joined while attending the annual meeting at Shorter College. I have attended every annual meeting since then except the joint meeting with the Florida Academy of Science in March, 2008, which occurred less than five weeks after I had by-pass surgery. I was elected President-elect in 1976-1977 but served as Acting President after the president resigned. I also served as President in 1977-1978 and again in 1987-1988. The Georgia Academy has been a major part of my professional career.

Sincerely,

Bob Powell, President
The Georgia Academy of Science



William J. McKinney
President

Welcome to Valdosta State University! It is my pleasure to welcome the Georgia Academy of Science to the Valdosta Campus for its annual meeting. Valdosta State is committed to promoting science education and fostering scientific research in Georgia, and the Academy has a long history of leading efforts in this important task.

Valdosta State University is proud of its new addition to our Bailey Science Center, providing additional state of the art laboratories for research and teaching. The College of Arts and Sciences at Valdosta State University offers B.S. degrees in biology, chemistry, math and computer science, physics, astronomy and geosciences. We also offer a M.S. in Biology. Additionally we offer an engineering studies program (RETP). The Dewar College of Education offers the Masters of Arts in Teaching in middle grades and secondary science and math. Faculty in the College of Arts & Sciences and the Dewar College of Education are active in their research specialties and offer significant opportunities for undergraduates to engage in their research projects and publications.

We are proud to announce our most recent NSF grant with Co-PI/PD Dr. Brian Gerber, Acting Dean, College of Education, and Dr. Thomas Manning, Professor, Department of Chemistry This \$1,154,295 award from the National Science Foundation (NSF) is for the *Valdosta State University Noyce Scholarship Program*. Through this five-year project, twenty academically talented but financially needy undergraduate science majors who might not have otherwise considered a career in K-12 education will be recruited into the teaching profession. These Noyce scholars will enter the program through a two-part summer science internship experience which begins after their sophomore year, with the scholarship phase of the program beginning in their junior year. Program participants, who will receive up to \$12,000 per year in scholarships, will earn a Bachelor's degree with a science major and will obtain teaching certification through a post-baccalaureate program. It is expected that program graduates will teach at high-need middle grades and secondary education schools and that they will be retained in the teaching profession beyond the service repayment period.

The work you are doing is incredibly important for our state, region, nation and world. I know that you will have an energetic and productive meeting.

Sincerely,

A handwritten signature in black ink, appearing to read "W. McKinney".

William J. McKinney, Ph.D.
President

OFFICE of the PRESIDENT

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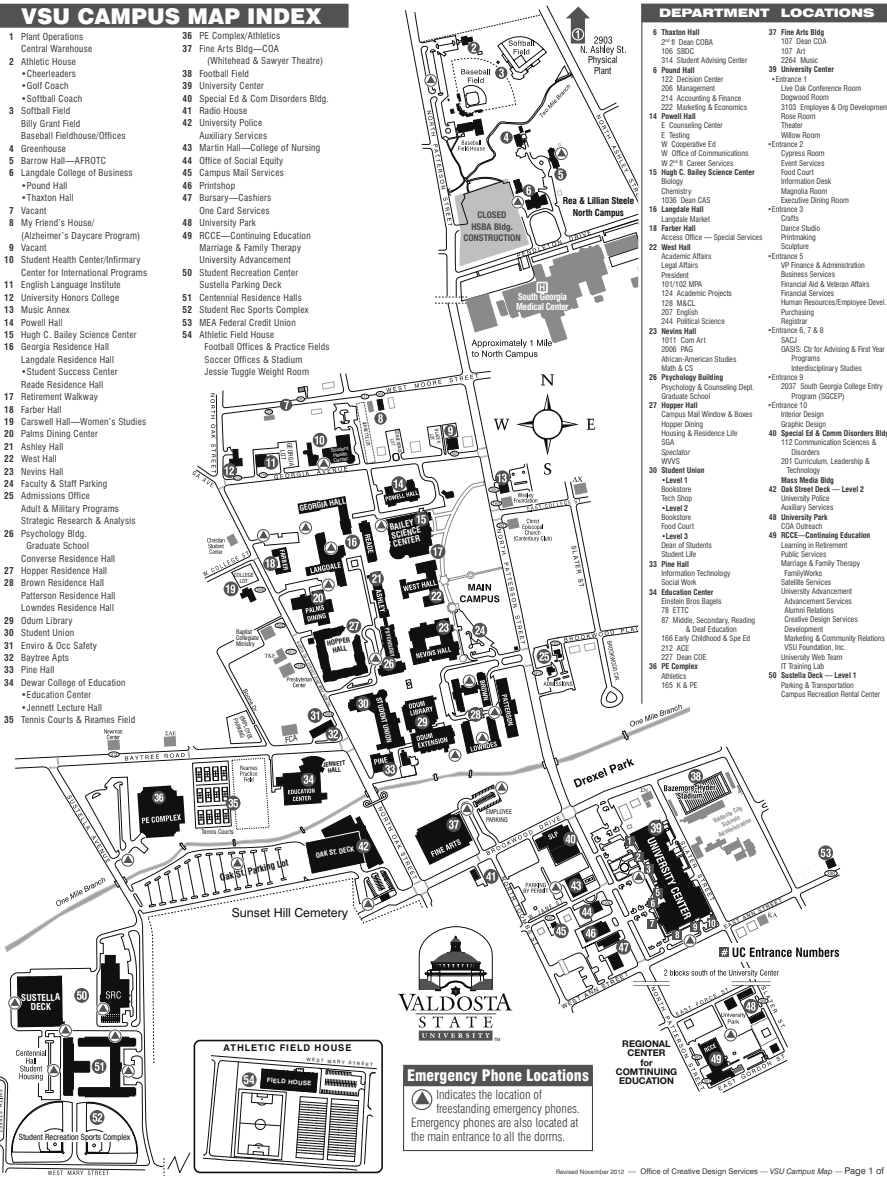
VALDOSTA STATE UNIVERSITY MAP

VSU CAMPUS MAP INDEX

- | | |
|--|--|
| 1 Plant Operations
Central Warehouse | 36 PE Complex/Athletics |
| 2 Athletic House
• Cheerleaders
• Golf Coach
• Softball Coach | 37 Fine Arts Bldg—COA
(Whitehead & Sawyer Theatre) |
| 3 Softball Field
Billy Grant Field
Baseball Fieldhouse/Offices | 38 Football Field |
| 4 Greenhouse | 39 University Center |
| 5 Barrow Hall—AFRTOC | 40 Special Ed & Com Disorders Bldg. |
| 6 Langdale College of Business
• Pound Hall
• Thaxton Hall | 41 Radio House |
| 7 Vacant | 42 University Police
Auxiliary Services |
| 8 My Friend's House/
(Alzheimer's Daycare Program) | 43 Martin Hall—College of Nursing |
| 9 Vacant | 44 Office of Social Equity |
| 10 Student Health Center/Infirmary
Center for International Programs | 45 Campus Mail Services |
| 11 English Language Institute | 46 Printshop |
| 12 University Honors College | 47 Bursary—Cashiers
One Card Services |
| 13 Music Annex | 48 University Park |
| 14 Powell Hall | 49 RCCE—Continuing Education
Marriage & Family Therapy
University Advancement |
| 15 Hugh C. Bailey Science Center | 50 Student Recreation Center
Sustella Parking Deck |
| 16 Georgia Residence Hall
Langdale Residence Hall
• Student Success Center
Reade Residence Hall
Retirement Walkway | 51 Centennial Residence Halls |
| 17 Farmer Hall | 52 Student Rec Sports Complex |
| 18 Carwell Hall—Women's Studies | 53 MEA Federal Credit Union |
| 19 Palms Dining Center | 54 Athletic Field House
Football Offices & Practice Fields
Soccer Offices & Stadium
Jessica Huggs Weight Room |
| 20 Ashley Hall | |
| 21 West Hall | |
| 22 News Hall | |
| 23 Faculty & Staff Parking | |
| 24 Admissions Office
Adult & Military Programs
Strategic Research & Analysis | |
| 25 Psychology Bldg.
Graduate School
Converse Residence Hall | |
| 26 Psychology Bldg.
Graduate School
Converse Residence Hall
Hopper Residence Hall
Brown Residence Hall
Patterson Residence Hall
Lowndes Residence Hall | |
| 27 Hopper Residence Hall | |
| 28 Brown Residence Hall | |
| 29 Odum Library | |
| 30 Student Union | |
| 31 Emire & Dea Safety | |
| 32 Baytree Apts | |
| 33 Pine Hall | |
| 34 Dewar College of Education
• Education Center
• Jennett Lecture Hall | |
| 35 Tennis Courts & Reames Field | |

DEPARTMENT LOCATIONS

- | | |
|--|--|
| 6 Thaxton Hall
2nd Dean COBA
108 SDC
314 Student Advising Center | 37 Fine Arts Bldg
107 Dean COA
107 SDC
204 Music |
| 9 Power Hall
122 Division Center
206 Management
214 Accounting & Finance
222 Marketing & Economics | 39 University Center
• Entrance 1
Law Lib Conference Room
Dogwood Room
3103 Employee & Org Development
Rose Room |
| 14 Powell Hall
E Counseling Center
W Cooperative Ed
W Office of Communications
W 214 Career Services | • Entrance 2
Cypress Room
Event Spaces
Food Court
Information Desk
Magnolia Room
Executive Dining Room |
| 15 Hugh C. Bailey Science Center
Geology
Chemistry
1030 Dean COA | • Entrance 3
Cafes
Dance Studio
Printmaking
Sculpture |
| 16 Langdale Hall
Langdale Market
17 Farmer Hall
Access Office — Special Services | • Entrance 5
VP Finance & Administration
Business Services
Financial Aid & Veteran Affairs
Financial Services
Human Resources/Employee Devt.
Purchasing
Registrar |
| 22 West Hall
Academic Affairs
Legal Affairs
President
101/102 MPH
120 Academic Projects
128 MACL
207 English
244 Political Science | • Entrance 6, 7 & 8
SACU
CASO, Ctr for Advising & First Year
SACU
Interdisciplinary Studies |
| 23 News Hall
1011 Gen Art
2006 PUG
African-American Studies
Math & CS | • Entrance 9
2007 South Georgia College Entry
Program (SCEPE) |
| 25 Psychology Building
Psychology & Counseling Dept.
Graduate School | • Entrance 10
Interior Design
Graphic Design |
| 27 Hopper Hall
Campus Mail Window & Boxes
Hopper Dining
Housing & Residence Life
SGA
Spectator
WWSV | 40 Special Ed & Com Disorders Bldg
112 Communication Sciences & Technology |
| 30 Student Union
• Level 1
Bookstore
Tech Shop
• Level 2
Bookstore
Food Court
• Level 3
Chair of Students
Student Life | Mass Media Bldg
42 Oak Street Deck — Level 2
University Police
Auxiliary Services |
| 33 Pine Hall
Information Technology
Social Work | 48 University Park
COA Outreach
49 RCCE—Continuing Education
Learning in Retirement
Public Services
Marriage & Family Therapy
FamilyWorks
Satellite Services
University Advancement
Advancement Services
Alumni Relations
Creative Design Services
Development
Marketing & Community Relations
VSU Foundation, Inc.
University Web Team |
| 34 Education Center
Enlighten Bros Bagels
75 TTC
87 Middle, Secondary, Reading
K & O Ed Education
166 Early Childhood & Spe Ed
212 ACE
227 Dean COE | 50 Training Lab
Sustella Deck — Level 1
Parking & Transportation
Campus Recreation Rental Center |
| 36 PE Complex
Athletics
165 K & PE | |



GAS 2013 PROGRAM**Friday, March 29, 2013**

1 PM - 6:00 PM	Oral and Poster Sessions	Bailey Science Center Classrooms
6 PM - 7 PM	Light Refreshments	Bailey Science Center Atrium
7 PM - 9 PM	<i>Event Options:</i>	
	Planetarium Show	Nevins Hall
	Open House for VSU Labs	
	"Fish Prints" Workshop (\$10 fee)	

Saturday, March 30, 2013

7:30 AM	Continental Breakfast	Bailey Science Atrium
8 AM - 12 PM	Oral Sessions	Bailey Science Center Classrooms
12:30 PM	Banquet Served (<i>RSVP by March 20, 2013</i>)	
1:00 PM	Banquet Address: Dr. Felicia Coleman	
1:30 PM	Academy Business Meeting	Student Union

**GAS 2013 ROOM ASSIGNMENTS
BAILEY SCIENCE CENTER**

Biological Sciences	3009
Chemistry	1024
Earth/ Atmospheric Sciences	1023
Physics/Mathematics, Computer Science, Engineering and Technology	1025
Biomedical Sciences	3017
Philosophy/History of Science	2020
Science Education	2021
Anthropology	2022

FRIDAY PAPER PRESENTATIONS

*Denotes student presenter

**Denotes student research in progress

Section I: Biological Sciences
Bailey Science Center, Room 3009
Paul T. Arnold, Presiding

- 1:00 THE FUNCTIONAL MORPHOLOGY OF TENSILE ELEMENTS IN SPANISH MOSS, *TILLANDSIA USNEOIDES* (L.) L.** , William H. Dawe* and T.A. Uyeno
- 1:15 THE DISTRUBUTION OF TOPMINNOWS (FUNDULIDAE) IN SOUTH AND SOUTHEAST GEORGIA** , Ashley L. Barnes* , D.L. Bechler, J.S. Salter and B. Albanese
- 1:30 DOMINANT BEHAVIOR MUTANTS FROM THE HERMAPHRODITIC VERTEBRATE MODEL FISH, *KRYPTOLEBIAS MARMORATUS*, Garrett L. Carter* and B.C. Ring
- 1:45 MITE AND DOMATIA DENSITY IN TWO FOREST TYPES IN WEST-CENTRAL GEORGIA, Skylar C. Kirk* , J.A. Barone, J.R. Harrell, M.A. Robinson, C.N. Allen, J.L. Burston, D.J. Ellis, J.H. Gilmore II, B.L. Holloman, J.D. Huffman, B.C. Long, A. McIntosh, B.J. Philpot, W.D. Rogers, J.M. Santos, S. Silvis, A.D. Skillman and B.M. Truett
- 2:00 A TEST OF THE MULTIPLICATIVE RISK MODEL USING A FRESH-WATER FOOD-WEB FRAGMENT, Samantha J. Worthy* , A.L. Bullcock, Z.R. Diener, A.U. Edwards, O.Y. Jackson, J.M. Joiner, M. Junius, J.E. Pitts, A.P. Shields, J.T. Skariah, V.C. Staples and C.B. Ruehl
- 2:15 AN ASSESSEMENT OF POLLINATION SUCCESS BY NATIVE BEES IN NORTH GEORGIA APPLE ORCHARDS, Catherine G. Schlueter* , N.G. Stewart and M.A. Schlueter
- 2:30 AN EXAMINATION OF RURAL, SUBURBAN, AND URBAN WATER QUALITY IN GEORGIA, COSTA RICA, AND COLOMBIA. Jose O. Castano* and M.A. Schlueter
- 2:45 MASON BEE (MEGACHILIDAE:*OSMIA*) ABUNDANCE AND DIVERSITY IN NORTH GEORGIA APPLE ORCHARDS FROM 2010-2012: THE ROLE OF *OSMIA* DURING PREMATURE APPLE BLOOM CONDITIONS, Nicholas G. Stewart* and M.A. Schlueter
- 3:00 **Break**
- 3:15 COSTS AND BENEFITS OF *CERATOMIA CATALPAE* CHEMICAL DEFENSE, Audrey Barrett* and E. Lampert

- 3:30 POPULATION GENETICS OF THREE CRAB SPECIES ALONG THE SOUTHEASTERN ATLANTIC COAST**, S.D. Mannix*, A.E. Hammak, A.L. Coleman, J.M. Reichmuth and A.L. Abdulovic-cui
- 3:45 SPADIX FUNCTION IN THE JACK-IN-THE-PULPIT, *ARISAEMA TRIPHYLLUM*, Sabrina M. Jones*, F.S. Corotto, M.S. Davis and A.R. McCaskill
- 4:00 EFFECT OF LAKE LANIER WATER QUALITY ON THE SURFACING FREQUENCY OF RED-EARED SLIDER TURTLES, *TRACHEMYS SCRIPTA ELEGANS* (WIED-NEUWIED)**, T.J. Pass*, R.C. Fuller and M.D. Horton
- 4:15 EFFECTS OF TEMPERATURE, pH, AND SUBSTRATE CONCENTRATION ON CELLOBIASE ACTIVITY FROM ENZYMES ISOLATED FROM COMMON AND GEORGIA-NATIVE MUSHROOMS**, Mary L. Calderon*, P.T. Arnold and J.C. Schroeder
- 4:30 EFFECTS OF DIETARY FLAVONOIDS ON CYP1A1-LUCIFERASE REPORTER ASSAY ACTIVITY**, Mary E. Maxwell* and J.C. Schroeder
- 4:45 POPULATION CHARACTERISTICS AND HABITAT PREFERENCES OF A STATE-ENDANGERED CRAYFISH *CAMBARUS PARRISHI* IN THE UPPER HIWASSEE RIVER, ** Kacey R. Miller*, A.M. Johnson and J.G. Davis
- 5:00 **Posters (will be displayed through 5:30)**

Section II: Chemistry
Bailey Science Center, Room 1024
Zewdu Gebeyehu, Presiding

- 3:15 PHOTOCURRENT PRODUCTION OF ENHANCED IRON OXIDE FILMS**, R.G. Fontanez and L. de la Garza
- 3:30 SYNTHESIS OF CHIRAL IMINES AND AMINES ON SILICA SURFACES, R. Tomlinson*, J. Baker, S. Booth, J. Brock, M. Patel, C. Perryman and J.T. Barbas
- 3:45 LEWIS ACID CATALYZED 2,3-REARRANGMENTS OF O-ALLYL-HYDROXYLAMINES**, J. C. Lord*, H. F. Lee* and J. M. Baxter Vu
- 4:00 **Posters (will be displayed through 5:30)**

Section IV: Physics, Mathematics, Computer Science and Technology
Bailey Science Center, Room 1025
Hasson M. Tavossi, Presiding

- 1:00 DETERMINING THE VALUE OF A VOTE IN THE UNITED STATES UNDER THE ELECTORAL COLLEGE VOTING SYSTEM USING BINARY INTEGER PROGRAMMING, Joseph M. Cauley*, Maximilian J. Wang* and Sudhir Goel
- 1:15 THE SUMMATION OF THE FIRST n INTEGER POWERS m^k , Maximilian J. Wang* and Sudhir Goel
- 1:30 ANALYSIS OF REUSING RANDOM NUMBERS, Timothy J. Daniel*
- 2:00 NUMERICAL SOLUTION OF COMPLEX EQUATIONS AND APPLICATION IN ELECTROMAGNETIC WAVE PROBLEM SOLVING, Jayanti R. Saha*, K.C. Chan and A.K. Saha
- 2:15 OSCILLATIONS OF A LONG RECTANGULAR BEAM ON TWO PIVOT POINTS, Matthew Roberts and Tom Colbert
- 2:30 TRANSIT OF VENUS, JUNE 2012, Amanda Mashburn*, Bob Powell, Robert Moore, Jr. and Victor Pruett
- 2:45 ARRAYS OF THREE DIMENSIONAL FLAT PANEL SOLAR COLLECTORS, Daniel Hartman*, Ben Jenkins and Bob Powell
- 3:00 **Break**
- 3:15 DEVELOPMENT OF A METHOD TO PREDICT RELATIVE OUTPUT FACTORS OF IRREGULARLY SHAPED ELECTRON FIELDS**, L. Burden*, J. Hauger, J. Lundeen*, J. Newton, C. Sailors*, R. Slayton and C. Wisnieski
- 3:30 SIMULATION OF A VIBRATING BEAM, Daniel Sanchez Carretero** and Javier E. Hasbun
- 3:45 A NUCLEAR PHYSICS SIMULATION SUITABLE FOR CLASSROOM USE, Benjamin E Hogan* and Javier E. Hasbun
- 4:00 INVESTIGATION OF LOW COST BROAD BAND PHOTO-DETECTORS BASED ON LEAD SULFIDE QUANTUM DOTS**, Ryan M. Landry*, Ajith DeSilva, P. K. D. D. P. Pitigala and A. G. U. Perera
- 4:15 SIZE DEPENDENT STUDY OF CADMIUM SELENIDE QUANTUM DOTS FABRICATED BY PHOTOLITHOGRAPHY**, Volker Beutner*, Raghuveer R Gadipalli, Ajith De Silva and Javier E. Hasbun
- 4:30 A COMPARISON OF TWO DIFFERENT NUMERICAL SOLUTIONS FOR THE TWO DIMENSIONAL ELASTIC WAVE EQUATION**, David C. McCall* and Christian Poppeliers

- 4:45 THE EFFECTS OF MEASUREMENT UNCERTAINTY ON SPACIOAN WAVE GRADIENTS AS ESTIMATED FROM A SEISMIC ARRAY**, C. Elizabeth Johnson
- 5:00 AUTOMATED MEASUREMENT OF FORCES BETWEEN PERMANENT MAGNETS AT ROOM TEMPERATURE AND AT LIQUID NITROGEN TEMPERATURE, Cordell FormyDuval*, Ethan Coley* and Ben de Mayo
- 5:15 USING MATLAB TO MEASURE THE POSITION OF AN OBJECT IN A MOVIE**, Ryan Landry and Julie Talbot

Posters (will be displayed through 5:30)

SATURDAY PAPER PRESENTATIONS

*Denotes student presenter

**Denotes student research in progress

Section I: Biological Sciences
Bailey Science Center, Room 3009
Paul T. Arnold, Presiding

- 8:00 FINDING CORRELATIONS BETWEEN BEHAVIOR VARIABLES AND CORRECT RESPONSES TO THE HUMAN-GIVEN CUE OF POINTING IN DOMESTIC DOGS (*CANIS FAMILIARIS*)**, Heather A. Richbourg* and J.G. Davis
- 8:15 FISH ASSEMBLAGE STRUCTURE IN LENTIC VEGETATED MICROHABITATS IN SOUTH GEORGIA**, John S. Salter, Jr* and D.L. Bechler
- 8:30 BRIDGE SITES AS REFUGES FOR FISH AND MACROINVERTEBRATE ASSEMBLAGES IN FIRST THROUGH FOURTH ORDER STREAMS, Charles W. Wright* and D.L. Bechler
- 8:45 METAL ACCUMULATION FROM DIETARY EXPOSURE IN THE SEA HARE, *APLYSIA CALIFORNICA*, Tayler A. Jarvis*, T. Capo and G.K. Bielmyer
- 9:00 MYOGLOBIN CONTENT IN VENTRICLES OF MANGROVE KILLIFISH (*KRYPTOLEBIAS MARMORATUS*) DURING EMERSION**, Nathan B. Shiver* and T.J. Grove
- 9:15 THE IMPACT OF BACKGROUND COLOR ON EGG LAYING RATES AND OUTCROSSING OF *KRYPTOLEBIAS MARMORATUS***, Lynda Bernhardt*, D.L. Bechler, B.C. Ring, J.F. Elder and R.L. Early
- 9:30 THE ECOLOGICAL ROLE OF *CORBICULA FLUMINEA* IN LAKE SEMINOLE, GA, U.S.A., Chase H. Patrick* and M.N. Waters
- 9:45 A COST-EFFECTIVE DEVICE FOR SAMPLING THE WATER COLUMN IN MARINE SYSTEMS**, T.F. West*, T.J. Manning and J.A. Nienow
- 10:00 **Break and Section Business Meeting**
- 10:30 LOG PACKING BEHAVIORS IN THE MANGROVE RIVULUS, *KRYPTOLEBIAS MARMORATUS*, D.L. Bechler and L. Vedas
- 10:45 PHYTOPLANKTON ASSOCIATIONS IN THE VICINITY OF DESOTO CANYON, NORTHEASTERN GULF OF MEXICO: DISTRIBUTIONAL PATTERNS, J.A. Nienow and S. Wise

- 11:00 A PRELIMINARY ASSESSMENT OF THE FIRST INSTAR MORPHOLOGY OF *AGABUS DISINTEGRATUS* (CROTCH) AND *A. PUNCTATUS* MELSHEIMER (DYTISCIDAE: COLEOPTERA), T.A. Shepley-James, E.H. Barman, R.J. Wilkes, B.P. White and G.W. Wolfe
- 11:15 LETHAL AND NON-LETHAL EFFECTS OF GIANT WATER BUGS ON SNAIL AND TADPOLE GRAZERS, Clifton B. Ruehl, H. Vance-Chalcraft and D.R. Chalcraft
- 11:30 Posters (Posters will be displayed through 12:00)

POSTERS

THE EFFECTS OF XYLITOL ON *FUSOBACTERIUM NUCLEATUM* BIOFILM FORMATION, Stephanie A. Arrowood* and A.L. Kwiatkowski

PLANT SALICYLIC ACID BIOSYNTHESIS AND METABOLISM: INSECTICIDAL EFFECT ON ARGENTINE ANT (HYMENOPTERA: FORMICIDAE)**, Megan Babb*, J. Marks*, J. Stephens*, S. Rountree*, E. Antakikam*, M. Brinkman, C. Kang and C. Lee

ANALYSIS OF THE SYNERGISTIC EFFECTS OF OREGANO AND GARLIC OIL AGAINST PATHOGENIC MICROBES**, R.P. Bagnal* and J.M. Morgan

RESTORATION OF DEGRADED BLACK BELT PRAIRIES: EFFECT OF FIRE AND CLEARING TREATMENTS, John A. Barone* and J.G. Hill

PROMOTING SCIENTIFIC RESEARCH THROUGH HERBARIUM DIGITIZATION AT VALDOSTA STATE UNIVERSITY**, J.M. Bartek*, A.M. Vardeman*, A.N. Blocker* and C.L. Louis*

MACROINVERTEBRATE DIVERSITY & *E. COLI* PRESENCE IN AN URBAN STREAM IN AUGUSTA, GA, Chris Bates, C. Taylor-Burton*, M. Nakama*, L. Quibeuf*, S. Sutton*, A. Woodward*, O. Flite and J.M. Reichmuth

COMPARING BAIT FISH AMONG THREE BARRIER ISLANDS OF THE GEORGIA-CAROLINA COASTAL REGION**, C.F. Best*, B. Saul and J.M. Reichmuth

PLANT EXTRACT EFFECTS ON AMYLOIDOGENIC FOLDING OF THE SUP35 PROTEIN OF *SACCHAROMYCES CEREVISIAE*** , Emily B. Blackmon*, J. Festa*, J.A. Tierno*, D. Pye* and M.L. Gleason

FALL AND WINTER HABITAT PREFERENCES OF TWO COMPETING CRAYFISHES IN A SMALL, HEADWATER STREAM**, Ashley Cross*, Z. Wagoner*, B. Bradley*, H. Hoopingarner* and J.G. Davis

ANALYSIS ON THE GENETIC DIFFERENCES BETWEEN THE MANGROVE KILLIFISH *KRYPTOLEBIAS MARMORATUS* AND *KRYPTOLEBIAS OCCELATUS*** , Fiifi A. Dadzie*, B. Ring and J.F. Elder

TEMPORAL VARIABILITY OF BAT ACTIVITY DURING WINTER IN LAMAR COUNTY, GEORGIA, Megan A. Dedge*, M.J. Bender, G.F. Clement and G.D. Hartman

PHYLOGENETIC ANALYSIS OF A FROG VIRUS 3-LIKE RANAVIRUS FOUND AT A SITE WITH RECURRENT MORTALITY AND MORBIDITY EVENTS IN SOUTHEASTERN ONTARIO, CANADA, Amanda L.J. Duffus and A.M. Andrews*

MEGACOPTA CRIBRARIA POPULATION DYNAMICS AT THE OCONEE RIVER GREENWAY, MLLEDGEVILLE, GA., K. Fogg*, S. Huckisson* and C. Zehnder

SEASONAL PATTERNS OF MACROINVERTEBRATE DRIFT IN LOW-ORDER STREAMS, Liz French*, C. Haygood*, S. McWhorter*, B. Smith* and M. Davis

BARCODING THE MISSISSIPPI AND ALABAMA BLACK BELT PRAIRIE FLORA USING THE RBCL-MATK GENE REGIONS, Robert B. Futrell*, J.A. Barone and K.S. Burgess

DO THEY STAY OR DO THEY GO NOW? A STUDY OF SITE FIDELITY AMONG THREE SPECIES OF MARINE FISHES**, M. W. Gieseeking* and J. Reichmuth

A COMPARISON OF THREE-DAY BIRD DIVERSITY SURVEYS IN TORTUGUERO NATIONAL PARK (COSTA RICA), Shezeen Gillani*, C. Valenzuela, K. Valenzuela and M.A. Schlueter

RELATIONSHIP BETWEEN CNR1 GENE VARIATION AND BEHAVIORAL DIFFERENCES AMONG KRYPTOLEBIAS MARMORATUS LABORATORY ISOGENIC LINES**, A. Gopinath*, J.F. Elder and B.C. Ring

CAMERA TRAP PRICE MAY NOT INFLUENCE CAPTURE SUCCESS, Justin B. Gossett*, J.M. Strickland*, M.J. Bender and G.D. Hartman

PLANT SHADE AVOIDANCE RESPONSE AT DIFFERENT TEMPERATURES, Jamekia Grant* and B. Kim

PLANT PIGMENT ACCUMULATION UNDER EXTRA FAR-RED LIGHT CONDITION AT DIFFERENT TEMPERATURES**, Joshua Hicks*, K. Peets, D. Zellous, D. Anderson, and B. Kim

EFFECT OF ACUTE HERBICIDE EXPOSURE ON NERVE ACTIVITY IN PROCAMBARUS ZONANGULUS, Kathleen S. Hughes, C.N. Allen*, S.M. Brackett*, J.L. Burston*, D.L. Ellis*, W.E. Grimes*, B.L. Holloman*, S.C. Kirk*, C.E. Lee*, D.A. Loper*, C. Morgan*, E.A. Oludimimu*, E.D. Walker*, S.B. Whitley* and S.L. Worthy*

HOST PLANT PREFERENCE OF MEGACOPTA CRIBRARIA**, Sarah M. Huskisson*, K. Fogg, and C.B. Zehnder

GLOBAL RANAVIRUS PHYLOGENY FOR THE FAMILY RANIDAE, Christie M. Jackson* and A.L.J. Duffus

ASSESSMENT OF CAMBARUS TRUNCATUS (OCONEE BURROWING CRAYFISH) DIVERSITY THROUGH GENETIC ANALYSIS**, Robert B. Jones*, Y.E. France and C.E. Skelton

CULTURABLE GUT MICROBIOME DIVERSITY OF TWO GENERALIST HERBIVORES, Alyssa Kelly* and E. Lampert

THE ECOLOGY OF THE LARGE MOUTH BASS (*MICROPTERUS SALMOIDES*) AND BLUEGILL (*LEPOMIS MACROCHIRUS*) POPULATIONS IN THE GORDON STATE COLLEGE POND, Darryll W. Kipp Jr.* , C.M. Jackson* , J. Thaeter* , E.J. Martin IV* , J.C. George, A.M. Andrews* and A.L.J. Duffus

EXPLORING THE ROLE ENVIRONMENT PLAYS ON GENE REGULATION USING A FLUORESCENTLY TAGGED GLUCOSE TRANSPORTER IN *SACCHAROMYCES CEREVISIAE*** , Tae Young Lee* and J.M. Morgan

IDENTIFICATION OF *NOCOMIS LEPTOCEPHALUS INTEROCULARIS* (CYPRINIDAE) FROM LUMPKIN COUNTY, GEORGIA, USING MITOCHONDRIAL CYT-B AND NUCLEAR IRBP2 DNA SEQUENCES, B.R. Mangum* , D.N. Dehner-Aganovic and S.A. Webb

ANTIMICROBIAL PROPERTIES OF EGG WHITE AGAINST THE BACTERIA *AEROMONAS HYDROPHILA*, *STAPHYLOCOCCUS AUREUS*, AND *ESCHERICHIA COLI*** , Natalie Mellem* , J. Butler* , S. Gitau* , A. Lester and D. McGarey

AN ACOUSTIC SURVEY OF ANURAN SPECIES RICHNESS IN LAMAR COUNTY, GEORGIA, Joseph D. Nestor* , B.L. Cochran, G.D. Hartman and A.L.J. Duffus

PHYTOPLANKTON ASSOCIATIONS IN THE VICINITY OF DESOTO CANYON, NORTHEASTERN GULF OF MEXICO: ANALYSIS OF THE SURFACE PIGMENTS** , A.V.F. Nienow* , M. Waters and J.A. Nienow

PHYTOPLANKTON ASSOCIATIONS IN THE VICINITY OF DESOTO CANYON, NORTHEASTERN GULF OF MEXICO: NEW RECORDS FOR THE GULF OF MEXICO, J.A. Nienow

FATE OF CAROTENOIDS CONSUMED BY *TRICHOPLUSIA NI* LARVAE** , Obadi Obadi* and E. Lampert

COMPARISON OF GROWTH AND DISPERSAL OF TWO CRAYFISHES IN A SMALL, HEADWATER STREAM.** Madison Perdue* , T. Haney* , H. Kudela* , A. Davenport* and J.G. Davis

CHARACTERIZATION OF THE *PEL* REGULATORY ELEMENT OF *PITX1* IN EMPETRICHTHYINE FISHES (GOODEIDAE)? : DNA SEQUENCE ANALYSIS, B.J. Przygoda* and S.A. Webb

PHYLOGENETIC RELATIONSHIPS OF VERTEBRATE RANAVIRUSES BASED ON THE MAJOR CAPSID PROTIEN NUCLEOTIDE SEQUENCE, Derek K. Pugh* and A.L.J. Duffus

STERILE MUTANTS OF THE MANGROVE KILLIFISH (*KRYPTOLEBIAS MARMORATUS*), Nicole R., Rutledge* , S. Sucar and B.C. Ring

DNA BARCODING AT GORDON STATE COLLEGE: A COLLABORATIVE LABORATORY PROJECT BETWEEN TWO UNDERGRADUATE COURSES**, Tiffany Schluter*, J. Alexander*, J. Stephens*, E. Antakikam*, M. Babb*, C.A. Danderson and C. Lee

DISTRIBUTION OF PLANKTONIC DIATOMS IN THE NORTHEASTERN GULF OF MEXICO**, A. Shultz*, C. Bryller*, J. E. Tillman, Jr.* and J.A. Nienow

INVESTIGATION OF STREAM DISTURBANCE ON REPRODUCTIVE LIFE HISTORY TRAITS IN BLUEHEAD CHUBS, Kaleigh Sims*, L. Jenkins*, M. Daigle*, S. Merck*, D. Dehner-Aganovic and M. Davis

PHYLOGENETIC AFFINITIES OF PISCINE IRIDOVIRUS ISOLATES FROM AROUND THE GLOBE, Jennie N. Thaeter* and A.L.J Duffus

VIABILITY OF *RICKETTSIA PROWAZEKII* AFTER THE DEATH OF GAMMA INTERFERON-PRETREATED, INFECTED, MACROPHAGE-LIKE RAW264.7 CELLS, AND PROTECTION OF THE MACROPHAGES BY POLYETHYLENE GLYCOLS, Kathryn H. Vernon and J. Turco

DEEP SEA PLANKTON SAMPLING VIA CHEMICALLY POWERED APPARATUS**, T.F. West III*, J.A. Nienow and T. Manning

A SNAIL'S PACE: DENSITY, MOVEMENT, AND FOOD CHOICE OF THE MARSH PERIWINKLE, C.J. Young* and J.M. Reichmuth

THE EFFECTS OF *MEGACOPTA CRIBRARIA* AND NITROGEN FIXING RHIZOBIUM ON SOYBEAN PHYTOCHEMISTRY**, Anne O. Zimmerman* and C.B. Zehnder

Section II: Chemistry
Bailey Science Center, Room 1024
Zewdu Gebeyehu, Presiding

8:15 THE COPPER (II) ION AS A DELIVERY AGENT FOR MEDICINAL AGENTS, Melody Sobhani, John Milam, Iris Rivera, Rachel Robertson, Satilla B. Johns, Haley Franklin and Thomas Manning

8:30 MULTIVARIATE ANALYSIS OF DRY POWDER MIXTURES OF ACETYLSALICYLIC ACID AND SALICYCLIC ACID USING FTIR-ATR AND MICROSOFT EXCEL **, C. A. Swanson*, E. R. Heilig* and M. C. Koether

8:45 REDUCTION OF HEXAVALENT CHROMIUM BY COFFEE, B. Garduno* and D. Kim*

9:00 APPLICATION OF GREEN TEA FOR HEXAVALENT CHROMIUM REDUCTION, C. Huynh* and C. Kim

9:15 **Break**

9:30 SYNTHESIS OF ACETYLENE CONTAINING PORPHYRINS**, A.K. Epps, E. Tavasoli, J. Vela and G. Mandouma

9:45 SYNTHESIS AND CHARACTERIZATION OF THE SULFA DRUG 4-AMINO-N-P-TOLYL BENZENESULFONAMIDE FOR POTENTIAL USE AS AN INEXPENSIVE ANTIBIOTIC**, S.D. McBain*, C. Appling* and D.P. Pursell

10:00 **Break and Section Business Meeting**

POSTERS

SYNTHESIS AND CHARACTERIZATION OF NANOPARTICLES CONTAINING CONFINED POLYSTYRENE**, M.B. Blackmon* and D.W. Holley

ALTERNATIVE INSTRUMENTATION FOR THE DISSOLUTION OF TOPICAL OINTMENTS, A.C. Smith

FABRICATION OF POLYMERIZED COLLOIDAL CRYSTAL ARRAY THIN FILM FOR CHEMICAL NERVE AGENTS DETECTION**, M. P. N. Bui and S.S. Seo

TOWARDS NOVEL SHAPE-PERSISTENT BENZO[C]CINNOLINE-ETHYNYLENE MACROCYCLES**, C.A. Brown and G.R. Mandouma

SYNTHESIS AND CHARACTERIZATION OF LANTHANIDE (III)-CARBOXYLATE COMPLEXES**, C.E. Milliron III* and Z. Gebeyehu

DISSOLUTION TESTING: ASSESSMENT OF POSSIBLE ALTERNATIVE METHODS AND INSTRUMENTATION FOR DISSOLUTION TESTING OF ASPIRIN TABLETS, E.R. Heilig*, C.A. Swanson* and M.C. Koether

CHARACTERIZATION OF THE PHYSICO-CHEMICAL PROPERTIES OF THE HARENNA FOREST HONEY IN BALE, ETHIOPIA, A. Belay, S. Worku, G. Bultossa, N. Adgaba and S.M. Abegaz*

OPTIMIZATION OF CO₂ ADSORPTION COMPOSITE MATERIALS FOR CARBON CAPTURE AND SEQUESTRATION TECHNOLOGIES, B. Hasanovic*, A. Gunter*, C. Kim and S.H. Park

CATALYST- AND SOLVENT-FREE HIGH YIELDING ULLMANN'S COUPLING REACTIONS, D. Mitchell* and G. Mandouma

THE ANALYSIS OF THE RELEASE RATE OF SALICYLIC ACID IN LIQUID STOMACH RELIEF SUSPENSIONS, A.S. Durden*

EXPLORING ORGANIC ACID CHLORIDES AS SUPERHYDROPHOBIC COATINGS, X. Zheng, C. Seay, K. Chan, L. Zheng and L. Wrensford, Albany State University, Albany, GA 31705.

Section III: Earth and Atmospheric Sciences
Bailey Science Center, Room 1023
Alfred J. Mead, Presiding

- 8:00 DEVELOPING A CLASSIFICATION SCHEME AND DIGITIZING PROTOCOL FOR ARTIFICIAL FEATURES ALONG ESTUARINE SHORELINES IN SOUTH CAROLINA**, rt S. Killingsworth*, A.R. Middleton* and C.W. Jackson
- 8:15 ASSESSING VULNERABILITY OF ARTIFICIAL STRUCTURES ALONG ESTUARINE SHORELINES IN SOUTH CAROLINA**, Adam R. Middleton*, A.S. Killingsworth* and C.W. Jackson
- 8:30 WATER QUALITY AT THREE BLACKWATER STREAM SITES, SOUTH GEORGIA, C.R. Nimmo* and D.M. Thieme
- 8:45 EFFICACY OF FILTRATION METHODS TO REMOVE CONTAMINANTS IN DRINKING WATER AND CONTAMINANT TRANSPORT IN GROUNDWATER AQUIFERS**, Alicia Estabrook* and Samuel Mutiti
- 9:00 GEOCHEMICAL EVOLUTION OF GROUND AND SURFACE WATER THROUGH A WETLAND SYSTEM**, Jenna B. Flitcroft*, C. Mutiti and S. Mutiti
- 9:15 STRATIGRAPHY OF LATE EOCENE SEDIMENTARY UNITS IN BALDWIN COUNTY**, Lori Berry*, Alfred J. Mead and Samuel M. Mutiti
- 9:30 A PRELIMINARY ANALYSIS OF MARINE MACROFOSSILS FROM EOCENE LIMESTONE IN JONES COUNTY, GEORGIA**, Shane J. Benton* and Alfred J. Mead
- 9:45 TOOTH AGE AND GROWTH RATE IN THE MOSASAUR *TYLOSAURUS PRORIGER***, Zachary T. Ansley*, K.M. Smith and M.D. D'Emic
- 10:00 **Break and Section Business Meeting**

POSTERS

BIOGEOGRAPHY AND STABLE ISOTOPE ECOLOGY OF AMERICAN MASTODONS (*MAMMUT AMERICANUM*) FROM THE ATLANTIC COASTAL PLAIN: EVIDENCE FROM A NEW MASTODON FROM NORTH CHARLESTON, SOUTH CAROLINA**, C.M. Brussell*, K.M. Smith, F. Rich and K.M. Brown

COMPARATIVE ANALYSIS OF GROUND PENETRATING RADAR (GPR) USING BI-DIRECTIONAL AND UNIDIRECTIONAL SURVEY PROFILES, Clara R. Rucker*, W.B. Hart* and Z.T. Ansley*

A COMPARISON OF $\delta^{18}\text{O}$ AND $d\text{D}$ SOUTH BEACH MIAMI OCEAN WATER TO SW FLORIDA ESTUARIES**, J.Y. Acevedo* and W. Feng

THE PREVALENCE AND POTENTIAL SOURCES OF ESTROGEN, *E. COLI*, AND COLIFORM BACTERIA IN FISHING CREEK AND THE OCONEE RIVER**, Tyler V. Mattix* and Samuel Mutiti

Section IV: Physics, Mathematics, Computer Science and Technology
Bailey Science Center, Room 1025
Hasson M. Tavossi, Presiding

- 8:00 AN APPROXIMATION METHOD FOR THE SOLUTIONS TO NON-LINEAR OSCILLATOR EQUATIONS OF MOTION, Kale Oyedeji and Ronald E. Mickens
- 8:15 SCIENTIFIC LITERACY IN PHYSICS, Bob Powell
- 8:30 ANALYSIS OF RAPID COOLING OF BIOMATERIALS CERAMICS, Barry Hojjatie, David Gibson and Ahmad Saatchi
- 8:45 IMPROVING THE ANODE PERFORMANCE BY ELECTRO-DEPOSITING PB-SN ALLOY, AMORPHOUS SI, AND MNO_2 ON ELECTROSPINNING-DERIVED CARBON NANOFIBER WEBS IN LITHIUM ION BATTERIES, A. Saatchi, B. Hojjatie, E. Ghanbari, A. R. Saatchi and J. Moazenni
- 9:00 VISUALIZING THE CUBICS' BAND ENERGIES AND FERMI SURFACES IN SOLID STATE PHYSICS, Javier E. Hasbun
- 9:15 A BRIEF HISTORY OF THE SARA CONSORTIUM, Kenneth S. Rumstay
- 9:30 ASTEROID PHOTOMETRY IN THE SARA REU PROGRAM, FROM 1999 TO 2012, M.A. Leake
- 9:45 CHANGES IN JUPITER'S GREAT RED SPOT IN 2010 AND EARLY 2011, Richard W. Schmude, Jr.
- 10:00 **Break and Section Business Meeting**
- 10:45 LIGHT CURVE OF JUPITER, Richard W. Schmude, Jr.
- 11:00 CHARACTERIZATION OF IRREGULAR POROUS MATERIALS BY ULTRASOUND: APPLICATION TO LUNG-TISSUE MODELING, Hasson M. Tavossi and Jared C. Harris*
- 11:15 MEASUREMENTS OF THE NONLINEAR INTERACTION BETWEEN COUNTERPROPAGATING ALFVÉN WAVES, D.J. Drake, J.W.R. Schroeder, G.G. Howes, C.A. Kletzing, F. Skiff and T.A. Carter

- 11:30 COMPUTER APPROXIMATIONS OF NORMAL DISTRIBUTION, Jin Wang and Said C. Fares
- 11:45 OCCURRENCE OF NEGATIVE RESISTIVITY IN A HIGH TEMPERATURE SUPERCONDUCTOR, Ben de Mayo

POSTERS

IRON-BASED SUPERCONDUCTIVITY: A STUDY OF SRFE2AS2, David L. George*, Luan P. Nguyen*, Walter Uhoya and Gary N. Chesnut

DOCUMENTING WAVE FIELD CONSISTENCIES ACROSS SMALL SCALE SEISMIC ARRAYS**, Clay F. Tuggle* and C. Poppeliers

MEASUREMENT OF THE FORCES BETWEEN TWO PERMANENT MAGNETS USING A PRECISION LINEAR MECHANICAL FEED, Natalee Hite*, Jessica Rattray* and Ben de Mayo

TESTING THE FEASIBILITY OF A BLADELESS WIND TURBINE**, Ian Agnew and Taylor Ray

Section V: Biomedical Sciences Bailey Science Center, Room 3017 Seyed H. Hosseini, Presiding

- 9:00 VIBRIO *CHOLERA* GHOST ENHANCE *CHLAMYDIA*-SPECIFIC IMMUNE RESPONSES VIA THP-1 CELL ACTIVATION** April Stevens, Roshan Pais, Francis Eko, Qing He and Godwin Ananaba
- 9:15 EFFECTS OF LIGHT EXPOSURE AND VITAMIN D ON THE DEVELOPMENT OF MYELIN BASIC PROTEIN IN THE MYELIN SHEATH OF NEURONAL AXONS IN JUVENILE ZEBRAFISH**, Callie Holloway* and Linda G. Jones
- 9:30 ALTERATION OF GLUT1 AND GLUT4 IN L6 MUSCLE CELLS IN RESPONSE TO GLUCOSE LEVELS AND INSULIN**, Cameron Medina* and Linda G. Jones
- 9:45 CHEMOTAXIS OF NEUTROPHILS IN A TAIL-FIN WOUND MODEL IN JUVENILE ZEBRAFISH**, Emalyn Cork*, Kacey Miller*, Chris Heard* and Linda G. Jones
- 10:00 **Break and Section Business Meeting**

POSTERS

PLANT BASED AS ANTIFUNGAL AGENT AGAINST *ASPERGILLUS* SPECIES IN GEORGIA PEANUTS**, Reesheda Gilbert

NLRP 3 INFLAMMASOME ASSEMBLY IS REQUIRED FOR CASPASE ACTIVATION DURING *CHLAMYDIA* INFECTION**, Danielle N. McKeithen*, Yusuf Omosun, E. Caroline Kibakaya*, Francis O. Eko, Joseph U. Igietseme, Godwin A. Ananaba and Qing He

AN ASSESSMENT OF THE TOXICITY OF NOVEL ANALOGUES OF PERSIN**, Heather D. Perry*, David N. Aban*, Thomas D. Crute and Richard D. Griner

ANTIMICROBIAL PROPERTIES OF EGG WHITE ON THE BACTERIA *AEROMONAS HYDROPHILA*, *STAPHYLOCOCCUS AUREUS*, AND *ESCHERICHIA COLI***, Natalie Mellem*, Joshua Butler*, Stephen Gitau*

RNA INTERFERENCE (RNAI) STRATEGIES TO REDUCE FITNESS OF INSECT PESTS**, Neha Reddy* and Wayne B. Hunter

STUDY OF THE GENE REGULATORY NETWORK FOR SEA URCHIN PIGMENT CELLS DEVELOPMENT**, Antonio C. Ortiz* and Cristina Calestani

PERFLUOROOCCTANOIC ACID (PFOA) DECREASES STEROIDOGENESIS IN MOUSE LEYDIG TUMOR CELLS**, S. Tadros* and J.D. Cannon

Section VI: Philosophy and History of Science
Bailey Science Center, Room 2020
E.T. McMullen, Presiding

9:00 QUANTUM STATES ARE NEITHER REAL NOR NON-REAL, BUT SEMI-REAL, Dennis W. Marks

9:30 EMERGENT BEHAVIOR, Ronald E. Mickens

10:00 **Break and Section Business Meeting**

10:30 LYELL AND WHERE THE PAST IS NOT EXPLAINED BY THE PRESENT, Tom McMullen

11:00 THE HISTORY OF DREDGING IN THE ST. MARYS RIVER, KINGS BAY NAVIGATION IMPROVEMENTS, AND AMELIA ISLAND BEACH RE-NOURISHMENT, Elliott O. Edwards, Jr.

Section VII: Science Education
Bailey Science Center, Room 2021
Ollie Irons Manley, Presiding

9:00 THE EFFECT OF HAND-HELD TECHNOLOGY ON STUDENT ENGAGEMENT AND ACHIEVEMENT**D.B. Addison* and R.A. Cooper

- 9:15 PRELIMINARY RESULTS EXPLAINING THE DISCORD BETWEEN CHEMICAL, BACTERIAL AND BIOLOGICAL MONITORING OF IMPAIRED CABIN CREEK**, Ryan d. Haire*, Jennie Thaeter* and M.C. Fermin-Ennis
- 9:30 SOURCES OF KNOWLEDGE ABOUT BIOLOGY FOR CHILDREN AT A COMMUNITY GARDEN, Judy Orton*, and M. Renken
- 9:45 INCREASING LITERACY AMONG URBAN STUDENTS IN SECONDARY SCIENCE CLASSROOMS THROUGH LITERACY INTEGRATION METHODS IN THE ERA OF COMMON CORE, A.S. Oyenuga* and Ollie Manley
- 10:00 **Break and Section Business Meeting**
- 10:30 HOW DO SUPPLEMENTED DIETS AFFECT THE NUTRITION AND TROPHIC INTERACTIONS OF AN ANIMAL MODEL?, Evan Lampert
- 10:45 TEACHING ETHNOMATHEMATICS AND INDIGENOUS MATHEMATICAL KNOWLEDGE SYSTEMS THROUGH CULTURALIMMERSION, Iman C. Chahine
- 11:00 SUPPLEMENTAL PROBLEM-SOLVING SESSIONS AND THEIR IMPACT ON STUDENT SUCCESS IN THE INTRODUCTORY PHYSICS SEQUENCE, Julie Talbot
- 11:15 FACULTY'S PERCEPTION OF THEIR PREPARATION TO TEACH IN AN ONLINE PROGRAM, Ollie Manley and Gladys Yarbrough
- 11:30 USING MULTIPLE INTERVENTION INSTRUCTIONAL SUPPORT IN PRECALCULUS CONCEPTS TO ADVANCE UNDERGRADUATE STUDENTS' SUCCESS IN CALCULUS, Iman C. Chahine and Mark Grinshpon

Section VIII: Anthropology
Bailey Science Center, Room 2022
Susan Kirkpatrick Smith, Presiding

- 8:15 ENVIRONMENTAL ASSESSMENT OF VINEYARD MOUNTAIN TRAIL, ALLATOONA DAM ARMY CORPS OF ENGINEERS LAND, Olivia Pisano* and Wayne Van Horne
- 8:30 THE UTILITY OF REMOTE SENSING TECHNIQUES FROM THE DABBS SITE: A LOOK AT THE EFFICIENCY OF THE GROUND PENETRATING RADAR AND MAGNETOMETER, Jeffrey Turner*, Keener Smith*, Stephanie Henry, Terry Powis and Sheldon Skaggs
- 8:45 "YEAH, BUT CAN IT KILL YOU?" UNDERSTANDING ENDOMETRIOSIS IN THE ATLANTA AREA, Amanda N. Day*

- 9:00 ULTRASTRUCTURAL INVESTIGATIONS FOR PALYNOLOGICAL EVIDENCE IN ARCHAEOLOGICAL MATERIALS: CALCULUS OF AN OLD KINGDOM MUMMY FROM ABYDOS, EGYPT, Ian H. Garrison* and Alexander S. Brown*
- 9:15 PHYLOGENETIC RELATIONSHIPS BETWEEN THE UPPER MOLARS OF *SAHELANTHROPUS TCHADENSIS* AND LATE MIOCENE HOMINOIDS AND HOMINIDS, Laura D. Lund* and Frank L. Williams
- 9:30 AGENCY AMONG THE SAVANNAH CULTURE 1100AD TO 1250AD: A SPATIAL ANALYSIS OF MISSISSIPPIAN BURIAL MOUND SITES ON THE GEORGIA COAST**, Billy McCarley
- 9:45 MEASURING POST-INUNDATION EROSION OF ARCHAEOLOGICAL SITES IN LAKE OCONEE - TWO CASE STUDIES, Tyler J. O'Connor*
- 10:00 **Break and Section Business Meeting**
- 10:30 THE ETHICAL TREATMENT OF HUMAN REMAINS IN THE MUSEUM CONTEXT, Samantha J. Roberts*
- 10:45 PRELIMINARY RESULTS OF INTENSIVE ARCHAEOLOGICAL SURVEY AT THE LINCOLN TRAIL SITE (9BN17) IN BRYAN COUNTY, GEORGIA, Ryan O. Sipe*
- 11:00 POPULATION CORRELATION: SITE SIZE IN THE MEWAR PLAIN, NORTH WEST INDIA, Caitlin Syfrett*
- 11:15 MAN OR MOUNTAIN? COMPARING CONSTRUCTED AND GEOGRAPHIC DEFENSES IN RAJASTHAN, INDIA**, Duncan Balinger

POSTERS

DENTAL MICROWEAR ANALYSIS OF THE LA CAPILLA DEL NINO SERRATINO SITE OF EARLY-CONTACT PERIOD PERU, Keegan T. Brooks*, Frank L'Engle Williams, Bethany L. Turner and Haagen D. Klaus

RECONSTRUCTING THE DIETARY BEHAVIORS OF *PARAPAPIO JONESI* FROM THE STERKFORTEIN AND SWARTKRANS CAVES OF PLIO-PLEISTOCENE SOUTH AFRICA USING DENTAL MICROWEAR, Carey J. Garland* and Frank L'Engle Williams

ANALYSIS OF PUNCTURE PIT POSITION AND USE WEAR IN PRIMATES FROM LIGHT MICROSCOPY OF DENTAL MICROWEAR FEATURES, Megan A. Sams* and Frank L'Engle Williams

FRIDAY PAPER PRESENTATIONS

*Denotes student presenter

**Denotes student "in progress" research

Section I: Biological Sciences
Bailey Science Center, Room 3009
Paul Arnold, Presiding

1:00 THE FUNCTIONAL MORPHOLOGY OF TENSILE ELEMENTS IN SPANISH MOSS, *TILLANDSIA USNEOIDES* (L.) L.**, William H. Dawe* and T.A. Uyeno, Valdosta State University, Valdosta, GA 31602. Spanish moss is a rootless, epiphytic relative of the pineapple that hangs in clumps from tree branches and grows downward as chains of nodes and internodes. Propagation occurs via seed production and also through fragmentation in which young tip nodes may continue to grow if appropriately relocated. This preliminary study describes the tensile structure of the plant using histological techniques and investigates the mechanics of fragmentation using tensile tests. As histology indicates that older nodes develop a more lignified core, we hypothesized that tip nodes would be weakest and nodes above would be progressively stronger. A load cell and a micro-manipulator were used to measure the tensile force at failure for each node in the chain. We found two different strength profiles; one showed increasing breaking strength at each node from tip to branch. The other showed a strength increase from tip to middle, but then top nodes near the branch became weaker. We conclude that Spanish moss may be modulating node strength to strengthen clump branch attachment or to facilitate fragmentation. Further stress/strain tests are needed to describe the mechanics of Spanish moss chains (e.g. Young's modulus of elasticity & work to fracture), and we are modeling chain architecture to characterize its effect on the plant's overall ability to form hanging clumps. Project funding; VSU Faculty Research Seed Grant 2011-12 to T.A.U.

1:15 THE DISTRIBUTION OF TOPMINNOWS (FUNDULIDAE) IN SOUTH AND SOUTHEAST GEORGIA**, Ashley L. Barnes*¹, D.L. Bechler¹, J.S. Salter¹ and B. Albanese², ¹Valdosta State University, Valdosta, GA 31602 and ²Department of Natural Resources, Social Circle, GA 30025. Two major species complexes in the family Fundulidae are found in South and Southeast Georgia. This study is examining the distribution of the members of each complex from the Aucilla River in the western portion of the study area to the east side of the Okefenokee Swamp. Initial work has focused in morphometric characters, with subsequent genetic analysis underway. The *Fundulus lineolatus* complex includes both eastern and western forms with only one population of the western form found in the study area. Members of the *F. chrysotus* complex includes *F. cingulatus* and *F. rubrifrons*, as well as the more abundant *F. chrysotus*. *Fundulus cingulatus* is found in the southeastern portion of the study area in the Alapaha River basin and the Okefenokee Swamp, and *F. rubrifrons* consists of a single population from the Alapaha River Basin in southern Lanier County. *Fundulus chrysotus*, while the most abundant species in the complex, is restricted primarily to the Withlacoochee River Basin.

1:30 DOMINANT BEHAVIOR MUTANTS FROM THE HERMAPHRODITIC VERTEBRATE MODEL FISH, *KRYPTOLEBIAS MARMORATUS*, Garrett L. Carter* and B.C. Ring, Valdosta State University, Valdosta, GA 31698. The mangrove killifish (*Kryptolebias marmoratus*) is a self-fertilizing vertebrate that produces clonal isogenic lines suitable for molecular genetic studies. Through a forward genetic dominant screen

(ENU mutagenesis; n=50 F1 fish), eight behavioral mutants were identified as exhibiting bold (lag-time) and/or aggressive (mirror test) behaviors via filming experiments. Three of these mutants descended from the same P mutated fish, therefore, 6 different dominant behavioral mutant alleles were identified. To confirm the behaviors were heritable, 72 F2 fish were reared from the original 8 F1 mutant parents and re-filmed. All F2 fish displayed Mendelian patterns of inheritance of the dominant behavioral traits. These mutants are currently under selection to produce true breeding clonal stocks into the F3 generation for future characterization at the neurophenomic level. Here we describe initial characterization through filming and statistical analysis. Behavioral mutants identified in this screen are useful for characterizing conserved behavior loci that may be applicable to behavioral syndrome research across the animal kingdom. This research was supported by NIH Grant # R15HD060017 from the Eunice Kennedy Shriver National Institute of Child Health & Human Development.

1:45 MITE AND DOMATIA DENSITY IN TWO FOREST TYPES IN WEST-CENTRAL GEORGIA, Skylar C. Kirk*, J.A. Barone, J.R. Harrell, M.A. Robinson, C.N. Allen, J.L. Burston, D.J. Ellis, J.H. Gilmore II, B.L. Holloman, J.D. Huffman, B.C. Long, A. McIntosh, B.J. Philpot, W.D. Rogers, J.M. Santos, S. Silvis, AD. Skillman and B.M. Truett, Columbus State University, Columbus, GA 31907. Plants and mites frequently engage in a mutualism in which plants provide domatia for predaceous and fungivorous mites, while mites provide protection against herbivores and pathogenic fungi. We examined the densities of mites and leaf domatia in two forest types in west central Georgia: warm temperate forest and long-leaf pine turkey oak forest. We expected to find a higher density of domatia in the relatively nutrient-poor long-leaf pine turkey oak forest than the nutrient-rich warm temperate forest. We also compared our domatia frequencies to other studies. There was no significant difference in the average number of domatia per leaf between warm temperate forests and long-leaf pine turkey oak forest, nor was there a difference between mite densities. However, there was a significant difference in the average leaf size between the two forest types. A significant difference was noted in domatia types across the two sites. Variability across species could be the cause of no significant difference between the two forest types. Our numbers were significantly lower than five other sites around the world.

2:00 A TEST OF THE MULTIPLICATIVE RISK MODEL USING A FRESHWATER FOOD-WEB FRAGMENT, Samantha J. Worthy*, A.L. Bullock, Z.R. Diener, A.U. Edwards, O.Y. Jackson, J.M. Joiner, M. Junious, J.E. Pitts, A.P. Shields, J.T. Skariah, V.C. Staples and C.B. Ruehl, Columbus State University, Columbus, GA 31907. Interactions between multiple predators may result in risk reduction or risk enhancement for prey. Predators that interfere with each other slow predator-prey encounter rates and reduce the risk of predation for prey. Conversely, prey may shift habitat use in response to one predator, which enhances their risk of predation by making them more vulnerable to another predator. We tested the multiplicative risk model for emergent multiple predator effects on the mortality of freshwater pulmonate snails (*Physa acuta*) using giant water bugs (*Belostoma flumineum*) and crayfish (*Procambarus zonangulus*) as predators. Treatments consisted of either one giant water bug, one crayfish, or an individual of each predator. Analysis of variance followed by Tukey's post-hoc test revealed that snail mortality in crayfish tanks (76%) was less than mortality in water bug tanks (98%), but mortality in combined predator treatments was intermediate (95%). A multiplicative risk model would predict 99% mortality in combined predator treatments based on mortality in single treatments. Therefore, combining predators resulted in risk reduction for snails likely from interference competition between giant water bugs and crayfish.

2:15 AN ASSESSMENT OF POLLINATION SUCCESS BY NATIVE BEES IN NORTH GEORGIA APPLE ORCHARDS, Catherine G. Schlueter*, N.G. Stewart and M.A. Schlueter, Georgia Gwinnett College, Lawrenceville, GA 30043. Most commercial apple orchards rely on European Honeybees (*Apis mellifera* L.) for pollination of their apple trees. Recent concerns over the declines in honeybee populations and increasing expenses to rent honeybee hives has generated a strong interest in identifying native insect pollinators, which can replace or supplement the honeybee. In this study, an assessment of native bee pollination success was examined. At Mountain View Orchards (McCaysville, GA), ten apple trees (*Malus domestica* Borkh.) were selected. On each tree, two similar branches (e.g. similar bud numbers and length) were identified. A netting enclosure, which excluded honeybee-size and larger bees, was placed over one of the selected branches in March 2012. The other branch (control) was left uncovered. All ten apple trees produced blossoms on both control and experimental branches. In August, apples were collected from both the control and experimental branches. Similar numbers of apples were produced on each tree; however, one of the experimental branches produced no apples. The apples were weighed, their circumferences measured, and their seeds counted. Two-tailed T-tests compared apple weight ($t = 1.305$, $p = 0.2038$), apple circumference ($t = 1.243$, $p = 0.2253$) and seed number ($t = 1.482$, $p = 0.1507$) between control and experimental branches. Statistical analyses indicated that there were no differences between the control and experimental groups in any of these measurements. The most common native pollinators captured in pan traps within the netting enclosure were *Andrena crataegi* and *Andrena carlini*. Therefore, native bees are effective pollinators in commercial apple production. Native bees provide a natural and sustainable agricultural alternative to the declining honeybee.

2:30 AN EXAMINATION OF RURAL, SUBURBAN, AND URBAN WATER QUALITY IN GEORGIA, COSTA RICA, AND COLOMBIA, Jose O. Castano* and M.A. Schlueter, Georgia Gwinnett College, Lawrenceville, GA 30043. This study examined the water quality of 26 different streams and rivers in Georgia-USA, Costa Rica, and Buenaventura-Colombia to evaluate the effect of human populations on these waterways. Streams and rivers were sampled in: (a) rural areas with large natural areas and farms, (b) suburban areas with predominantly residential housing and less than 30% vegetation, and (c) urban areas with mostly paved roads and large commercial areas. Specific water quality indicators gathered from biological, physical, and chemical results were used to grade each site using North American water quality assessment methods. Macroinvertebrates, used in the biological assessment, were sampled using a D-net and a seine net in three riffles and three pool areas per site. The chemical and physical analyses tested for temperature, water flow, dissolved oxygen, pH, ammonia, nitrate, turbidity, phosphate, copper, lead, and mercury. There was a significant difference ($F = 8.12$, $p = 0.0024$) in the biological assessment between urban streams (mean biological index = 5.5), suburban streams (mean biological index = 10.8), and rural streams (mean biological index = 16.2). Sensitive macroinvertebrate groups such as stoneflies (Plecoptera) and riffle beetles (Coleoptera) were abundant in rural areas in all three countries. High dissolved oxygen levels correlated ($r = 0.557$, $p = 0.003$) with high diversity of macroinvertebrates (high biological index). Trace levels of mercury (5 ppb) were found in some Costa Rican and Colombian rivers. In all three countries, rural sites had higher dissolved oxygen levels, and lower ammonia and phosphate levels compared to suburban and urban sites. This study found water quality conditions were worse in urban and suburban areas in all three countries due to pollutants and other negative factors (e.g. sedimentation) introduced through human activity.

2:45 MASON BEE (MEGACHILIDAE:OSMIA) ABUNDANCE AND DIVERSITY IN NORTH GEORGIA APPLE ORCHARDS FROM 2010-2012: THE ROLE OF OSMIA DURING PREMATURE APPLE BLOOM CONDITIONS, Nicholas G. Stewart* and M.A. Schlueter, Georgia Gwinnett College, Lawrenceville, GA 30043. Native mason bees (*Osmia* species) provide low-cost, sustainable pollination services more efficiently than honeybees. For instance, 250 metallic blue *Osmia lignaria* females pollinate equivalently to 2.4 honeybee hives (16,000 - 50,000 bees). Furthermore, *Osmia* are easy to attract, maximize and transplant artificially within and between orchards. Unlike the most abundant native apple pollinators, the mining bees (*Andrena*), mason bees were the earliest emerging bees in 2010-2012. Typically, *Osmia* actively forage for brood provisions amidst a seasonal period devoid of floral resources in apple orchards, forcing constant migratory behavior as they search out flowers until the bloom. In 2010, we collected 9 mason bees from 5 species during the typical apple bloom spanning mid-April through early-May. The subsequent aberrant bloom periods during two years following 2010 were progressively premature. The 2011 bloom began in late-March and ended early-April, before apple blooms begin under traditional spring conditions. As a result, an *Osmia* abundance spike was recorded – jumping from 9 to 39 specimens. In 2011, the onset of the bloom occurred around March 2nd and was complete before April – the earliest bloom on record throughout the Eastern Seaboard. With over 232 mason bees collected, representing 13 of the 19 species known to occur in all of Georgia, *Osmia* abundances hit an all-time high for apple orchards in our study. Our findings indicate that mason bees may be optimal safe-guards for early apple blooms. While typical native pollinators are reduced during premature bloom conditions, native pollination deficiencies can be mitigated in apple orchards by *Osmia*-maximization – thereby further justifying the use of sustainable native pollination-systems.

3:00 Break

3:15 COSTS AND BENEFITS OF *CERATOMIA CATALPAE* CHEMICAL DEFENSE, Audrey Barrett* and E. Lampert, University of North Georgia, Oakwood, GA 30566. Sequestration of consumed plant compounds is a defense used by many insect herbivores. One compound, catalpol, is sequestered by several herbivore species, rendering them unpalatable to predators. However, catalpol sequestration has been shown to weaken immune response, and reduce digestive efficiency. Here we test whether catalpol sequestration is costly or beneficial to the catalpa specialist *Ceratomia catalpae*. First, respirometry was used to compare CO₂ production as larvae consumed catalpol throughout development. If catalpol sequestration is costly, we predicted reduced CO₂ production as larvae continuously consumed catalpol as they developed; however, we found no such relationship in our group of larvae. Next, we exposed predatory *Solenopsis* sp. ants to *C. catalpae* samples to determine if catalpol sequestration deterred the ants. We found that gut and hemolymph samples were highly deterrent compared to a control and plant extract. Our results show that catalpol sequestration is highly beneficial to this herbivore species, while any cost of sequestration is negligible.

3:30 POPULATION GENETICS OF THREE CRAB SPECIES ALONG THE SOUTHEASTERN ATLANTIC COAST**, S.D. Mannix*, A.E. Hammak, A.L. Coleman, J.M. Reichmuth and A.L. Abdulovic-cui, Augusta State University, Augusta, GA 30904. The Blue Crab (*Callinectes sapidus*), fishery is the second largest seafood industry in Georgia. It is both economically and ecologically important. Blue Crabs are commonly found along with other ecologically important species, including *Callinectes similis* and

Arenaeus cribrarius. The aim of our research is to study the genetic diversity among these different species. We will sequence several mitochondrial loci from each crab species by using the already sequence DNA of the Blue Crab. This DNA will help us to develop primers used for comparison. A lack of genetic diversity in the three species could indicate an unhealthy ecosystem. Suppression of diversity may be caused by the natural removal of genes from predation, or it could indicate that the species genes are becoming fixed by over fishing. Currently, we are collecting crabs, using a monofilament and bag seine on two different beaches, Tybee Island GA and Hunting Island SC. These islands differ in population dynamics. Tybee is a very urbanized area while Hunting Island is left semi-un-touched. We are extracting DNA from crab limbs stored in ethanol following standard molecular methods. The genetic diversity of the ecosystem will be based on the difference in genes of the crab species. The more differences the healthier the ecosystem.

3:45 SPADIX FUNCTION IN THE JACK-IN-THE-PULPIT, *ARISAEMA TRIPHYLLUM*, Sabrina M. Jones*, F.S. Corotto, M.S. Davis and A.R. McCaskill, University of North Georgia, Dahlonega, GA 30597. Aroids are perennial herbs that are characterized by inflorescences with a rod-shaped spadix surrounded by a vase-like spathe. A prominent aroid in Georgia is the Jack-in-the-Pulpit, *Arisaema triphyllum*. In this study, we assessed the role of the spadix in attracting insect visitors to *A. triphyllum*. Two study sites near Dahlonega, GA, were chosen: one along an unnamed first-order stream and the other along Cane Creek (34°33'02"N; 84°03'46"W; 34°31'03"N; 84°00'13"W). Plants received either ablation of the distal appendix (n = 40), removal of the spadix tip (n = 30), or a sham ablation (n = 31). Treatments were assigned by an Excel random number generator. Each treated plant had a 5 mm x 20 mm Agralan pot plant sticky trap placed at the back of the spathe chamber to collect visitors. Inflorescences were collected at senescence. Despite the treatment applied, the number of Diptera captured was not affected. In contrast, ablation reduced the number of Collembola captured to just 29% of what was found in the other two treatments (interaction of taxa and treatment after square root transformation: $F_{10,480} = 2.761$, $P = 0.003$). Other taxa were poorly represented. Pollination in *A. triphyllum* has previously been attributed to fungus gnats and the thysanopteran, *Heterothrips arisaemae* Hood. Our results suggest that Collembola, which do not fly, may play a role in pollination, perhaps within clustered plants in which long-distance travel is not necessary.

4:00 EFFECT OF LAKE LANIER WATER QUALITY ON THE SURFACING FREQUENCY OF RED-EARED SLIDER TURTLES, *TRACHEMYS SCRIPTA ELEGGANS* (WIED-NEUWIED)**, T.J. Pass*, R.C. Fuller and M.D. Horton, North Georgia College & State University, Dahlonega, GA 30597. Polluted waters have been shown to cause physiological distress in animals, including aquatic turtles that must surface to exchange gases. The rate of surfacing offers a simple method of quantifying behavioral responses to environmental stressors. The purpose of this study was to assess the frequency of turtles surfacing when held in water collected from eleven sites in Lake Lanier, Georgia and tributaries of that reservoir. Each water collection site was monitored for environmental parameters (e.g., temperature, pH, biological oxygen demand, chemical oxygen demand, hardness, fecal coliform counts, and turbidity). Three adult turtles, tagged for identification using colored pipe cleaners wrapped around the carapace and plastron, were housed in individual aquaria containing 20-liters of water from each of the eleven sites. These were placed in a greenhouse with controlled temperature settings. Three turtles were placed in one aquarium that served as the experimental set-up and three in a separate aquarium to serve as control. The breathing frequency of the turtles

was recorded using digital videography for one hour and viewed for analysis. To determine the significance in the breathing frequencies between set-ups, and the environmental parameters between sites, analysis of variance was used.

4:15 EFFECTS OF TEMPERATURE, pH, AND SUBSTRATE CONCENTRATION ON CELLOBIASE ACTIVITY FROM ENZYMES ISOLATED FROM COMMON AND GEORGIA-NATIVE MUSHROOMS**, Mary L. Calderon*, P.T. Arnold and J.C. Schroeder, Young Harris College, Young Harris, GA 30582. Fungi and bacteria use the enzyme cellobiase (β -glucosidase) in order to help break down cellulose from plant cell walls to obtain glucose. The cellobiase enzyme was examined under several conditions, including different temperatures and pH values, to determine the optimal environment for enzymatic activity. Enzymes were extracted from different mushroom species (common and Georgia-native) to deduce their ability to break down an artificial substrate (p-nitrophenol glucopyranside). Initial findings using a purified form of cellobiase suggest that the enzyme forms product (p-nitrophenol, which can be detected under basic condition by absorbance at 410nm) at the fastest rate when conditions are 37°C or pH 5.0. Enzymes isolated from mushrooms were further characterized using Lineweaver-Burk analysis to determine maximum velocity (V_{max}) and substrate affinity (K_m) at optimal conditions. Other initial findings led to the hypothesis that enzymatic activity of mushrooms will vary greatly among the different species of mushroom examined. As this is likely to be due (at least in part) to varying levels of enzyme among mushroom samples, K_m values of the mushroom enzymes will be compared.

4:30 EFFECTS OF DIETARY FLAVONOIDS ON CYP1A1-LUCIFERASE REPORTER ASSAY ACTIVITY**, Mary E. Maxwell* and J.C. Schroeder, Young Harris College, Young Harris, GA 30582. The aryl hydrocarbon receptor (AHR) is a ligand-activated transcription factor involved in the regulation of multiple cellular pathways, including transcription of the *cyp1a1* gene. While many AHR agonists are known carcinogens to which humans are commonly exposed, dietary constituents (including flavonoids) that have chemo-preventative properties have been found to act as antagonists of the AHR pathway. A chemo-preventative approach may be effective in decreasing the incidences of many human cancers by incorporating a dietary regimen that includes a number of these naturally occurring AHR antagonists. Kaempferol, apigenin, resveratrol, and hesperitin are all common flavonoids isolated from various plant materials. Benzo[a]pyrene (B[a]P) and 3-methylcholanthrene (3-MC) are both known agonist of the AHR. Cultured hepatocytes will be treated with B[a]P or 3-MC alone or in combination with one of the flavanoids listed to determine their protective effects on AHR activation. This activation will be determined by measuring luciferase activity of the pGudLuc reporter gene, which has been stably transfected into the hepatocyte cell line used in this experiment. Funded by the Young Harris College Biology Research Initiative.

4:45 POPULATION CHARACTERISTICS AND HABITAT PREFERENCES OF A STATE-ENDANGERED CRAYFISH *CAMBARUS PARRISHI* IN THE UPPER HIWASSEE RIVER**, Kacey R. Miller*, A.M. Johnson and J.G. Davis, Young Harris College, Young Harris, GA 30582. Crayfishes are keystone species in headwater aquatic ecosystems responsible for processing organic material, increasing nutrient availability and engineering complex benthic stream habitat. This study defined population characteristics and habitat preferences of a state-endangered, understudied species, *Cambarus parrishi* in the upper Hiwassee River watershed of northeast Georgia. Crayfish were collected at seven sites over one year. Multiple habitat parameters including substrate size, depth, water velocity, and stream roughness were measured at a microhabitat scale. Cor-

relation analysis identified habitat variables associated with *C. parrishi* presence which were incorporated into logistic regression models to predict probability of presence at available microhabitats. *C. parrishi* prefer habitats with slower water velocities, cobble substrates and shallow depths, Due to low incidences of capture ($n=46$), data on reproduction was limited. Length-frequency histograms were constructed to assign ages to sampled individuals to allow for calculation of annual growth rate and estimate mortality rate of the population through a catch-curve regression model. Crayfish older than two years of age were rare ($n=6$), and estimated annual mortality rate of the population was 25% ($P<0.001$; $R^2=0.90$). This study provided essential habitat information and population metrics that will aid in developing monitoring and targeted conservation strategies for this species.

Section II: Chemistry
Bailey Science Center, Room 1024
Zewdu Gebeyehu, Presiding

3:15 PHOTOCURRENT PRODUCTION OF ENHANCED IRON OXIDE FILMS**, R.G. Fontanez and L. de la Garza, Valdosta State University, Valdosta, GA 31698. *Iron (III) Oxide* (Fe_2O_3) nanocrystalline films are being pursued as materials in solar cell fabrication because of the high efficiency in energy conversion in the visible range of the electromagnetic spectrum and their potential for the splitting of water for hydrogen gas production. *Iron (III) oxide* films were obtained by dip-coating deposition of *iron (III) oxide* nanoparticles colloidal solution mixed with 20% pluronic to increase the porosity of the films onto *indium-tin oxide* (ITO) slides. The Fe_2O_3 -ITO slides were annealed under oxygen at 450°C for 1 hr. The absorbance of the slides before and after annealing was recorded. The annealed Fe_2O_3 -ITO slides photocurrents were measured in a three-electrode photoelectrochemical cell under irradiation with a Xenon lamp before and after modification with *enediol* ligands bearing different pendant chemical groups. Experiments were carried out in buffer electrolyte solution containing *hydroquinone* as the redox carrier at several pHs. Results on the effect of the pendant-chemical group, either $-COOH$ or $-NH_2$ in the efficiency of photocurrent production will be presented. Authors acknowledge the support from the Faculty Seed Research Grant from Valdosta State University for the materials used in this project.

3:30 SYNTHESIS OF CHIRAL IMINES AND AMINES ON SILICA SURFACES, R. Tomlinson*, J. Baker, S. Booth, J. Brock, M. Patel, C. Perryman and J.T. Barbas, Valdosta State University, Valdosta, GA 31698. Recently we have been investigating “greener” methods for the synthesis of aromatic *benzodiazines*, chiral imines and chiral amines. We have discovered that we can synthesize these compounds in tandem, in one pot, at ambient temperatures, in quantitative yields. Furthermore, our syntheses take place in minutes, use little solvent, and are economical. Typically, 2 g of activated silica, are added to an anhydrous solution of equimolar quantities (2×10^{-3} mol) of an aldehyde and a primary chiral amine. The reaction is monitored by GC-MS and takes only a few minutes for the complete formation of the imine. To this solution, 0.15 g of *sodium borohydride* are added and stirred briefly. The solution is cooled in an ice bath and a few drops of water are added periodically to complete the reduction of the imine. In turn, the mixture is filtered, the silica washed several times with anhydrous ether, and the extracts combined and dried over anhydrous *sodium sulfate*. The ether is removed under vacuum to yield pure chiral amines. The products are analyzed by IR, GC-MS, and proton and C-13 NMR, and polarimetry.

3:45 LEWIS ACID CATALYZED 2,3-REARRANGMENTS OF *O*-ALLYLHYDROXYLAMINES**, J. C. Lord*, H. F. Lee*, J. M. Baxter Vu, Valdosta State University, Valdosta, GA 31698. While chiral carbinamines are common pharmacophores, a green, rapid, and economical construction of these small molecules remains a challenge to the synthetic chemist. This work focuses on the formation of tertiary carbinamine centers via a 2,3-rearrangement of hydroxylamine allyl ethers. After screening a variety of Lewis and Brønsted acids, we have developed a *silver trifluoromethanesulfonate* promoted 2,3-rearrangement of *O*-allylhydroxylamines. This Lewis acid catalyzed rearrangement offers several advantages over current technology: 1) it lends itself towards developing an asymmetric variant of this transformation via the use of a chiral Lewis acid or a metal salt with chiral ligand additives, 2) the exclusion of *n*-BuLi to promote the reaction will result in a broader substrate scope by allowing acidic or electrophilic functional groups to be present in the molecule, and 3) this rearrangement is an environmentally friendly alternative to the Overman rearrangement.

**Section IV: Physics, Mathematics, Computer Science,
Engineering and Technology
Bailey Science Center, Room 1025
Hasson M. Tavossi, Presiding**

1:00 DETERMINING THE VALUE OF A VOTE IN THE UNITED STATES UNDER THE ELECTORAL COLLEGE VOTING SYSTEM USING BINARY INTEGER PROGRAMMING, Joseph M. Cauley*, Valdosta State University, Valdosta, GA 31698. The Electoral College system in the United States allows for a leader to be elected to the position of president without the support of the majority of the population by a large margin. In this paper we derive the minimum percentage of registered voters required to elect a president by creating a binary integer programming problem to represent the minimum number of registered voters to win the Electoral College. To find this minimum number, we make some reasonable.

1:15 THE SUMMATION OF THE FIRST n INTEGER POWERS m^k , Maximilian J. Wang* and Sudhir Goel, Valdosta State University, Valdosta, GA 31698. In order to find a limit of Riemann sums in calculus courses, it is necessary to find the sums for many problems: $S_k(n) = \sum_{m=1}^n m^k$. We propose a new approach to derive closed form solutions for $S_k(n)$ using linear algebra. It is simple and efficient for any arbitrary positive integer k . Solutions are modeled as a linear system equation. Gaussian Elimination is used to solve this system. The implementation of computer programing is based on the Backward Substitution algorithm.

1:30 ANALYSIS OF REUSING RANDOM NUMBERS, Timothy J. Daniel*, Valdosta State University, Valdosta, GA 31698. Simulation modeling and programming have come to play a major role in the world today. Random number generation is a large part of that role. How costly is creating this randomness? We discuss and analyze an efficient way to create and reuse random numbers. To show the efficiency, we discuss the Floyd's algorithm and how it is used to determine the quality of the random numbers.

2:00 NUMERICAL SOLUTION OF COMPLEX EQUATIONS AND APPLICATION IN ELECTROMAGNETIC WAVE PROBLEM SOLVING, Jayanti R. Saha*, K.C. Chan and A.K. Saha, Albany State University, Albany, GA 31705. In industries and in

many physics problems, solutions of complex equations are necessary. In this research, a general form of complex equation: $a + ib = (x + iy)^n$ (where, a & b are known, x & y are unknown and n is either an integer, or a fraction or a function) is considered and an algorithm has been developed to solve this generalized complex equation using MATLAB programming language. A method has also been devised to verify the result using commercially available Wolfram Alpha software, which does not provide a direct and generalized result. Finally, the solution technique is applied to determine the electrical property (complex permittivity) of a piece of Teflon block placing in a rectangular waveguide WR284 and exciting with microwave frequencies from 2.6 to 3.95 GHz from a Vector Network Analyzer E5071C. The validity of the algorithm is verified by using Teflon blocks of different sizes and obtaining the same complex permittivity each time as expected. This work is supported by Albany State University Undergraduate Research Program.

2:15 OSCILLATIONS OF A LONG RECTANGULAR BEAM ON TWO PIVOT POINTS, Matthew Roberts and Tom Colbert, Augusta State University, GA 30904. A long rectangular beam is balanced on a block. The beam is given an angular displacement and set into motion which rotates about one edge of the block and then switches to the other edge. The experiment was motivated by observation that such a system changed its oscillation frequency dramatically as the amplitude decreased. To track the motion, a mirror was placed on the beam at the center of mass and used to observe the deflection of a laser spot as the beam oscillated. The spot was recorded using video and tracker analysis tools. We observed the effect of both decay and increasing frequency. The measured decay rate was 56.11942 half cycles. The system has been modeled by using energy conservation to predict the motion of the oscillating beam. The damping takes place each time the beam hits the block and switches over to the alternate pivot point. The model fits the experimental data very well for many oscillations. In the late time, the model diverges from the experiment significantly, suggesting there are additional energy loss mechanisms which are not yet accounted for.

2:30 TRANSIT OF VENUS, JUNE 2012, Amanda Mashburn*, Bob Powell, Robert Moore, Jr. and Victor Pruett, University of West Georgia, Carrollton, GA 30118. A transit of Venus, the passage of the planet directly between the Earth and the Sun, occurred on June 5, 2012. This was only the eighth transit of Venus since Kepler predicted such events in 1631, since pairs of transits occur eight years apart separated by long gaps of 121.5 years and 105.5 years. In June, 2004, only a few people saw the transit, which ended shortly after the Sun rose. The West Georgia Observatory held an open house on June 5, 2012. Although the sky was partly cloudy, over 300 people saw beginning of the 2012 transit via projections on a screen, with eclipse shades, and through telescopes equipped with solar filters. Photographs of the transit were made through a telescope. This observation of the 2012 transit ended when the Sun sat with the transit still in progress. The next transits of Venus will be in December 2117 and 2125.

2:45 ARRAYS OF THREE DIMENSIONAL FLAT PANEL SOLAR COLLECTORS, Daniel Hartman*, Ben Jenkins and Bob Powell, University of West Georgia, Carrollton, GA 30118. The Massachusetts Institute of Technology has reported that three dimensional photovoltaic structures generate a higher energy density per base area than flat panels. They proposed some designs which support that statement. We have built a simple scale model and have collected data that also supports that work. These data

were gathered using a simple geometric arrangement of two solar panels at right angles to each other and two panels in a flat array as a control. Analysis showed reflections from one panel to a second panel help to increase the output when the angle of incidence was greater than 45 degrees. Future work involves more complex designs, including models similar to the one proposed by MIT, and examining the total output during a full day.

3:00 **Break**

3:15 DEVELOPMENT OF A METHOD TO PREDICT RELATIVE OUTPUT FACTORS OF IRREGULARLY SHAPED ELECTRON FIELDS**, L. Burden*¹, J. Hauger¹, J. Lundeen*¹, J. Newton¹, C. Sailors*¹, R. Slayton² and C. Wisnieski², ¹Augusta State University, Augusta, GA 30904 and ²Georgia Radiation Therapy Center, Augusta, GA 30912. High energy electron beams delivered from a linear accelerator are often used to treat irregularly shaped superficial lesions. The relative output factor (ROF) is crucial during treatment planning to ensure the proper machine settings are used to deliver the prescribed radiation dose to the lesion. Direct measurement of the ROF for individual patients is time consuming and inefficient. This project will develop an empirical method which can be used to predict the ROF for irregularly shaped electron fields. It will be shown that by dividing the irregular field into wedge-shaped segments the ROF can be calculated by approximating these segments as a fraction of a circular field and summing the dose contribution from each. The ROF of nine circular fields from 2cm to 10cm in increments of 1cm were measured and used as the reference circles for the segment calculations. The measured ROF for several irregular fields will be compared to the predicted ROF.

3:30 SIMULATION OF A VIBRATING BEAM, Daniel Sanchez Carretero** and Javier E. Hasbun, Department of Physics, University of West Georgia, Carrollton, GA 30118. In this presentation we develop a simulation of a vibrating beam with fixed nodes. The purpose of the simulation is to aid the users in visualizing the beam's vibration and how the dimensional parameters affect the frequency. The simulation is carried out in MATLAB due to its graphical efficiency. The program is capable of graphing frequency versus length, width, height, and density. It finds the frequency of the beam's vibration using the Euler-Bernoulli beam theory and finds the percent error given the experimental measurement as input. The property of the material to resonate is dependent on the material's Young's modulus, density, and physical dimensions. The program assigns the density and Young's modulus depending on the material inputted. The frequency of vibration uses a parameter (β) that's normally obtained from a self-consistent solution of the theory; however, it is possible to improve the agreement between theory and experiment by optimizing the β parameter.

3:45 A NUCLEAR PHYSICS SIMULATION SUITABLE FOR CLASSROOM USE, Benjamin E Hogan* and Javier E. Hasbun, Department of Physics, University of West Georgia, Carrollton, GA 30118. The orbits of a nucleon and its respective parent nucleus about their common center of mass are simulated in an effort to provide a pedagogical approach to the understanding of the structure of atomic nuclei. The nuclear exercise is treated by solving the problem with an effective force on the reduced mass of the system. The potential governing the mean field is modeled by the Woods-Saxon form-factor with parameters that enable it to describe experimental findings. The Woods-Saxon potential is preferred over the infinite well and harmonic oscillator methods because both require infinite separation energies of the nucleons. The results provided by

the harmonic oscillator are substituted for a continuum spectrum. Also, a potential resembling the geometric distribution of nuclear density is possible. The simulation is created using Easy Java Simulations (EJS) which is part of the Open Source Physics project and a MATLAB version. The resulting illustration depicts the orbits traced out by the nucleon-core two body system as well as its associated reduced mass.

4:00 INVESTIGATION OF LOW COST BROAD BAND PHOTO-DETECTORS BASED ON LEAD SULFIDE QUANTUM DOTS**, Ryan M. Landry*¹, Ajith DeSilva¹, P. K. D. D. P. Pitigala² and A. G. U. Perera², ¹University of West Georgia, Carrollton, GA 30118 and ²Georgia State University, Atlanta, GA 30303. We have developed a non-polar solvent synthesis for lead sulfide (PbS) quantum dots (QDs) in polyvinylcarbazol (PVK). Optical spectroscopy methods of the composites have shown a particle size distribution between 5 and 10 nm with broad optical absorption from 300 to 700 nm, with peak at 480 nm. We study this composite PbS quantum dot (QD) polymer layer as a ultra violet (UV)- infrared (IR) broad band photo-detector. The detector has a configuration of FTO/PVK-PbS QDs/FTO. At room temperature, the device showed a UV-IR spectral response from 300 – 1300 nm with two response peaks at 470 nm and 635 nm with responsivities of ~ 0.8 mA/W and ~ 1.1 mA/W respectively, for 4.9 V bias. We use optical spectroscopy, XRD and electrical measurements to characterize the device.

4:15 SIZE DEPENDENT STUDY OF CADMIUM SELENIDE QUANTUM DOTS FABRICATED BY PHOTOLITHOGRAPHY**, Volker Beutner*, Raghuvveer R. Gadipalli, Ajith De Silva and Javier E. Hasbun, University of West Georgia, Carrollton, GA 30118. One of the forerunners in nanotechnology is quantum dots (QDs). Quantum dots are nano-sized semiconductor particles whose electronic properties are similar to that of molecules rather than bulk semiconductors. The optical and electronic properties of QDs can be tuned by changing the size of the QDs. We employed wet chemical and photolithography methods to synthesize different sizes of CdSe QDs. Cadmium-perchlorate Hexahydrate and Selenourea salts as precursors and 1-Thioglycerol as a capping agent were used in the chemical process. By varying UV light exposure time, the different sizes of QD's were synthesized. As the exposure time changes from 5 minutes and 100 minutes, the size of QDs were estimated to be in the range from 3 nm to 10 nm. We use a combination of X-ray spectroscopy and optical spectroscopy to determine their chemical composition and the average size.

4:30 A COMPARISON OF TWO DIFFERENT NUMERICAL SOLUTIONS FOR THE TWO DIMENSIONAL ELASTIC WAVE EQUATION**, David C. McCall* and Christian Poppeliers, Georgia Regents University, Augusta, GA 30904. The elastic wave equation describes the evolution of the vector particle motion of a solid material at a point due to the passage of a mechanical wave. We have solved the 2-D elastic wave equation using a well-known finite difference method that is second order accurate in both space and time ($O(t^2, x^2)$). The goal of this project is to compare two implementations of this numerical solution using two different computing languages. We find that the $O(t^2, x^2)$ is subject to a high degree of numerical artifacts. Because of this we have started work a $O(t^2, x^4)$ scheme which has a lower degree of numerical artifacts.

4:45 THE EFFECTS OF MEASUREMENT UNCERTAINTY ON SPATIOAN WAVE GRADIENTS AS ESTIMATED FROM A SEISMIC ARRAY**, C. Elizabeth Johnson, Augusta State University, Augusta, GA 30904. Seismic arrays are used to measure the spatial and temporal changes of a seismic wave field. They do this by recording the

wave field in numerous locations on the earth simultaneously. For this project, we analyzed the effects of measurement uncertainties on the estimation of the wave spatial gradients as recorded by a seismic array. Our primary purpose is to determine how the array aperture influences the estimates of the gradients and quantities derived from them given known measurement uncertainties. We constructed a synthetic seismogram and recorded it on a virtual array. The virtual seismometer has known uncertainties in the location and the recorded wave field has known uncertainties in amplitude and phase. We perform a Monte Carlo simulation where the uncertainties are normally distributed and random for each realization of the seismogram. We then compute statistics that indicate that there is an optimal array aperture that minimized the uncertainty in the computed gradients and attributes derived from them for a given amplitude of measurement uncertainties.

5:00 AUTOMATED MEASUREMENT OF FORCES BETWEEN PERMANENT MAGNETS AT ROOM TEMPERATURE AND AT LIQUID NITROGEN TEMPERATURE, Cordell FormyDuval*, Ethan Coley* and Ben de Mayo, University of West Georgia, Carrollton, GA 30118. Permanent magnets are economically important in the electronic technologies of entertainment, medicine, and national defense. In this study an automated system was used to investigate the mechanical forces between two permanent magnets of different shapes, both at room temperature (around 294 K) and at liquid nitrogen temperature (LN2, around 69 K at our altitude). A Vernier Software (VS) Force Sensor (DFS-BTA) and a VS Rotary Motion Sensor (ROT-ULI) powered by a motor were used in conjunction with VS's LabPro data acquisition hardware and VS Logger Pro 3 software to move a cubical permanent magnet (strength approximately 58 mT) towards or away from a stationary circular permanent magnet (approximately 43 mT) in a cryostat both when the second magnet was at room temperature and at LN2 temperature. The system was connected to a Mac Mini computer to record and analyze the data. Distances between the magnets varied from approximately 61 mm to 11 mm; about 17,000 measurements were recorded per experimental run. Forces were in the range of 4 to 0.1 Newtons; LN2 temperatures did not affect the magnitude of the inter-magnet forces.

5:15 USING MATLAB TO MEASURE THE POSITION OF AN OBJECT IN A MOVIE**, Ryan Landry and Julie Talbot, University of West Georgia, Carrollton, GA 30118. Movies made with a camera or camcorder can be analyzed using Matlab. After first calibrating the movie using a known length, the Matlab program can determine the x- and y-coordinates of an object's motion, and then graph each coordinate as a function of time. Currently, the program can find the position within 5%. Still in progress is a curve-fitting program that would determine the equation of the trajectory for motion that is more complicated than simple linear or quadratic plots.

SATURDAY PAPER PRESENTATIONS

*Denotes student presenter

**Denotes student “in progress” research

Section I: Biological Sciences Bailey Science Center, Room 3009 Paul Arnold, Presiding

8:00 FINDING CORRELATIONS BETWEEN BEHAVIOR VARIABLES AND CORRECT RESPONSES TO THE HUMAN-GIVEN CUE OF POINTING IN DOMESTIC DOGS (*CANIS FAMILIARIS*)**, Heather A. Richbourg* and J.G. Davis, Young Harris College, Young Harris, GA 30582. Fifty domestic dogs of different ages and breeds were individually tested in 18 consecutive trials using the human-given social cue of pointing to locate a hidden treat. Each individual's age and breed was recorded, as well as a rated score for different behavioral aspects of the dog, including level of sociability, attention, and responsiveness. During each trial, a human informant stood equidistant between 2 hiding locations and gave the cue while another informant held the dog until the cue was acknowledged. The dog was then released to choose an area to search, and this area was either scored correct or incorrect. Each dog underwent 12 trials with a cue given and 6 trials with no cue serving as a control. The findings will be tested against chance, as well as analyzed for correlations between behavioral variables and a correct response. The highest correlated variables will be plotted in an equation to predict a correct response in a dog with certain characteristics. All results will be grouped together by trial number 1-18 and will be analyzed to see if the dogs learned over the trial period as a group.

8:15 FISH ASSEMBLAGE STRUCTURE IN LENTIC VEGETATED MICRO-HABITATS IN SOUTH GEORGIA**, John S. Salter Jr* and D.L. Bechler, Valdosta State University, Valdosta, GA 31698. Aquatic vegetation provides multiple resources such as shelter, food, and breeding habitats for many fish species. Fishes that occupy habitats with similar ecological characteristics are described as fish assemblages. However, not all vegetation offers the same set of resources, and therefore, we hypothesized that not all fish assemblages that occupy aquatic vegetation are identical. Based on vegetated structure complexity occupying the water column, we predicted that submergent vegetation would contain the most diversity. This study involved an analysis of fish assemblages at 18 vegetated lentic sites in South Georgia. Total area, percent vegetated surface area coverage, water volume, and major plant species as well as other physicochemical data were recorded for each locality. Comparative analysis of each location was conducted using, Freidman test, Principal Component Analysis (PCA) and multiple linear regression analyses. Thirty-two fish species were collected across all sites, and significant differences in fish assemblages existed between sites. A defining factors related to assemblage structure was conductivity and slope of the study site, but not surface area covered by vegetation as hypothesized. PCA identified *Gambusia holbrooki*, *Leptolucania ommata*, *Elassoma zonatum*, and *Aphrododerus sayanus* as principal species defining fish assemblage structure.

8:30 BRIDGE SITES AS REFUGES FOR FISH AND MACROINVERTEBRATE ASSEMBLAGES IN FIRST THROUGH FOURTH ORDER STREAMS, Charles W. Wright* and D.L. Bechler, Valdosta State University, Valdosta, GA, 31698. Anthropogenic impacts such as bridge sites can greatly alter established streambed morphology

and associated ecology. At bridge sites, streams are often channelized approaching the site and deep pools are created at the bridge site causing ecological disturbances of fish and invertebrate assemblages. However restoring channels and reducing negative anthropogenic practices allows the return of natural habitats that are likely to include more sensitive species. Recent conservation studies have suggested that sites of anthropogenic origins may serve as potential habitats for reestablishment of populations following a drought event. We examined fish and macroinvertebrate assemblages, and physiochemical factors associated with these assemblages, at 14 bridge sites involving first through fourth streams. Fish assemblages were least diverse upstream of bridge sites, most diverse at bridge sites and intermediate downstream of bridge sites. Macroinvertebrate assemblages did not exhibit as distinctive a pattern as did fish assemblages. Upstream macroinvertebrate assemblages were less diverse than bridge site and downstream assemblages, a pattern that was only disrupted for the bridge site by third order stream data. The results from this study suggest that bridge sites, if properly engineered, can serve as valuable refuges for reestablishing fish and macroinvertebrate assemblages up and down stream after events such as the severe drought that impacted South Georgia in 2011.

8:45 METAL ACCUMULATION FROM DIETARY EXPOSURE IN THE SEA HARE, *APLYSIA CALIFORNICA*, Tayler A. Jarvis¹, T. Capo² and G.K. Bielmyer¹, ¹Department of Biology, Valdosta State University, Valdosta, GA 31698 and ²University of Miami, Miami, FL 33124. Marine ecosystems are heavily influenced by metals due mainly to anthropogenic sources. Several metals often co-occur at metal-impacted sites in the environment. Recent studies have reported the significance of dietary metal transfer in aquatic food chains, particularly in lower trophic levels. We investigated the accumulation and effects of dietary metals in the sea hare, *Aplysia californica*. Green seaweed, *Ulva lactuca*, and red seaweed, *Agardhiella subulata* were each concurrently exposed to three concentrations (10, 100, 1000 µg/L) of five metals (Cu, Ni, Pb, Cd, and Zn) for 48 h and then used as diets for *Aplysia californica* for two weeks. Body mass and length of *A. californica* were measured midway and at the end of the exposure duration. The sea hares were then dissected and their organs digested and analyzed for metals. Metal accumulation varied with different metals. Each metal accumulated within at least one organ, and Cu accumulation was greater than other metals. In most of the organs analyzed, there were higher levels of metals in *A. californica* fed *U. lactuca* as compared to *A. subulata*. These results indicate that *U. lactuca* may accumulate metals in a more bioavailable form than within *A. subulata* and/or that *U. lactuca* may be a more nutritious diet than *A. subulata*. Significantly reduced body length and weight were observed between the control and metal-exposed *A. californica* at the end of the exposure period. This research supports the use of *A. californica* as a bioindicator of metal pollution in aquatic systems.

9:00 MYOGLOBIN CONTENT IN VENTRICLES OF MANGROVE KILLIFISH (*KRYPTOLEBIAS MARMORATUS*) DURING EMERSION**, Nathan B. Shiver* and T.J. Grove, Valdosta State University, Valdosta, GA 31698. The mangrove killifish, *Kryptolebias marmoratus*, can leave its aquatic habitat and survive for more than one month in moist, terrestrial environments. Oxygen supply to aerobic tissues may change during emersion as the fish switches from relying on gills to obtain oxygen from water to cutaneous exchange to obtain oxygen during prolonged exposure to air. Cardiac muscle is a highly aerobic muscle, and unlike other striated muscle, has low anaerobic capacity. Myoglobin is an oxygen-binding protein expressed in aerobic muscle and may play important roles in oxygen storage and supply during emersion. Our research examines the effects of emersion on myoglobin expression in heart ventricles from *K. marmoratus*. We are

testing the hypothesis that expression of myoglobin in ventricles increases as individuals transition from water-breathing to air-breathing during emersion. Using immunochemical techniques and purified yellowfin tuna (*Thunnus albacares*) myoglobin as a standard we are quantifying myoglobin protein in ventricles of *K. marmoratus* during emersion. Data collected will provide new insights into the physiological adaptation of this amphibious teleost that has adapted to both aquatic and terrestrial environments. Supported by National Science Foundation grant IOS-0817805.

9:15 THE IMPACT OF BACKGROUND COLOR ON EGG LAYING RATES AND OUTCROSSING OF *KRYPTOLEBIAS MARMORATUS*** , Lynda Bernhardt*¹, D.L. Bechler¹, B.C. Ring¹, J.F. Elder¹ and R.L. Early², ¹Valdosta State University, Valdosta, GA 31698 and ²University of Alabama-Tuscaloosa, Tuscaloosa, AL 35487. The mangrove killifish, *Kryptolebias marmoratus*, is characterized by a reproductive system involving androdioecy in which populations are composed of hermaphrodites and males where self-fertilization or outcrossing can occur. As a result of self-fertilization, it is possible to develop nearly 100% homozygous strains or to reestablish heterozygosity via outcrossing between a hermaphrodite and a male. Because these fish are widely used in many areas of research, the need for eggs is often great. This research examines the relationship of background color to movement patterns, egg laying and outcrossing. Prior to beginning this study, we determined lag time, a measure of boldness, on untested killifish strains to determine behavioral position on a shy/bold continuum. From this initial work, five strains (R2, HON 7, SSRHL, SLC8E, and VOL) were selected to represent different geographic origins and levels of shyness and boldness in killifish. All five strains have been tested for activity and movements as a function of color preference. Movement rates parallel the shy/bold order previously established as well as geographic regions. Color preference tests showed black was most preferred and white least preferred. Egg production as a function of black and white backgrounds revealed a daily cyclical pattern of oviposition with sudden bursts of increased oviposition upon changing background color.

9:30 THE ECOLOGICAL ROLE OF *CORBICULA FLUMINEA* IN LAKE SEMINOLE, GA, U.S.A., Chase H. Patrick* and M.N. Waters, Valdosta State University, Valdosta, GA 31698. The persistent growth of the invasive species, *Hydrilla verticillata*, in Lake Seminole, Georgia has contributed to a decrease in native submerged aquatic vegetation and has negatively impacted both recreational use and water quality. The invasion of *Hydrilla verticillata* has also made management of the shallow Lake Seminole reservoir problematic. Recent benthic sampling revealed that an invasive clam, *Corbicula fluminea*, was present throughout the lake and its two primary tributaries, the Chattahoochee River and Flint River. Although previous research demonstrated the presence of *Corbicula fluminea* in the lake since 1963, little is known about the clam's distribution and impact on lake ecology. We collected ponar dredges of surface sediments throughout the lake to determine the distribution and ecological role of *Corbicula fluminea* in the Lake Seminole system. Results show that *Corbicula* is distributed throughout the lake and that population density is related to limnological factors (water depth, habitat, sediment organic matter). In addition, *Corbicula* biomass was compared to adjacent surface sediments and showed that the clam could be a new ecological vector for transferring metals and nutrients to other parts of the ecosystem.

9:45 A COST-EFFECTIVE DEVICE FOR SAMPLING THE WATER COLUMN IN MARINE SYSTEMS** , T.F. West* , T.J. Manning and J.A. Nienow, Valdosta State University, Valdosta, GA 31698. Marine plankton are a source of food for many fish and

mammals. To fully characterize the plankton community, samples must be retrieved from the water column and analyzed in the laboratory. Current methods to retrieve samples of plankton use large nets of specified mesh size deployed from research vessels equipped with powerful winches. Our goal is to make a simpler device that can be deployed from any boat, whether or not it is equipped with a winch system, and successfully retrieve plankton samples from depths in excess of 400 meters. Our preliminary design consists of four PVC cylinders open at the distal end and sealed at the proximal end, aligned in a geometric diamond shape. Two of the cylinders have arms attached to hold plankton nets equipped with PVC collection tubes. On the distal end, a chemical engine is locked into place relative to the cylinders. The chemical engine consists of solid calcium metal surrounded by a wax polymer designed to tear away at the desired depth and expose the calcium metal to the seawater. As the calcium reacts with the seawater it generates hydrogen bubbles which are fed into the hollow PVC cylinders via a system of smaller diameter PVC pipes. As the cylinders fill with gas and the device ascends, the nets will direct plankton samples into the collection tubes. The entire device is retrieved once it surfaces with the help of a global GPS mounted on its surface. If successful the device will provide a cost effective and ecologically friendly tool for use in marine research.

10:00 **Section Business Meeting**

10:30 LOG PACKING BEHAVIORS IN THE MANGROVE RIVULUS, *KRYPTOLEBIAS MARMORATUS*, D.L. Bechler and L. Vendas, Valdosta State University, Valdosta, GA 31698. Log packing has previously been described in the mangrove killifish, *Kryptolebias marmoratus*, a behavior in which fish move into cavities inside logs and occupy them for extended time periods when the log is not submerged in water. Detailed studies of behavioral interactions involving *K. marmoratus* dyads in open water situations have also been conducted. The present work studied nine fish in an aquarium with an artificial log containing chambers similar to insect galleries; and examined behaviors that occurred when fish entered, occupied and left the log as water levels fluctuated leaving the aquarium and log dry or filled with water. Interactions were scored as neutral, aggressive and submissive based on previous studies. Twenty-one behaviors were observed: (1) eleven neutral behaviors, (2) five aggressive behaviors, and (3) five submissive behaviors. All neutral behaviors involved single fish that were either entering or leaving the log or adjusting position within the log. Agonistic behaviors (aggressive and submissive) involved two or more fish with the majority of the behaviors involving means by which one fish moved via different mechanisms involving swimming or wiggling over a dry surface in order to secure a position in the log or avoid contact with another fish. A primary factor contributing to the diversity and occurrence of behaviors was the presence or absence of water within the log which required that fish move and interact with each other in different ways. When water was present, agonistic interactions were common; but when water was absent, agonistic interactions and neutral behaviors were uncommon as fish remained relatively quiescent.

10:45 PHYTOPLANKTON ASSOCIATIONS IN THE VICINITY OF DESOTO CANYON, NORTHEASTERN GULF OF MEXICO: DISTRIBUTIONAL PATTERNS, J. A. Nienow¹ and S. Wise², ¹Valdosta State University, Valdosta GA 31698 and ²Florida State University, Tallahassee FL 32104. We are conducting a multi-year study of the phytoplankton in the vicinity of DeSoto Canyon with the primary goal of characterizing the structure of the association in space and time. Here we report distributional patterns along three transects extending offshore from the panhandle of Florida during May 2012. At each station 1-liter samples were collected at 20-25m intervals to depths of up to

200 m. These were filtered onto 0.45 µm filters, air-dried, then examined with SEM to quantify the most abundant species. Near shore samples were dominated by the diatoms *Cyclotella choctawhatcheeana* and *Fragilariopsis* cf. *pseudonana*, and the coccolithophores *Emiliana huxleyi*, *Gephyrocapsa ericsonii*, and *G. oceanica*; the loricate protest *Paulinella ovalis* was also abundant (>20,000 per liter). Off-shore, the chain-forming diatoms *Leptocylindrus danica* and *Pseudonitzschia* sp. are dominant in the surface waters, with coccolithophores increasing in important with depth. Overall, the greatest phytoplankton diversity was measured at 80 meters below the surface. These results may indicate the complex mingling of at least two distinct bodies of water: nearshore waters influenced by outflows from the bays and offshore surface waters influenced by currents. Deeper waters are stable enough to permit some degree of vertical stratification.

11:00 A PRELIMINARY ASSESSMENT OF THE FIRST INSTAR MORPHOLOGY OF *AGABUS DISINTEGRATUS* (CROTCH) AND *A. PUNCTATUS* MELSHEIMER (DYTISCIDAE: COLEOPTERA), T.A. Shepley-James¹, E.H. Barman², R.J. Wilkes², B.P. White¹ and G.W. Wolfe², ¹Georgia Military College, Warner Robins, GA 31093 and ²Georgia College & State University, Milledgeville, GA 31061. Although descriptive information for mature larvae of *Agabus disintegratus* and *A. punctatus* is available, first instars have not been described. The purpose of this research was to describe first instar larvae of both species. In Georgia, specimens of *A. punctatus* can be separated from members of *A. disintegratus* by the presence of a distinct, dark stripe on the cranium of the former. Cranial architectures are similar although the intermandibular distance (gape) of *A. disintegratus* is significantly ($P = 0.0003$) narrower than that of *A. punctatus*, suggesting that the two species exploit different prey regimes during the first stadia. The analysis of the primary chaetotaxy of the head and its appendages, legs, last abdominal segment, and urogomphi revealed no major differences between these two species. However, the analysis of legs did reveal unexpected variation in the morphology of some elements of femoral, tibial, and tarsal sensilla when compared to previously published descriptions of first instars of Nearctic *Agabus*. This project was supported in part by resources provided by the Department of Biological and Environmental Sciences, Georgia College & State University. Aquatic Coleoptera Laboratory Contribution No.84.

11:15 LETHAL AND NON-LETHAL EFFECTS OF GIANT WATER BUGS ON SNAIL AND TADPOLE GRAZERS, Clifton B. Ruehl^{1, 2}, H. Vance-Chalcraft¹ and D.R. Chalcraft¹, ¹East Carolina University, Greenville, NC 27858 and ²Department of Biology, Columbus State University, Columbus, GA 31907. Separating the lethal and non-lethal effects of predators reveals the relative importance of each on competing prey populations and community structure, but lethal effects are rarely tested alongside non-lethal ones. We tested for differences in these two properties of predators on competing prey with a factorial experiment using either one hundred *Hyla chrysoscelis* tadpoles, one hundred *Physa acuta* snails, fifty of each together crossed with the presence of a lethal water bug, *Belostoma flumineum*, a non-lethal (contained) water bug, or no water bug. A final treatment contained no snails, tadpoles, or water bugs to test for direct effects of grazers and indirect effects (trophic cascades) of water bugs on periphytic algae. Lethal water bugs consumed on average 47% of *H. chrysoscelis* resulting in 27% faster growth (mg/day) for surviving tadpoles that balanced tadpole production (mg/tank/day) between predator treatments (lethal vs. non-lethal vs. no water bug). Snails suffered 97% mortality and grew 26% slower resulting in much lower snail production among predator treatments. Non-lethal water bugs induced deeper tail fins in tadpoles, while growth and shell shape was not altered in snails. Intraspecific competition was stronger than interspecific; tadpoles and snails grew faster when they were together than alone at same overall

density. Lethal effects of predators indirectly affected periphyton resources in snail tanks through a density-mediated trophic cascade; we found no evidence of cascades for tadpoles or non-lethal water bugs on either species. Overall, lethal effects were more important than non-lethal ones regardless of prey vulnerability, and among non-lethal effects, the less vulnerable species (*H. chrysoscelis*) exhibited larger responses. Studies assessing the importance of non-lethal predators within communities should consider the strength of both lethal and non-lethal effects together.

POSTERS

THE EFFECTS OF XYLITOL ON *FUSOBACTERIUM NUCLEATUM* BIOFILM FORMATION, Stephanie A. Arrowood* and A.L. Kwiatkowski, Young Harris College, Young Harris, GA 30582. *Fusobacterium nucleatum* naturally occurs in a biofilm of plaque in the human mouth and contributes to dental disease. Xylitol is a sugar alcohol which decreases biofilm formation by *Streptococcus mutans*. In this study, experiments were performed to observe the effect of xylitol on *F. nucleatum* growth and biofilm formation. *F. nucleatum* was grown in Schaedler broth with 0%, 0.5%, 1% or 2% xylitol for 72 hours. The cells were grown in plastic 96-well plates at 37°C under anaerobic conditions. Growth was determined by absorbance readings at a wavelength of 600 nm. Biofilm formation was determined by safranin staining and absorbance readings at 492 nm using a spectrophotometer. The experimental data shows that xylitol inhibits *F. nucleatum* growth at concentrations as low as 0.5% xylitol. However, it may aid in biofilm formation since, although cell numbers decreased, the amount of biofilm stayed the same with or without xylitol in the growth medium.

PLANT SALICYLIC ACID BIOSYNTHESIS AND METABOLISM: INSECTICIDAL EFFECT ON ARGENTINE ANT (*HYMENOPTERA: FORMICIDAE*)**, Megan Babb*, J. Marks*, J. Stephens*, S. Rountree*, E. Antakikam*, M. Brinkman¹, C. Kang² and C. Lee¹, ¹Gordon State College, Barnesville, GA 30204 and ²School of Molecular Biosciences, Washington State University, Pullman, WA 99164-4660. The Argentine ant, *Linepithema humile* (Mayr), native to South America has become an important pest in the southern United States, and safe methods of controlling Argentine ant are needed for domestic environments. Most plants depend on defense molecules known as secondary metabolites. One of the main classes of secondary metabolites is a salicylic acid, β -hydroxybenzoic acid. It is synthesized from phenylalanine via cinnamic acid and *o*-coumaric acid or via benzoic acid. In this report, the toxicity to worker ants was tested for salicylic acid and their precursor molecules, namely phenylalanine, *o*-coumaric acid, cinnamic acid and benzoic acid. In addition, the corresponding water soluble derivatives of those phenolics, sodium salicylate and sodium cinnamate were tested. These compounds are found in nature in the form of plant defensins. The results showed that phenylalanine and *p*-coumaric acid had little effect on workers while exposure from salicylic acid, cinnamic acid, *o*-coumaric acid and benzoic acid resulted in higher mortality of workers. In addition acetoaminophen, a synthetic benzoic acid, was also tested to investigate the possible mortality effect of salicylic acid through a possible catabolic quinone formation, which also resulted in relative high mortality.

ANALYSIS OF THE SYNERGISTIC EFFECTS OF OREGANO AND GARLIC OIL AGAINST PATHOGENIC MICROBES**, R.P. Bagnal* and J.M. Morgan, Gainesville State College, Oakwood, GA. Among the most common ailments plaguing modern society are bacterial infections, whether respiratory, digestive or integumentary. Even with modern antibiotics, scientists are always on the move to develop new and better drugs to

deal with the constant problem of antibiotic resistance. Oregano oil and garlic oil have been tested for their antimicrobial properties in a series of studies over the past several years. Individually, both have been shown to have significant antimicrobial effects, but their synergistic and/or antagonistic effects have not been studied. To investigate this question, we began by ensuring the efficacy of the oils being used. The oils were tested in pure form, as well as in varying dilutions, using the Kirby-Bauer technique. The dilutions were put on the diffusion discs and placed on bacterial spread plates containing either *Escherichia coli*, *Enterococcus faecalis*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Klebsiella pneumoniae*, or *Streptococcus pyogenes* and incubated at 37°C. After determining the minimum inhibitory concentration (MIC) of oregano oil and garlic oil, studies were designed to explore the synergistic effect against the bacteria tested. Results from these studies will be useful in determining the efficacy of naturally-occurring substances compared to antibiotics against specific microbes.

RESTORATION OF DEGRADED BLACK BELT PRAIRIES: EFFECT OF FIRE AND CLEARING TREATMENTS, John A. Barone*¹ and J.G. Hill², ¹Columbus State University, Columbus, GA 31907 and ²Mississippi State University, Mississippi State, MS 39762. In the early 19th century, about 144,000 ha of prairies were scattered throughout the Black Belt region of Mississippi and Alabama. Most prairies have been converted to agricultural fields or pastures, and remaining prairies are often subject to invasion by eastern red cedar trees. In this four-year study, we examined the ecological consequences and economic costs of three methods for removing cedars from prairie sites: clearing, burning, and cutting and burning on site. Twenty-one 20 by 10m plots were established in remnant prairies along the Natchez Trace Parkway in Mississippi. During the growing season, monthly censuses of forbs and grasses were conducted, along with early and late season assessments of ant and grasshopper diversity and composition. The response to the treatments varied across time. For example, initially, the number of plant species rose on cleared sites compared with controls ($P=0.028$), only to drop back down in the final year of the study. In contrast, sites that were cut and burned saw a steady rise in the number of species across the three years' post-treatment. Drought conditions may be responsible for a significant reduction in species richness in the control and burned treatments during the final year of the study ($P=0.030$). Though expensive, clearing may be the most effective means for removing cedars and restoring degraded prairies.

PROMOTING SCIENTIFIC RESEARCH THROUGH HERBARIUM DIGITIZATION AT VALDOSTA STATE UNIVERSITY**, J.M. Bartek*, A.M. Vardeman*, A.N. Blocker* and C.L. Louis*, Valdosta State University, Valdosta, GA 31698. The Valdosta State University Herbarium is collaborating with the University of Georgia Herbarium in an effort to preserve, secure, and enhance valuable scientific collections, while increasing interest in the study of plants. This three-year project will produce an on-line atlas of the plants of Georgia, based upon the combined holdings of the two largest herbaria in the state. Undergraduate student assistants at Valdosta State University are actively involved in digitizing and curating the herbarium. More than 30,000 vascular plant, bryophyte, and lichen specimens at Valdosta State have been imaged and databased, and student assistants have demonstrated their work to a national audience through an iDigBio workshop on digitization of herbarium collections in September 2012. An ancillary effort between Odum Library and the Valdosta State University Herbarium is using data and images generated through this project to create a virtual herbarium that will locally serve data and images online. These projects will increase access to valuable herbarium resources, bringing specimens and data before a much wider audience of researchers and the general public. This research was supported by the National Science Foundation (NSF-BRC

1054366, R. Carter PI) and a Valdosta State University Faculty Research Grant (M. Holt PI, R. Carter Co-I).

MACROINVERTEBRATE DIVERSITY & *E. COLI* PRESENCE IN AN URBAN STREAM IN AUGUSTA, GA, Chris Bates¹, C. Taylor-Burton^{*1}, M. Nakama^{*1}, L. Quibeuf^{*1}, S. Sutton^{*1}, A. Woodward^{*1}, O. Flite^{1,2} and J.M. Reichmuth¹, ¹Augusta State University, Augusta, GA 30904 and ²Southeastern Natural Sciences Academy, Augusta, GA 30906. As urbanization increases, many streams are affected by land use changes that increase the amount of impervious surface and decrease soil retention and percolation. This can result in dynamic levels of nutrients, sediment, and contaminant concentrations in the water. These changes can ultimately decrease stream habitat and the ability of aquatic organisms to maintain viable populations. Another emerging issue is the presence of bacteria associated with fecal waste within urban stream ecosystems. Butler Creek is a typical urban stream that drains a portion of Augusta, GA. Over the course of this study (January 2011-present date), water temperature, velocity, and pH were all within normal ranges. Nitrate was not detected and orthophosphate levels were low, ranging from 1-3 ppm. Samples collected to date show a low abundance and low overall diversity of macroinvertebrates. *E. coli* and non-*E. coli* coliforms were present in either the water column or sediment for every sample collected. Some *E. coli* also demonstrated resistance to antibiotics. These results suggest that the stream warrants continued monitoring, particularly to determine the discrepancy between the phosphate levels and the low macroinvertebrate levels. This project was funded by the Center for Undergraduate Research and Scholarship at Augusta State University.

COMPARING BAIT FISH AMONG THREE BARRIER ISLANDS OF THE GEORGIA-CAROLINA COASTAL REGION**, C. F. Best*, B. Saul and J.M. Reichmuth, Augusta State University, Augusta GA 30904. Current research suggests that estuaries are subject to anthropogenic degradation affecting many of the fish species that live in these important ecosystems. The comparison of estuaries with varying human environmental influence can provide insight into their overall health. Bait fish are economically and ecologically important because they provide food for sport fish and they are ecological indicators for pollution. The length and abundance of two vitally important bait fishes, *Menidia menidia* (Atlantic silverside) and *Engraulis eurystole* (bay anchovy), were compared among three barrier islands with varying human impacts within the Georgia-Carolina coastal region. Hunting Island (SC) and Tybee Island (GA) are accessible by vehicle and open to the public. St. Catherine's Island (GA) is only accessible by boat and is closed to the public. Sampling occurred on Hunting and Tybee islands and that data was compared to existing historical data from ongoing research at St. Catherine's Island. Fish near each island were sampled on a monthly basis using two types of beach seines. Preliminary findings show some size and count differences among the three islands, suggesting that anthropogenic influence may be at play.

PLANT EXTRACT EFFECTS ON AMYLOIDOGENIC FOLDING OF THE SUP35 PROTEIN OF SACCHAROMYCES CEREVISIAE**, Emily B. Blackmon*, J. Festa*, J.A. Tierno*, D. Pye* and M.L. Gleason, Georgia College & State University, Milledgeville, GA 31061. Prions and amyloids are ordered aggregates of protein monomers that are implicated in a variety of neurodegenerative diseases as well as normal biological functions. One of the most well-studied prions is the yeast non-Mendelian inheritance factor [PSI⁺], the prion form of the SUP35 protein. Our progress in studying the efficacy of plant extracts to block the [PSI⁺] prion's *in vitro* aggregation will be described, as will each extract's ability to affect change *in vivo*, namely, its ability to cure [PSI⁺] yeast

of the prion or to block Sup35's assembly in [psi] yeast from being induced to form [PSI⁺]. Methods will include yeast growth on selective media, SDS-PAGE, Western-blot, and spectrofluorometric-based thioflavin-T assays. This work is supported in part by a 2011/12 Faculty Research Grant from Georgia College and by funds from the Georgia College & State University Foundation.

FALL AND WINTER HABITAT PREFERENCES OF TWO COMPETING CRAYFISHES IN A SMALL, HEADWATER STREAM.** Ashley Cross*, Z. Wagoner*, B. Bradley*, H. Hoopingarner* and J.G. Davis, Young Harris College, Young Harris, GA 30582. Two crayfishes, *Cambarus bartoni* and *Cambarus hiwasseeensis*, are native to Corn Creek in north Georgia. This study evaluated the partitioning of habitat use among these two species. Crayfishes were collected from 10, 25-m sections of stream utilizing a stratified, random sampling design. Collections were made using a seine and a 0.5 m² quadrat to estimate density and relative abundance of each species. Within each sampled quadrat, dominant substrate type, depth, water velocity, canopy cover, and distance to bank were estimated. Using correlation analysis, variables correlated to presence for each species will be identified and logistic regression models will be constructed to predict the suite of variables responsible for crayfish presence. Analysis of habitat use by crayfishes is needed to identify areas or streams in need of conservation and can be useful in habitat restoration projects. Overall, crayfishes are an understudied group of organisms, but provide many relevant ecosystem services in aquatic habitats.

ANALYSIS ON THE GENETIC DIFFERENCES BETWEEN THE MANGROVE KILLIFISH *KRYPTOLEBIAS MARMORATUS* AND *KRYPTOLEBIAS OCCELATUS***[†], Fifi A. Dadzie*, B. Ring and J.F. Elder, Valdosta State University, Valdosta, GA 31698. The identification and classification of *Kryptolebias marmoratus* and *Kryptolebias ocellatus* as separate or similar species has been a problem. *K. marmoratus* and *K. ocellatus* belong to the Aplocheilidae family and order CYPRINODONTIFORME. They are both self-fertilizing vertebrates resulting in clonal reproduction suitable for genetic studies. Based on morphological studies, both fishes were thought to be synonymous but recent mitochondrial studies of these fishes suggest otherwise. Though they are known to be self-fertilizing, out crossing has been observed which results in a form of heterozygous offspring. Recently, a viable hybrid (Gitmo) between *K. marmoratus* and *K. ocellatus* was isolated in the VSU aquatic lab. This hybrid questions the species status of these congener fishes. Here we present a comparative genomic study on the Gitmo hybrid and its parents. A phylogenetic analysis of these sequences among loci commonly used in standard systematic studies will be employed. Analysis of ribosomal RNA and the mitochondrial COI gene should help resolve the questionable relationships among these killifishes.

TEMPORAL VARIABILITY OF BAT ACTIVITY DURING WINTER IN LAMAR COUNTY, GEORGIA, Megan A. Dedge*, M.J. Bender, G.F. Clement and G.D. Hartman, Gordon State College, Barnesville, GA 30204. Understanding activity patterns of bats is critical when investigating many bat-related ecological questions. However, few data exist concerning bat activity patterns in the southeastern U.S., particularly during winter. The primary objective of our research was to assess the temporal variability of bat activity during winter in Lamar County, Georgia. We used an Anabat SD2 detector to record echolocation call activity at a single location from 12 November 2011 to 21 March 2012. Bats were active at low levels throughout the sample period. Nightly activity was significantly correlated with average nightly temperature, but no obvious temperature threshold was detected. Bat activity was strictly nocturnal although diurnal activity has been noted in other regions of North America. Bat activity varied substantially among

nights, sometimes several-fold on consecutive nights. To assess the influence of sample duration on perceived activity we randomly selected 100 iterations of subsamples ranging from 2 to 12 nights. For subsets containing at least 5 nights, $\geq 44\%$ percent had means within 30% of the mean of the entire dataset whereas 18% of the 2-night subsamples were within 30%. Researchers estimating bat activity in the southeastern U.S. during winter should sample multiple nights and use caution when estimating activity from a small number of sample nights. Experimental designs and ecological inferences should account for the potential bias of activity estimates when possible given the temporal variability we observed.

PHYLOGENETIC ANALYSIS OF A FROG VIRUS 3-LIKE RANAVIRUS FOUND AT A SITE WITH RECURRENT MORTALITY AND MORBIDITY EVENTS IN SOUTH-EASTERN ONTARIO, CANADA, Amanda L.J. Duffus and A.M. Andrews*, Gordon State College, Barnesville, GA, 30204. Ranaviruses are emerging pathogens of ectothermic vertebrates. We examined the phylogenetic relationship of ranaviruses obtained from infected *Lithobates sylvaticus* tadpoles from 2001 to 2004 from Oliver Pond, near Peterborough, Ontario (44°31'N, 78°32'W), a site of persistent infection. The ranavirus present at this pond was originally designated as a frog virus 3-like (FV3-like) virus based on the sequence of the major capsid protein and was thought to have no sequence variation between isolates. However, we examine several isolates over a three year period and find that there is both sequence differences between and within years. We also find that not all of the virus isolates group with FV-3, which had originally been reported. Additionally, we discuss the problems with using only a partial gene sequence to assign viral identity and the use of these partial sequences to reconstruct phylogenetic relationships within the iridoviruses.

MEGACOPTA CRIBRARIA POPULATION DYNAMICS AT THE OCONEE RIVER GREENWAY, MLLEDGEVILLE, GA., K. Fogg*, S. Huckisson* and C. Zehnder, Georgia College & State University, Milledgeville, GA 31061. *Megacopta cribraria* (the kudzu bug), an agricultural pest of plants in the Fabaceae, is native to China and India. It was first identified in Georgia in 2009 and since its initial discovery in the Southeastern United States, there have been abundant sightings of *M. cribraria* in the vicinity of large patches of *Pueraria lobata* (kudzu). The purpose of this research was to observe *M. cribraria* population dynamics. *M. cribraria* samples were obtained from various *P. lobata* sites along walking trails at the Oconee River Greenway in Milledgeville, Georgia. Sample sites were chosen based on the abundance of *P. lobata*, and sites were sampled using sweep nets weekly from May until November, 2012. Specimens were later counted and identified as either juvenile or adult. In 2012, there was a steady increase in *M. cribraria* density from June until August, with a subsequent decline from September to November. Life stage abundance showed primarily an adult population during early spring from April until May and a higher proportion of juveniles in late fall. Based on observational study, *M. cribraria* have distinct reproductive, colonization and dispersal rates based upon seasonal changes of temperature and vegetation abundance. Adults begin emerging early in the spring in search of host plants to feed and oviposit on, then the next generation of adults begin emerging in June with the population peaking during summer.

SEASONAL PATTERNS OF MACROINVERTEBRATE DRIFT IN LOW-ORDER STREAMS, Liz French*, C. Haygood*, S. McWhorter*, B. Smith* and M. Davis, University of North Georgia, Dahlonega, GA 30597. We investigated seasonal patterns of benthic macroinvertebrate drift in two low-order streams in the southern Appalachian foot-

hills (Lumpkin Co., GA) during fall 2011, spring 2012 and summer 2012. Standard drift nets were established in a first- and third-order stream in the Chestatee River basin. Each stream was sampled eight times seasonally on different dates for two-hour intervals: four morning samples (a period of two hours after sunrise) and four evening samples (a period of two hours after sunset). Drift diversity was determined using the Shannon Index. We assessed patterns of drift numbers in Ephemeroptera, Plecoptera, and Trichoptera clades (EPT), and patterns of drift diversity, with ANOVA. Mean sample size was 4.56. We found no significant difference in diversity values across seasons or time of day, but there was a trend towards higher diversity in the third-order stream ($F_{1,36} = 3.63$; $P = 0.065$). EPT captures were higher in spring than summer and fall ($F_{2,108} = 5.47$; $P = 0.005$), with more captures in the third-order stream ($F_{1,108} = 6.99$; $P = 0.009$) and more captures in evening samples ($F_{1,108} = 6.99$; $P = 0.009$). Higher EPT captures in spring could be explained by increased prepupation events, emergence patterns, and benthic density. Lower captures during morning samples is likely associated with predator avoidance. Higher discharge of the third-order stream probably accounts for higher EPT captures.

BARCODING THE MISSISSIPPI AND ALABAMA BLACK BELT PRAIRIE FLORA USING THE RBCL-MATK GENE REGIONS, Robert B. Futrell*, J.A. Barone and K.S. Burgess, Columbus State University, Columbus, GA 31907. Species identification is an often difficult, yet vitally important process for the study of biological systems. DNA barcoding is a recent molecular tool that can be used for plants to identify them to the species level. The recent agreement to use the *rbcl-matK* chloroplast gene regions as the standard DNA barcode for plants has resulted in numerous efforts to barcode local floras and establish plant DNA barcode databases for future ecological applications. We examined how effective these regions were for a complex flora with many polytypic genera. This study tested 190 samples from the threatened Black Belt prairies of Mississippi and Alabama. Both regions, *rbcl* and *matK*, were recovered in 92.6% of the samples. The identification success was lower than comparable studies at 56.4%. Monotypic genera in this study had a higher proportion of resolution (100%) than polytypic genera (66.7%). The study demonstrated a strong negative correlation between species per genera and resolution (Spearman's $\rho = -0.817$, $P < 0.001$). These results suggest that *rbcl* and *matK* have lower discriminatory rates in more complex floras.

DO THEY STAY OR DO THEY GO NOW? A STUDY OF SITE FIDELITY AMONG THREE SPECIES OF MARINE FISHES**, M. W. Gieseking* and J. Reichmuth, Augusta State University, Augusta, GA 30904. Diversity studies among three barrier islands, Hunting Island, SC, Cocksbur Island, GA, Tybee Island, GA, showed that three fish species, *Trachinotus carolinus*, *Mugil curema* and *Mugil cephalus*, are consistently present in coastal waters. The current investigation looks to determine whether these ecologically and economically important fish species stay in one area or migrate in and out of a region during different stages of their development (juvenile or adult). Current literature for the three genera suggests seasonal site fidelity for all three species, but not much has been studied on either *Mugil* species and little is known about *Trachinotus*. Using monofilament and cotton mesh bag seines, a fish measuring board, and T-Bar anchor tags, fish were caught using a quarter haul technique, measured with the fish board to nearest cm, identified, tagged and released. Tagging occurred subcutaneously behind the first dorsal fin on *T. carolinus* that were at least 8.0 cm, and *Mugil spp.* at least 7.0 cm in length. Fish were tagged at a range of sizes in hopes to tag a wide variety of age classes to determine their site fidelity. To date 3 Striped Mullet, 28 Pompano, and 54 White Mullet have been tagged on Tybee; 1 Striped Mullet and 9 White Mullet have been tagged on

Cockspur; and 26 Striped Mullet, 16 Pompano, and 39 White Mullet have been tagged on Hunting. Only one fish has been recaptured. This study was funded by Augusta State's Center of Undergraduate Research & Scholarship and Pamplin Student Research Funds.

A COMPARISON OF THREE-DAY BIRD DIVERSITY SURVEYS IN TORTUGUERO NATIONAL PARK (COSTA RICA), Shezeen Gillani*, C. Valenzuela, K. Valenzuela and M.A. Schlueter, Georgia Gwinnett College, Lawrenceville, GA 30043. Costa Rica, Central America, is renowned for its diverse ecosystems, which contain numerous flora and fauna. Of the 850 different bird species that call Costa Rica home, approximately 375 live in the Tortuguero region. Bird diversity and abundance data can provide an assessment of ecosystem health because birds feed off the fish and insects that live in the local ecosystem. Students from GGC conducted a three-day survey of Costa Rican birds in the Tortuguero National Park in May 2011 and May 2012. Each day, students traveled down river by boat, observing birds for 2-4 hours and performed additional observations while walking through the rainforest for an additional 2-3 hours. Species diversity and abundance data was collected both years. Only verified species observations (2 or more observers) were included in the study. In May 2011, students observed roughly 150 birds composed of 38 different species. In May 2012, the group observed roughly 250 birds composed of 41 different species. Nine of the birds species present in the 2011 survey were absent in the 2012 survey. Twelve of the species counted in the May of 2012 were new species not observed in 2011. The most abundant bird species seen throughout the Tortuguero river region in both years were the: Anhinga, Bare-Throated Tiger Heron, Cattle Egret, White Egret, Great Blue Heron, Little Blue Heron, and Ringed Kingfisher. A significant increase in abundance was seen in the Montezuma Oropendola and toucan species (Keel-billed, Chestnut, and Collared Aracari) in 2012 compared to the previous year. Overall bird abundance and diversity was higher in 2012. Based on the bird data, the Tortuguero ecosystem has remained a healthy ecosystem without any significant negative environmental impacts from 2011.

RELATIONSHIP BETWEEN *CNR1* GENE VARIATION AND BEHAVIORAL DIFFERENCES AMONG *KRYPTOLEBIAS MARMORATUS* LABORATORY ISOGENIC LINES**, A. Gopinath*, J.F. Elder and B.C. Ring, Valdosta State University, Valdosta, GA 31698. The endocannabinoid system (ECS) is composed of molecules that include endogenous cannabinoids (endocannabinoids), cannabinoid receptors and the enzymes that regulate the concentration of endocannabinoids. In human beings and other vertebrate models the ECS is implicated in the regulation of several bodily functions from appetite regulation to processing rewards. The *cnr1* gene encodes the CB1 receptor (Cannabinoid receptor 1) which is an integral part of this system. Polymorphism in the *cnr1* gene (Cannabinoid receptor 1 gene) in humans is associated with substance addiction, depression, anorexia and several other disorders. *Kryptolebias marmoratus* (kmar) are self-fertilizing hermaphrodites that produce clonal progeny. This study aims to sequence the *cnr1* gene in four isogenic lines of kmar and correlate polymorphism to behavioral differences. Since the dynamics of the ECS is yet to be fully characterized in any organism, a significant result could help provide the spark to encourage study of the ECS in this simple vertebrate.

CAMERA TRAP PRICE MAY NOT INFLUENCE CAPTURE SUCCESS, Justin B. Gossett*, J.M. Strickland*, M.J. Bender and G.D. Hartman, Gordon State College, Barnesville, GA 30204. Camera traps have become a widely-used sampling technique in wildlife ecology research. However, few experimental data are available to researchers choosing from among the myriad brands and models being sold. The objective of this

project was to experimentally evaluate the trap success of two camera models, an inexpensive flash illumination model and a high-end infrared illumination model. A matched-pair experimental design was used to sample 30 points in Spalding and Butts Counties, Georgia between 21 August and 2 November 2012. Camera trapping was conducted at each point for a period of one week. No significant difference in the number of weekly captures between the matched camera pairs was detected (Wilcoxon Signed Rank Test; $P = 0.6387$). Our data suggest that inexpensive camera models should be sufficient for many research projects and high-end models may not significantly improve capture success. We recommend experimentally evaluating camera performance, when possible, rather than choosing models based on price alone.

PLANT SHADE AVOIDANCE RESPONSE AT DIFFERENT TEMPERATURES, Jamekia Grant* and B. Kim, Department of Natural Sciences, Albany State University, Albany, GA 31705. Depleting red light (around 660 nm) and/or enriching far-red light (around 730 nm) in the environment causes a set of reactions called shade avoidance response, which include petiole elongation and reduction of plant pigments. Despite many well documented reports on shade avoidance response, it is not well understood how this response varies in different temperature contexts. Therefore, we investigated the extent of petiole elongation in *Arabidopsis thaliana* seedlings under extra far-red light condition at 18°C, 22°C and 26°C. The extent of far-red-mediated petiole elongation was very similar at 18°C and 22°C, with very little temperature effect. Higher temperature (26°C) induced a significant level of petiole elongation under white light condition, where the length was similar to the length induced by the extra far-red light at the same temperature. These data indicate that the far-red light could not further induce the petiole elongation at the 26°C temperature. ANOVA testing further suggests that the temperature signal may interfere with the petiole elongation during the shade avoidance response.

PLANT PIGMENT ACCUMULATION UNDER EXTRA FAR-RED LIGHT CONDITION AT DIFFERENT TEMPERATURES**, Joshua Hicks*, K. Peets, D. Zellous, D. Anderson, and B. Kim, Department of Natural Sciences, Albany State University, Albany, GA 31705. The plant photoreceptor phytochrome can sense the ratio of red (660 nm) and far-red light (730 nm) in its environment. It is known that excess amount of far-red light compared to red light causes a set of reactions called shade avoidance response, including the reduction of plant pigments and stem elongation. Despite many well documented reports on shade avoidance response, it is not well known how this response differs at different temperatures. Therefore, we investigated the level of chlorophylls, carotenoids and anthocyanin contents in *Arabidopsis* seedlings under extra far-red light condition at 18°C, 22°C and 26°C. When regular white light condition was used, the amount of all tested pigments was reduced with increasing temperature. Supplementation of extra far-red (FR) light to the regular white light also reduced the amount of all pigments tested in the plant. Unlike other pigments, however, the reduction level of anthocyanin under extra FR light condition was temperature dependent. The FR-mediated reduction rate of anthocyanin was highest at 18°C and lowest at 26°C. The ANOVA test further suggests that the temperature signal may interfere with the extra FR-mediated reduction of anthocyanin accumulation.

EFFECT OF ACUTE HERBICIDE EXPOSURE ON NERVE ACTIVITY IN *PRO-CAMBARUS ZONANGULUS*, Kathleen S. Hughes, C.N. Allen*, S.M. Brackett*, J.L. Burston*, D.L. Ellis*, W.E. Grimes*, B.L. Holloman*, S.C. Kirk*, C.E. Lee*, D.A. Loper*, C. Morgan*, E.A. Oludimimu*, E.D. Walker*, S.B. Whitley* and S.L. Worthy*, Columbus State University, Columbus, GA 31907. Exposure to certain levels of atrazine and

metolachlor has been linked to deleterious effects including developmental delays and behavioral changes in various aquatic species. The present study examined the effect of these chemicals on nerve activity in the white river crayfish, *Procambarus zonangulus*. Following dissection, nerve 3 was exposed to either atrazine or metolachlor, and nerve activity was detected and recorded for up to five minutes using Biopac Student Lab Pro software version 3.7 and a suction electrode attached to a Biopac MP30 transducer. Data was analyzed using one-way ANOVA. Neither atrazine ((0.07 ug/ml: 1.9 +/- 2.3 (n=7), 0.02 ug/ml: 0.9 +/- 0.6 (n=5); data expressed as ratio to baseline +/- SD) nor metolachlor ((0.2 ug/ml: 0.6 +/- 0.5 (n=5)) exposure affected nerve activity amplitude. Similarly, neither atrazine (0.07 ug/ml: 1.0 +/- 0.6, 0.02 ug/ml: 2.2 +/- 2.6) nor metolachlor (0.2 ug/ml: 3.8 +/- 4.7) exposure affected nerve firing frequency. The results indicate that bolus, short-term treatments of atrazine and metolachlor did not affect *P. zonangulus* nerve activity. Future studies will examine effects of chronic exposure on nerve activity as well as herbicide combinations on aquatic invertebrates.

HOST PLANT PREFERENCE OF *MEGACOPTA CRIBARIA*** , Sarah M. Huskison*, K. Fogg and C.B. Zehnder, Georgia College & State University, Milledgeville, GA 31061. *Megacopta cribaria* is an invasive insect species that was first discovered in Georgia in 2009. These insects feed on kudzu, another invasive species, but they also feed on other types of legumes, including economically important crops like soybeans. Preference tests were conducted to determine which legumes *M. cribaria* favored besides kudzu. Initially, four cages were set up with equivalent amounts of pea leaves and lima bean leaves. There was a strong preference for lima beans. To follow this, fifteen additional trials were run, this time using lima beans and soybeans. Trials took place for two weeks and plant size, age, and bug counts were noted. Throughout the trials it was evident that *M. cribaria* preferred soybeans to lima beans. Plant quality differences between soybeans and lima beans could be the cause of the preference, but further investigation is needed.

GLOBAL RANAVIRUS PHYLOGENY FOR THE FAMILY RANIDAE, Christie M. Jackson* and A.L.J. Duffus, Gordon State College, Barnesville, GA 30204. Ranaviruses are large, double-stranded DNA viruses from the family *Iridoviridae*, which infect fish, amphibians, and reptiles, typically causing external and internal hemorrhaging and necrosis. The Office International des Epizooties recognizes the virus' role in amphibian population reduction and has recommended notification of naturally occurring ranavirus outbreaks. Ranaviruses are distinguished from other members of the *Iridoviridae* by their major capsid protein sequence and are commonly categorized into several sub-categories using them. This study analyzes phylogenetic trees composed from ranid ranavirus major capsid protein sequences to potentially determine the origin of ranid ranaviruses. Complete and partial ranavirus major capsid protein sequences from ranids were gathered using GenBank. Sequences were aligned and subjected to evolutionary analysis producing both maximum likelihood and neighbor joining phylogenetic trees in MEGA. Although two different methods were used to create the phylogenetic trees, the bootstrapping values and branching patterns are similar supporting their results. A potential continental origin is not clear from the results; however, they do suggest the ranavirus isolates from the United Kingdom could have potentially come from North America.

ASSESSMENT OF *CAMBARUS TRUNCATUS* (OCONEE BURROWING CRAYFISH) DIVERSITY THROUGH GENETIC ANALYSIS** , Robert B. Jones*, Y.E. France and C.E. Skelton, Georgia College & State University, Milledgeville, GA 31061. *Cambarus truncatus* Hobbs is a freshwater crayfish species known from only 11 localities in the Oconee River system of Georgia. *Cambarus truncatus* is considered to be a primary

burrower as it spends most of its life in a complex burrow system away from open water. Despite the fact that the various populations of *C. truncatus* have become increasingly isolated due to anthropogenic forces and are considered by many authorities to be threatened, almost nothing is known with regards to its life history or genetic diversity. The goal of this project is to assess the genetic diversity of *C. truncatus* among different populations using molecular phylogenetic analysis and to gain insight into its dispersal capability. The gene regions selected for analysis are the mitochondrial genes, 16s and Cytochrome Oxidase I (COI), and the GAPDH gene. Genomic PCR was performed using total genomic DNA extracted from 14 specimens, and all three gene markers have been successfully amplified for sequencing analysis. We hypothesize that individual populations of *C. truncatus* are founded by a single female progenitor, which then should be reflected by the identical mtDNA sequences within the populations. Genetic diversity will be discussed, and inter- and intrapopulation relationships will also be presented.

CULTURABLE GUT MICROBIOME DIVERSITY OF TWO GENERALIST HERBIVORES, Alyssa Kelly* and E. Lampert, University of North Georgia, Oakwood, GA 30566. Endosymbionts play a major role in the ecology of herbivorous insects. For instance, they may metabolize plant compounds, enhance digestive efficiency, and prevent ingested pathogens from establishing. Here we use culture methods to determine the gut microbiome of two species of Lepidopteran generalist herbivores, the fall armyworm *Spodoptera frugiperda* and the Eastern tent caterpillar *Malacosoma americanum*. We test the hypothesis that the culturable microbiome is dependent on the physiological conditions inside the midgut, which can potentially vary among herbivore species and also vary within a species based on diet. Each species was reared on a host plant belonging to the Rosaceae or a host plant belonging to the Juglandaceae, and guts were plated on tryptic soy agar. Colonies were isolated and Gram-stained for identification. Tent caterpillar guts contained greater numbers of fungi compared to armyworms regardless of plant species. We primarily identified Gram-positive prokaryotes in both species, along with Gram-negative bacilli. Future goals include PCR and sequencing to further identify the microbiome. We discuss the implications of gut microbiome in regard to understanding the ecology of plant-herbivore-symbiont interactions.

THE ECOLOGY OF THE LARGE MOUTH BASS (*MICROPTERUS SALMOIDES*) AND BLUEGILL (*LEPOMIS MACROCHIRUS*) POPULATIONS IN THE GORDON STATE COLLEGE POND, Darryll W. Kipp, Jr.* , C.M. Jackson*, J. Thaeter*, E.J. Martin IV*, J.C. George, A.M. Andrews* and A.L.J. Duffus, Gordon State College, Barnesville, GA 30204. Using mark-recapture methods, we examined the population ecology of largemouth bass (*Micropterus salmoides*) and bluegill (*Lepomis macrochirus*) in the Gordon State College pond. We angled for several hours on a regular basis from June 2012 to October 2012 to capture the fish. The fish were checked to see if they already had a transmitter; if they did not, they were then tagged with a 9 mm internal transmitter to permit for individual identification. For each fish caught or recaptured, the following measurements were taken: length, width, girth and weight. The average length for largemouth bass ($n = 57$) was 10.6 ± 1.32 inches, whereas for bluegill ($n = 122$) it was 6.46 ± 0.58 inches. The average width for largemouth bass was 2.69 ± 0.33 inches, for bluegills it was 3.14 ± 0.4 inches. The average girth was 33.4 ± 4.83 mm for largemouth bass and 21.05 ± 2.35 mm for bluegills. The average weights of the largemouth bass and bluegill were 0.68 ± 0.22 lbs and 0.27 ± 0.07 lbs, respectively. The recapture rate was very low for both species; only 5 bluegills were re-captured and 9 bass (one of which was caught 3 times). Most recaptured fish had lost weight, perhaps because of the stress caused by receding water.

EXPLORING THE ROLE ENVIRONMENT PLAYS ON GENE REGULATION USING A FLUORESCENTLY TAGGED GLUCOSE TRANSPORTER IN *SACCHAROMYCES CEREVISIAE*** , Tae Young Lee* and J.M. Morgan, Gainesville State College, Oakwood, GA 30566. Gene regulation, the process of turning genes on and off, is crucial to life and allows a cell to respond to the environment in which it is living. The goal of this project is to investigate the role environmental glucose plays in gene regulation by observing fluorescence protein tagged glucose transporters. *Saccharomyces cerevisiae* utilize glucose transporters to bring sugar into the cell so that it may be metabolized. Environmental glucose levels can alter the gene expression of hexose transporters in the yeast resulting in differential expression of the transporters. Using a strain of *S. cerevisiae* containing green fluorescence protein (GFP) tagged glucose transporter, the visualization of gene expression and the cellular localization can be determined. The hexose transporter 2 (HXT2) is a high affinity glucose transporter that is expressed under low glucose conditions and repressed under high glucose concentrations. In this research, the environment will be altered by changing the glucose levels in which the yeast grow. Fluorescence microscopy will be used to determine the cellular localization and thus expression of the HXT2-GFP. It is expected that lower levels of glucose will result in expression and localization to the plasma membrane of the HXT2-GFP while high levels of glucose will result in the suppression of HXT2-GFP.

IDENTIFICATION OF *NOCOMIS LEPTOCEPHALUS INTEROCULARIS* (CYPRINIDAE) FROM LUMPKIN COUNTY, GEORGIA, USING MITOCHONDRIAL CYT-B AND NUCLEAR IRBP2 DNA SEQUENCES, B.R. Mangum*, D.N. Dehner-Aganovic and S.A. Webb, University of North Georgia, Dahlonega, GA 30597. A subspecies of Bluehead Chub (*Nocomis leptocephalus interocularis*, Cyprinidae) was previously misidentified as River Chub (*N. micropogon*) in the Chattahoochee River watershed in Lumpkin Co., Georgia, due to limited usefulness of morphological characters used to discriminate *Nocomis* taxa. Head tubercle pattern and intestinal coiling pattern have been used previously to distinguish these taxa, but distinct tubercles only occur in breeding males, and intestinal coiling pattern is variable in *N. l. interocularis*. To reliably determine the identity of collections from the Chattahoochee watershed, we sequenced DNA from both mitochondrial and nuclear loci of two individuals collected from Bryant Creek and Pecks Mill Creek in Lumpkin Co., Georgia. We sequenced 248 nucleotides of mitochondrial cytochrome-b and 867 nucleotides of nuclear interphotoreceptor retinol binding protein 2 using standard molecular methods. Both fish were assigned to *N. l. interocularis* based upon sequence similarity and phylogenetic analysis. They clustered tightly with a previously-published sample from the Chattahoochee watershed in Carroll Co., Georgia. The implications of this finding with respect to previous studies that included misidentified specimens will be discussed. Funding was provided by the North Georgia College & State University Department of Biology and School of Science and Health Professions.

ANTIMICROBIAL PROPERTIES OF EGG WHITE AGAINST THE BACTERIA *AEROMONAS HYDROPHILA*, *STAPHYLOCOCCUS AUREUS*, AND *ESCHERICHIA COLI*** , Natalie Mellem* , J. Butler* , S. Gitau* , A. Lester and D. McGarey, Kennesaw State University, Kennesaw, GA 30144. Antimicrobial properties of egg white have long been documented, however the mechanism is not well understood. This study determined the lethal point of egg white on various concentrations of the bacteria *Aeromonas hydrophila*, *Escherichia coli* and *Staphylococcus aureus*. One ml of egg white from three-day-old fertilized eggs was aseptically transferred to sterile test tubes. *Aeromonas hydrophila*, *Staphylococcus aureus* and *Escherichia coli* at cell counts ranging from

1×10^3 to 1×10^6 colony forming units (CFUs) were inoculated into the egg white, and incubated and cultured over a three-day period at 37°C . In a separate experiment, 1×10^3 to 1×10^6 CFUs of these bacteria were inoculated 1 cm from a developing embryo in a shell-less environment and tracked for three days for embryo survival and bacterial persistence. In egg white inoculated with 1×10^3 to 1×10^5 CFUs (1 CFU/ μl up to 100 CFUs/ μl) no bacteria were recovered after 24 hours. At 5×10^5 CFUs (500 CFUs/ μl) a severe drop in bacterial population occurred within 24-48 hours, then bacterial cells repopulated in 50% of the tubes. At 1×10^6 CFUs (1000 CFUs/ μl) no antimicrobial action of egg white was observed since there was no reduction in bacterial CFUs. In the shell-less egg experiment, 1×10^3 CFUs of each bacterium was lethal to the developing embryo. Results show that egg white has antimicrobial properties that completely destroy pathogens at concentrations of 100 CFUs/ μl or less, and kill 50% of the pathogens at 500 CFUs/ μl . Death of the embryos in the shell-less experiment most likely occurred because the inoculation was on the yolk, thus avoiding the antimicrobial action of egg white. Funding was by KSU Peach State LSAMP Program.

AN ACOUSTIC SURVEY OF ANURAN SPECIES RICHNESS IN LAMAR COUNTY, GEORGIA, Joseph D. Nestor*, B.L. Cochran, G.D. Hartman and A.L.J. Duffus, Gordon State College, Barnesville, GA 30204. Male anurans vocalize during their breeding seasons in order to attract mates, and each species' call is unique and identifiable. We recorded calls of frogs at 10 localities in Lamar County, Georgia in order to assess presence and distribution of anuran species within the county. Calls of 10 species were recorded during the study. The majority of species we recorded coincided with the known distribution of those species within the state; however the calls of the wood frog, *Lithobates sylvaticus*, were recorded at two separate locations during our study. Some authors have published range maps suggesting that wood frogs may occur within Lamar County, but there have been no records of the species. Our study confirms the occurrence of *L. sylvaticus* in Lamar County.

PHYTOPLANKTON ASSOCIATIONS IN THE VICINITY OF DESOTO CANYON, NORTHEASTERN GULF OF MEXICO: ANALYSIS OF THE SURFACE PIGMENTS**, A.V.F. Nienow*, M. Waters and J.A. Nienow, Valdosta State University, Valdosta GA 31698. We are conducting a multi-year study of the phytoplankton in the vicinity of DeSoto Canyon. The goal of this research is the characterization of the structure of the phytoplankton associations in the region as a means of assessing the movement of water in the region. As part of this effort, surface pigments will be analyzed using HPLC. In particular, 5-liter samples of surface water will be collected at 10 mile intervals along three transects extending from the mouths of Pensacola, Choctawhatchee, and St. Andrew Bays in December 2012 and March 2013. These samples will be filtered through glass fiber filters, frozen, and returned to the lab. In the lab, the filters will be extracted overnight, and aliquots of extract will be separated and analyzed using HPLC. The results should provide information concerning the relative abundance of the major groups of phytoplankton. These will be compared with direct counts of the phytoplankton associations determined elsewhere. They will also be compared with satellite imagery as available.

PHYTOPLANKTON ASSOCIATIONS IN THE VICINITY OF DESOTO CANYON, NORTHEASTERN GULF OF MEXICO: NEW RECORDS FOR THE GULF OF MEXICO, J.A. Nienow, Valdosta State University, Valdosta, GA 31698. We are conducting a multi-year study of the phytoplankton in the vicinity of DeSoto Canyon with the primary goal of characterizing the structure of the association in space and time. So far, 13 cruises have been conducted along three transects extending from the panhandle of Florida,

with additional cruises planned at 3-month intervals. At each station 1-liter samples are collected at 20-25-m intervals to depths of up to 200 m. These are filtered onto 0.45 μm filters and examined with SEM to quantify the most abundant species. Net-plankton samples are collected at odd-numbered stations for analysis of larger forms. At this point we have documented the presence of 35 genera of haptophytes, 55 genera of diatoms and 6 genera of dinoflagellates. Included in these are representatives of the calcareous dinoflagellate genus *Thoracosphaera* Kamptner and the diatom genus *Nanoneis* Norris characterized by a single raphe slit per valve. In addition, we have observed what appears to be a previously unknown species of the chain-forming diatom genus *Fragilariopsis* Hustedt. The cells of the new species are linear, 80-100 μm long, 3-5 μm wide, inflated in the center and at the poles, with 20 striae in 10 μm . Tips of the valve are concave, giving it a bone-shaped appearance not previously seen in the genus. The lack of previous records of these distinctive forms highlights the state of our knowledge of the phytoplankton of the Gulf of Mexico.

FATE OF CAROTENOIDS CONSUMED BY *TRICHOPLUSIA NI* LARVAE**, Obadi Obadi* and E. Lampert, University of North Georgia, Oakwood, GA 30566. Plants provide a variety of resources to herbivores, including secondary metabolites that are not necessarily sources of energy or building blocks. Photosynthetic pigments such as carotenoids are available in most plants, and have important roles as antioxidants. We selected *Trichoplusia ni* (Lepidoptera), which are generalist herbivores as larvae, as a model to research the fate of plant carotenoids after consumption. Sixty larvae were reared briefly on carotenoid-free artificial diets before being randomly split into two groups of 30 and provided either kale or basil leaves as sources of carotenoids and other nutrients. Larvae were reared on leaves 15d, until the final instar, whereupon hemolymph was extracted and frozen at -80°C for further analysis. Continuing research will include isolation of carotenoids from hemolymph, and measurement of carotenoids in these samples using spectrophotometry. Carotenoid content will also be measured in both host plants, and the amounts presented in the plants will be compared to sequestration in *T. ni* hemolymph. Lastly, we will examine excreted frass for the presence of carotenoids. Our goal is to reveal the fate of these compounds, which have important roles in protecting animals from oxidative damage.

COMPARISON OF GROWTH AND DISPERSAL OF TWO CRAYFISHES IN A SMALL, HEADWATER STREAM**, Madison Perdue*, T. Haney*, H. Kudela*, A. Davenport* and J.G. Davis, Young Harris College, Young Harris, GA 30582. Life history characteristics of many crayfishes are poorly understudied. This study compares growth and dispersal of two crayfishes, *Cambarus bartoni*, a widespread, habitat generalist, with *Cambarus hiwasseeensis*, an endemic, habitat specialist in a few north Georgia streams. Growth was measured using three separate techniques: discriminant length-frequency analysis, holding cages, and recapture of tagged individuals. Crayfishes were collected in spring and fall 2012 and will be collected in early spring 2013 to construct length frequencies. Visual-implant elastomer (VIE) was used to tag crayfishes with unique, individualized marks to determine dispersal capabilities. Instream holding cages contained a male and female of similar-size of a species and were placed in either riffle or pool habitats for approximately 5 months. All crayfishes were captured using a mesh-seine or by hand collection. Initial results of a pilot study to evaluate tag retention show 100% retention of VIE tags. Additionally, *C. bartoni* is the dominant crayfish, being captured at a rate of 10 times *C. hiwasseeensis*. Ongoing research will hopefully result in recaptured crayfishes for further analysis of growth and dispersal. Results from this study will better define crayfish

life history, provide insight into various barriers that affecting dispersal, and potentially suggest why species such as *C. bartoni* dominate crayfish fauna in many streams.

CHARACTERIZATION OF THE *PEL* REGULATORY ELEMENT OF *PITX1* IN EMPETRICHTHYINE FISHES (GOODEIDAE)?: DNA SEQUENCE ANALYSIS, B.J. Przygoda* and S.A. Webb, University of North Georgia, Dahlonega, GA 30597. Common genetic mechanisms may explain pelvic girdle reduction in disparate vertebrate groups. Sticklebacks (Gasterosteidae, Teleostei) and manatees (Sirenia, Mammalia) have been shown to exhibit pelvic girdle reduction due to a deletion in an enhancer region (*pel*), which presumably binds transcription factors that up-regulate the *Pituitary homeobox transcription factor 1* (*Pitx1*) gene. In this study we continued investigation of pelvic reduction in empetrichthyine fishes (Goodeidae) by sequencing an approximately 800 bp region from *Crenichthys baileyi* and an approximately 300 bp region from *Empetrichthys latos* using standard molecular techniques. DNA sequences from these taxa were found to be highly dissimilar and are likely not homologous. Additionally, searches of these sequences (and subregions within) against public bioinformatics repositories returned no significant matches. These particular *C. baileyi* and *E. latos* sequences, unfortunately, do not contain the *pel* enhancer of *Pitx1*, however they most likely do correspond to noncoding nuclear DNA. Funding was provided by the North Georgia College & State University Department of Biology and School of Science and Health Professions.

PHYLOGENETIC RELATIONSHIPS OF VERTEBRATE RANAVIRUSES BASED ON THE MAJOR CAPSID PROTIEN NUCLEOTIDE SEQUENCE, Derek K. Pugh* and A.L.J. Duffus, Gordon State College, Barnesville, GA, 30204. Ranaviruses are emerging infections in ectothermic and poikilothermic vertebrates. Understanding their phylogenetic relationships is extremely important because many of these virus strains have loose host specificity, which means that one strain of the virus can affect multiple taxa of hosts. Combined with the fact that the disease caused by ranavirus infection can be quite severe and accompanied by a very high mortality rate, they pose a large threat to many species. Here we use the gene sequence of the major capsid protein (MCP) of 10 different ranaviruses isolated from different vertebrate species from around the globe to construct a Maximum-likelihood phylogenetic tree. The MCP sequences were gathered from the GenBank Database and all analyses performed in the software package MEGA. Interestingly, frog virus 3, the type species of ranaviruses, does not group with the rest of the ranaviruses. The tree reveals no host or geographical patterns in the groupings. Using phylogenetic trees to predict possible hosts for ranaviruses may be a useful tool, but requires further investigation.

STERILE MUTANTS OF THE MANGROVE KILLIFISH (*KRYPTOLEBIAS MARMORATUS*), Nicole R., Rutledge*, S. Sucar and B.C. Ring, Valdosta State University, Valdosta, GA 31698. *Kryptolebias marmoratus* is unique among vertebrates due a self-fertilizing mode of reproduction utilizing a mixed gonad, the ovotestis. To determine if genetics play a role in the development of the ovotestis, a recessive sterile screen across two generations (ENU mutagenesis; n=307 F2 fish) was performed. Sixteen sterile mutant fish were identified as exhibiting maternal effect (class I) or non-egg laying (class II) sterile phenotypes; representing seven potential alleles descended from 46 individual F1 founders (i.e. seven families). To confirm these mutations were heritable, an average of six F3 fish were raised from non-sterile F2 siblings across each family (n=284). 83 sterile fish were confirmed into the F3 generation as expected (p<0.05). All families exhibited class II phenotypes (non-egg layers) with penetrance strongest across 2 of the 7 alleles (n=24). Among the 3,139 F4 embryos scored from the remaining 59 F3 sterile

fish that laid eggs, 80% were non-viable indicative of strong maternal effects (class I) on early development from these sterile alleles. The remainder of the 201 F3 fish scored produced normal embryos as expected because they are either carriers of the sterile alleles or homozygous wild-type. The class I mutant phenotypes ranged from early cleavage stage to caudal-rostral defects leading to developmental arrest and are similar to those previously observed in maternal effect screens in the zebrafish model (*Danio rerio*). Continued characterization of the class II, non-egg layer mutants by histology, are predicted to uncover genes required for proper ovotestis development applicable to our better understanding of vertebrate gonadogenesis. This research was supported by NIH Grant # R15HD060017 from the Eunice Kennedy Shriver National Institute of Child Health & Human Development.

DNA BARCODING AT GORDON STATE COLLEGE: A COLLABORATIVE LABORATORY PROJECT BETWEEN TWO UNDERGRADUATE COURSES**, Tiffany Schluter*, J. Alexander*, J. Stephens*, E. Antakikam*, M. Babb*, C.A. Danderson and C. Lee, Gordon State College, Barnesville, GA 30204. To improve engagement of hands-on laboratory experiences in upper division biology and research classes, junior or senior biology majors that have enrolled in biotechnology and special research topic courses will participate in a hands-on laboratory research project involving the DNA barcoding of plant species from local grocery stores and the Gordon State College Walking Trail. In Fall 2012, we incorporated DNA barcoding as a part of biotechnology laboratory course, in which students mastered laboratory skills involved in DNA sequence analysis. Students currently enrolled in the biotechnology class who are eager to continue the DNA barcoding project have enrolled in a special research topics course in Spring 2013. In this course the students will isolate the genomic DNA and amplify chloroplast *rbcL* sequences by polymerase chain reaction (PCR). In addition, a couple of non-coding chloroplast DNA loci, as well as nuclear ribosomal DNA, such as the internal transcribed spacer regions of the 18S-26S DNA loci, will be explored in order to effectively delimit species relationships. DNA sequencing will be done by GeneWiz, and students will analyze the sequence data using either MEGA or DNA Subway software. Additionally, these sequences will be associated with collected and prepared voucher specimens housed in herbarium cabinets on campus.

DISTRIBUTION OF PLANKTONIC DIATOMS IN THE NORTHEASTERN GULF OF MEXICO**, A. Shultz*, C. Bryller*, J. E. Tillman, Jr.* and J.A. Nienow, Valdosta State University, Valdosta GA 31698. We are conducting a multi-year study of the phytoplankton associations in the vicinity of DeSoto Canyon with the primary goal of characterizing the structure of the association in space and time. This will improve our understanding of base-line conditions and allow for better assessments the impact of environmental disasters. Net plankton samples (25 μ m mesh, vertical tows of up to 100 m) are collected at one to three month intervals from five stations along three transects extending 50 miles from the panhandle of Florida. Samples are fixed in Lugol's iodine in the field and returned to the lab for further processing. A portion of each sample is digested with nitric acid, rinsed, then mounted in Naphrax for light microscopy. Both digested and undigested samples are then observed using a light microscope equipped with a digital camera. Each species in each sample is photographed and identified to species where possible using standard identification manuals for marine diatoms. Distinct associations of species will be identified using cluster analysis. This research is being conducted in conjunction with the Deep-C Consortium, a collaborative effort funded by the BP/Gulf of Mexico Research Initiative to better understand the impacts of oil spills such as the Deepwater Horizon disaster of 2010.

INVESTIGATION OF STREAM DISTURBANCE ON REPRODUCTIVE LIFE HISTORY TRAITS IN BLUEHEAD CHUBS, Kaleigh Sims*, L. Jenkins*, M. Daigle*, S. Merck*, D. Dehner-Aganovic and M. Davis, University of North Georgia, Dahlonega, GA 30597. Bluehead Chubs (*Nocomis leptoccephalus interocularis*, ACTINOPTERYGII: Cyprinidae) are common minnows in the Chattahoochee watershed. We investigated the potential effect of agricultural disturbance on ovary and egg mass in chubs in six low-order streams in northeast Georgia (Lumpkin County). Streams were categorized as either disturbed (subjected to apparent agricultural disturbance) or less disturbed (without apparent agricultural impact). Each stream was sampled three times during April-June 2012 using a backpack electrofisher. Specimens were measured (standard length), sexed, and gonadectomized. A subsample of ten eggs was obtained from each of 60 females with ripe ovaries. Egg subsamples and ovaries were dried at 40°C for 72 hours and weighed. Mean egg mass was not significantly different between disturbed and less disturbed sites ($t = 1.67$, $df = 58$, $P = 0.10$). Regression analysis showed a positive linear relationship between ovary mass and standard length in both disturbance types. ANCOVA (standard length as the covariate) revealed a significant effect of standard length ($F_{1,78} = 12.15$, $P = 0.001$) but no significant differences in gonad mass between disturbance types ($F_{1,78} = 0.62$, $P = 0.43$). Disturbance in these streams does not appear to significantly impact chub reproductive life history traits, perhaps reflecting a lack of plasticity or that the degree of disturbance was not severe enough to impact chub reproduction.

PHYLOGENETIC AFFINITIES OF PISCINE IRIDOVIRUS ISOLATES FROM AROUND THE GLOBE, Jennie N. Thaeter* and A.L.J Duffus, Gordon State College, Barnesville, GA 30204. Iridoviruses are a family of large double stranded DNA viruses that have the potential to cause great harm in both salt and fresh water fish. They are currently classified as emerging infections. They cause disease and death in the wild and in aquaculture facilities around the world. The whole genomes of eight different iridoviruses from Asia and one from North America were obtained from the GenBank database. They were aligned using the ClustalW algorithm in the software package MEGA. Maximum likelihood and Neighbor-joining phylogenetic trees were constructed with 1000 bootstrap replicates. All of the branches in both phylogenies are extremely well supported (100%). The relationships shown in both phylogenetic trees may indicate that these piscine iridoviruses have a recent common ancestor. Due to their close geographical locations and the branching patterns of the trees, it is likely that the differences in the isolates are due to host-specific adaptations and/or local adaptations. More research is required to determine the exact causes of the differences.

VIABILITY OF *RICKETTSIA PROWAZEKII* AFTER THE DEATH OF GAMMA INTERFERON-PRETREATED, INFECTED, MACROPHAGE-LIKE RAW264.7 CELLS, AND PROTECTION OF THE MACROPHAGES BY POLYETHYLENE GLYCOLS, Kathryn H. Vernon and J. Turco, Valdosta State University, Valdosta, GA 31698. *Rickettsia prowazekii*, the bacterial cause of epidemic typhus in humans, grows abundantly within the cytoplasm of untreated endothelial cells and untreated macrophages. When gamma interferon (IFN- γ)-pretreated, mouse macrophage-like RAW264.7 cell cultures are infected with *R. prowazekii*, however, many of the macrophages die within several hours after infection. The purpose of this research was to determine if the rickettsiae remain viable after the death of their IFN- γ -pretreated host cells and if polyethylene glycols (osmotic cell lysis inhibitors) would protect the macrophages. Viability of the rickettsiae was assessed by determining their ability to grow in untreated, Vero cell cultures. Rickettsiae released from broken, IFN- γ -pretreated macrophages (after cell death) grew well in Vero cells, and similarly to rickettsiae released from broken, untreated macrophages.

Thus, *R. prowazekii* remains viable after the death of the IFN- γ -pretreated RAW264.7 cells. Polyethylene glycols (PEGs) were added to the macrophages during and after infection at a concentration of 30 mM. PEGs of 2,000 and 4,000 daltons (average molecular weights) prevented macrophage death; whereas, PEGs of 1,450 and 400 daltons did not. These data suggest that osmotic lysis contributes to macrophage death.

DEEP SEA PLANKTON SAMPLING VIA CHEMICALLY POWERED APPARATUS**, T.F. West III*, J.A. Nienow and T. Manning, Valdosta State University, Valdosta, GA 31602. Freshwater and marine plankton are sources of study for many biologists. Marine plankton thrive in the water column of the sea and is a source of food for many fish and mammals. Samples must be retrieved from the water column for analysis in the laboratory. Current capture methods to retrieve samples of plankton utilize large nets. A new device will be designed to successfully retrieve plankton samples from extreme depths of one-thousand to fifteen-hundred feet. The preliminary design will consist of four PVC tubes with only the proximal ends sealed, aligned in a geometric diamond shape. Two of the tubes will have arms that extend outward that contain nets in the shape of a funnel that lead to a total of two collection tubes. On the distal end, a chemical engine is locked into place via the four PVC pipes. The chemical engine will consist of solid calcium metal surrounded by a wax polymer designed to tear away at desired depths. This exposes the calcium metal that reacts with the water by generating hydrogen bubbles which feed into the hollow PVC tube from the chemical engine. As the device ascends, the collecting nets will feed algae samples into the tubes and the entire device will be retrieved once it surfaces, located via a global GPS mounted onto the device. This device will be cost efficient, ecologically friendly and therefore will be filed for a patent. The apparatus will be a useful tool for further marine plankton research.

A SNAIL'S PACE: DENSITY, MOVEMENT, AND FOOD CHOICE OF THE MARSH PERIWINKLE, C.J. Young* and J.M. Reichmuth, Augusta State University, Augusta, GA 30904. Marsh periwinkles (*Littorina irrorata*) are an important food source for blue crabs and migrant birds, and are important in transfer of energy in the salt marsh food web. The purpose of this study is to measure movement of snails, record their density in the Fort Pulaski National Park and Hunting Island State Park salt marshes, examine the snail's preferred food source, and determine how snails affect the salt marsh. To measure the movement of snails, the mark and recapture technique was used. The density of snails was measured by counting and recording the number of snails along a line transect. An artificial salt marsh microcosm was created in the lab containing labeled snails and two food choices, *Salicornia spp.* and *Spartina alterniflora*, to monitor which plant the snails favor. The effects of snails on the salt marshes were determined by looking for an increase or decrease of *Spartina* found on the salt flats. Recent literature has suggested the periwinkle snails do not move farther than two meters from an origin. However, our data suggest the snails move much farther than the two-meter radius. Our data have also shown that the density of snails seems to be determined by the health and density of the *Spartina* and, furthermore, that *Spartina* is a preferred food choice compared to the *Salicornia*. The effects of the snails on the *Spartina* have yet to be determined. This project was funded by Augusta State's Center of Undergraduate Research & Scholarship and Pamplin Student Research Fund.

THE EFFECTS OF MEGACOPTA CRIBRARIA AND NITROGEN FIXING RHIZOBIUM ON SOYBEAN PHYTOCHEMISTRY**, Anne O. Zimmerman* and C.B. Zehnder, Georgia College & State University, Milledgeville, GA 31061. *Megacopta cribraria*, commonly known as the lablab or kudzu bug, is an invasive pest to many economically

important legumes in the Southeastern United States including *Glycine max* (soybeans). Legumes have a mutualistic relationship in their roots with nitrogen fixing bacteria called rhizobium which may be affected by above ground herbivory. The purpose of this research was to determine the effects of *M. cribraria* and rhizobium on soybean phytochemistry. First, half of the soybean seedlings were inoculated with *Bradyrhizobium jaboricum* rhizobium, and then half of the inoculated and half of the uninoculated plants were exposed to herbivory from five adult *M. cribraria*. After 72 hours of herbivory, the first pair of true leaves was collected. One was used for nitrogen analysis and the other was used for phytochemical assays including trypsin inhibitor and chitinase concentrations. The root nodules were counted before the roots were dried and weighed for below ground biomass. Results are forthcoming.

Section II: Chemistry
Bailey Science Center, Room 1024
Zewdu Gebeyehu, Presiding

8:15 THE COPPER (II) ION AS A DELIVERY AGENT FOR MEDICINAL AGENTS, Melody Sobhani, John Milam, Iris Rivera, Rachel Robertson, Satilla B. Johns, Haley Franklin and Thomas Manning, Chemistry Department, Valdosta State University, Valdosta, GA 31698. An expanding area of medicinal chemistry is the efficient delivery of medicinal agents. Systems that have been well studied include nanoparticles, micelles, liposome's and proteins. Our approach is focused on amine containing drugs. Using computational methods we have modeled approximately one hundred and fifty drugs from the World Health Organizations List of Essential medicines and an additional one hundred known cancer drugs. Copper(II), a hexavalent species has a strong preference for amines. Multiple drugs can be attached to a single cation, increasing water solubility, stability and allowing the drugs to arrive at the diseased area simultaneously. Almost a dozen new compounds have been synthesized using this approach. New cancer drugs from our group have been accepted by the National Cancer Institute and have demonstrated highly competitive GI50 values. Likewise, new antibiotics developed in our lab have been accepted and tested by the Infectious Diseases section of NIH and have tested very well (MIC values) against microbes associated with Tb. In addition the presentation will review structural studies including LC-MS, UV/Vis, 1 and 2D NMR, LC-MS, MALDI-TOF-MS and FT-ICR.

8:30 MULTIVARIATE ANALYSIS OF DRY POWDER MIXTURES OF ACETYLSALICYLIC ACID AND SALICYCLIC ACID USING FTIR-ATR AND MICROSOFT EXCEL**, C. A. Swanson*, E. R. Heilig* and M. C. Koether, Kennesaw State University, Kennesaw, GA 30144. This project was an attempt to bring chemometric techniques as applied to complex spectra using dry samples and common widely used software (Microsoft Excel) into the undergraduate laboratory. Ground samples of *acetylsalicylic acid* and *salicylic acid* were analyzed using Fourier Transform Infrared Spectra between the wavelengths of 2500-4000 cm^{-1} . A calibration set was created in batches of ~2 grams with respect to mass percent using a composition sequence of 0, 20, 40, 60, and 80 percent of pure *salicylic acid*. The powders were mixed for over 8 hours with an improvised method using horizontal stir plates. The spectra and calibration matrix were put into Microsoft Excel and the calculations were set manually. After the calculations were computed correctly, macros were developed within Microsoft Excel to automatically re-adjust the calculations for each new set of spectra. The original spectra, first derivatives, and second derivatives of the calibration spectra were analyzed using this method. Each

calculation for the second derivative spectra utilizing the data from 2500-3500 cm^{-1} were less than 20% error from known values. Validation sets have yet to be run.

8:45 REDUCTION OF HEXAVALENT CHROMIUM BY COFFEE, B. Garduno^{1*} and D. Kim^{2*}. School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA 30043 and ²Lambert High School, Suwanee, GA 30024. Hexavalent *chromium* [Cr(VI)] can be found in a variety of compounds that are commercially utilized. Unfortunately, it has been found that it can pose a threat to human health because it is considered as a carcinogen. In this research, coffee was introduced as a reducing agent to study the potential application for Cr(VI) contaminated water remediation process. Various amounts of coffee were introduced to 20 mg/liter hexavalent chromium solution and the rate of Cr(VI) reduction was determined. The concentration of Cr(VI) was determined using diphenylcarbazide colorimetric method at a wavelength of 540nm. Experimental results showed that the hexavalent *chromium* can be removed from the solution by both adsorption and reduction processes indicating that the coffee can be an effective alternative reducing agent for the remediation of hexavalent chromium contaminated resources.

9:00 APPLICATION OF GREEN TEA FOR HEXAVALENT CHROMIUM REDUCTION, C. Huynh* and C. Kim, School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA 30043. Green tea is one of the most consumable drinks in the world and it is well known for the great resource of antioxidant. In this research, antioxidant capacity of green tea was determined and its reducing strength was applied to reduce toxic hexavalent *chromium*. The antioxidant capacity of the prepared teas and the dissolved amounts of hexavalent *chromium* were determined using the trolox equivalent antioxidant capacity (TEAC) assay and *diphenylcarbazide* colorimetric method, respectively. The results showed that the dissolved antioxidants from the green tea was strong enough to reduce hexavalent *chromium* and it could be a potential non-toxic environmentally friendly reducing agent for the remediation of Cr(VI) contaminated wastewaters.

9:15 **Break**

9:30 SYNTHESIS OF ACETYLENE CONTAINING PORPHYRINS**, A.K. Epps^{1,2}, E. Tavasoli^{1,3}, J. Vela^{1,3} and G. Mandouma², ¹Ames Laboratory, Ames, IA 50011, ²Department of Natural Sciences, Albany State University, Albany, GA 31705 and ³Department of Chemistry, Iowa State University, Ames, IA 50011. Nanocrystals are at the core of biotechnological methods used in modern medicine and renewable energy. Nanocrystals are molecular-sized solids formed with a repeating, 3D pattern of atoms with an equal distance between each part. Nanocrystals are known to benefit from their size, intense absorption, and good solubility useful in organic fluorescent dyes, cell imaging, solar energy storage, catalytic technologies, or even optical electronics due to their ability to change the wavelength of light. We investigated a fundamentally new procedure for surface modifications by direct synthesis, allowing control of the degree of functionalization while maintaining the nanocrystal's original photo stability. *Porphyrim* syntheses were done in a three steps: synthesis of the *nitrophenyl triphenylporphyrin* from *pyrrole*, *nitrobenzaldehyde* or *benzaldehyde*. The *nitroporphyrin* was reduced using *tin chloride*. The final goal was condensation of the amine with an acetylene containing acid. The overall goal would be controlling the valency of the quantum dots surface using UV/VIS.

9:45 SYNTHESIS AND CHARACTERIZATION OF THE SULFA DRUG 4-AMINO-*N-P*-TOLYL BENZENESULFONAMIDE FOR POTENTIAL USE AS AN INEXPENSIVE ANTIBIOTIC**, S.D. McBain*¹, C. Appling*² and D.P. Pursell¹, ¹Georgia Gwinnett College, Lawrenceville, GA 30043 and ²Gwinnett School of Math, Science, and Technology, Lawrenceville, GA, 30044. We completed the multi-step synthesis and characterization of 4-amino-*N-p*-tolylbenzenesulfonamide from aniline using a variety of reaction scales and reaction conditions. Melting point, FT-IR, GC-MS, and ¹H NMR data indicate good purity and overall yield. This presentation will report the synthetic route and characterization results, as well as the initial testing of the antibiotic usefulness of the sulfonamide drug.

10:00 Section Business Meeting

POSTERS

SYNTHESIS AND CHARACTERIZATION OF NANOPARTICLES CONTAINING CONFINED POLYSTYRENE**, M.B. Blackmon* and D.W. Holley, Columbus State University, Columbus, GA 31907. Previous studies suggest that when polymers are placed under conditions of confinement (where the dimensions of the space are smaller than the radius of gyration of the polymer in the melt) they exhibit different physical properties than polymers not under confinement, particularly a lower glass transition temperature. In order to synthesize nanoparticles containing confined linear polystyrene, we will be using an approach involving sequential addition of styrene to a solution containing water and a surfactant. We will polymerize the micelles that result to produce linear polystyrene and encapsulate this polystyrene with a shell of crosslinked polymer consisting of divinylbenzene. The particles that result will be characterized with regard to molecular weight, polydispersity and size by the use of viscometry and gel-permeation chromatography. The glass transition temperature of the particles will be characterized by differential scanning calorimetry. We would like to acknowledge Columbus State University for the funds used to pursue this research.

ALTERNATIVE INSTRUMENTATION FOR THE DISSOLUTION OF TOPICAL OINTMENTS, A. C. Smith, Kennesaw State University, Kennesaw, GA 30144. Standardized dissolution testing is an important in vitro process to ensure consistency in bioavailability of the active pharmaceutical ingredient in the post formulation of new drug products. Instruments are specifically tailored to meet these demands and can cost thousands of dollars. To bring the concept of dissolution testing to the classroom, it would be beneficial to lower the cost by substituting a less expensive instrument in place of the industrial grade instrument. Rate of release of the active pharmaceutical ingredient of zinc in topical anti-itch ointments was studied via dissolution testing in the Hanson Vision Classic 6 instrument compared to a method using the less expensive Phipps & Bird jar tester. The latter had an average of 34.4% dissolved Zinc from approximately 0.4 g Caladryl Clear ointment at 37.0°C when taken at sixty minutes. Using a beaker and the Phipps & Bird jar tester at 50 RPM and 75 RPM was 29.2% and 36.2% dissolved, respectively. However, the effect of temperature on solubility was taken into consideration, as the jar tester has no temperature control mechanism. At a room temperature of 25°C, the Hanson Vision Classic 6 returned a rate of 22.5% while the Phipps & Bird jar tester returned a rate of 22.8%, indicating similar results for both instruments.

FABRICATION OF POLYMERIZED COLLOIDAL CRYSTAL ARRAY THIN FILM FOR CHEMICAL NERVE AGENTS DETECTION**, M. P. N. Bui and S. S. Seo, Albany State University, Albany, GA 31705. Synthetic chemical nerve agents or organophosphorous compounds such as *demeton-S*, *parathion* and *paraoxon-ethyl*, are widely used in agricultural as pesticides in the US and worldwide. As a result of the high toxicity and the important for national security, fast, effective, and more-compact low-cost instruments to detect chemical nerve agents in the environment and public place are needed. In this study, we fabricated a polymerized colloidal crystal array (PCCA) thin film of *polystyrene* (PS) particles with modified capping agents for detection of chemical nerve agent. Our photonic crystal hydrogel materials contain mesoscopically periodic arrays of colloidal particles that self-assemble into highly ordered crystalline colloidal arrays (CCA) with lattice spacing that Bragg diffract visible light. The structure of PCCA thin film, and the effect of monomer ratio, pH, and solvent media have been investigated. Several capping agents have been used to modify PCCA thin films and applied for the detection of *phosphorous* compounds using optical diffraction measurement.

TOWARDS NOVEL SHAPE-PERSISTENT BENZO[C]CINNOLINE-ETHYNYLENE MACROCYCLES**, C. A. Brown and G. R. Mandouma, Albany State University, Albany, GA 31705. A novel *shape-persistent macrocycle* based on *benzo[c]cinnoline* and *acetylene* units has been envisaged as the host molecule in our attempt to build candidates for sensors and molecular electronics. This system is analogous to *oligophenyleneethylenes* (OPEs) which have been used extensively in molecular electronics. To build the proposed *oligobenzo[c]cinnoline-ethynylene*, a three steps synthesis is being implemented, starting from *1,4-dichloro-2-nitrobenzene*. First, a tandem Ullmann coupling – reductive diazotization afforded *2,9-dichlorobenzo[c]cinnoline* in high yield. Then, a Katz-modified Sonogashira coupling gave us access to *2,9-diethynylbenzo[c]cinnoline* monomer. Trimerization of the latter will be accomplished through the time-honored Glaser coupling to afford the macrocyclic structure. The supramolecular chemistry of such system is of interest with regards to the possibility of fine-tuning its different properties such as conductance, sensing, and fluorescence.

SYNTHESIS AND CHARACTERIZATION OF LANTHANIDE (III)-CARBOXYLATE COMPLEXES**, C. E Milliron III*, Z. Gebeyehu and R. Dabke, Columbus State University, Columbus, GA 31907. Complexes of *lanthanide (III)* ions are of much interest because of their luminescence properties. The luminescence intensity of these metal ions can be enhanced by chelating the metal ions to organic antenna chromophores that are capable of absorbing intensely in the UV region and transfer the energy to the metal ion. In this study, aromatic *carboxylate* ligands that possess large conjugated systems were used to synthesize the *lanthanide* ion complexes. The metal complexes were synthesized by the reaction of $MCl_3 \cdot 6H_2O$ ($M = Sm, Nd, Tb$) with *2, 2'-biquinoline-4-4'-dicarboxylic acid dipotassium salt* ($K_2[C_{20}H_{12}N_2O_4]$), *Hydroquinone Sulfonic acid potassium salt* ($C_6H_5KO_3S$), and *2-Hydroxybenzo-[a]carbazole-3-carboxylic acid sodium salt* ($C_{17}H_{10}NNaO_3$) in different solvents. The reactions resulted in the formation of yellow, white, and brown powders in high yields. The products were characterized by IR- spectroscopy and elemental analysis and were tested for solubility. The preliminary results suggested the formation of the expected complexes: $Sm_2[C_{20}H_{12}N_2O_4]_3$, $Sm[C_6H_5O_3S]_3$, $Sm[C_{17}H_{10}NO_3]_3$, $Nd_2[C_{20}H_{12}N_2O_4]_3$, and $Tb_2[C_{20}H_{12}N_2O_4]_3$. Our future work will be studying the solubility of the products in different organic solvents, UV-Vis, Fluorescence, electrochemical property studies and NMR spectroscopic characterizations of all the complexes. Authors acknowledge the support from Student Research and Creative Endeavors Grants that is provided by the Office of the Provost, Columbus State University.

DISSOLUTION TESTING: ASSESSMENT OF POSSIBLE ALTERNATIVE METHODS AND INSTRUMENTATION FOR DISSOLUTION TESTING OF ASPIRIN TABLETS, E.R. Heilig*, C.A. Swanson* and M.C. Koether, Kennesaw State University, Kennesaw, GA 30144. The experiment explores possible experiments and/or methods to be performed for educational purposes that can be used as a substitution for more expensive instruments most commonly used when following USP guidelines. The Hanson Vision Classic 6, one of the more expensive dissolution testers was used as a basis of comparison with three other instruments/methods. Two of these used the Phipps&Bird PB-700; one used the vessels belonging to the instruments, while the other substituted 1000mL beakers in their place. The third was a method incorporating the use of stir plates, stir bars, and 1000mL beakers. Rite Aid Brand Pain Relief Aspirin Tablets (325 mg) were used for analysis. Overall results and data support the possibility of using the PB-700 with the 1000 mL beakers in lieu of the Hanson Vision Classic 6, especially in cases of monetary concerns or inaccessibility. More tests conducted with both the Hanson Vision Classic 6 and the PB-700 (with beakers) would need to be performed in order to truly decide comparability.

CHARACTERIZATION OF THE PHYSICO-CHEMICAL PROPERTIES OF THE HARENNA FOREST HONEY IN BALE, ETHIOPIA, A. Belay¹, S. Worku², G. Bultossa³, N. Adgaba⁴ and S.M. Abegaz^{5*}, ¹School of Agriculture, Adama Science and Technology University, Ethiopia, ²University of Swaziland, Faculty of Agriculture, Department of Consumer Sciences, ³Department of Food Science and Postharvest Technology, Haramaya University, Ethiopia, ⁴Bee Research College of Food Science and Agriculture, King Saud University and ^{5*}Columbus State University, Department of Chemistry, Columbus, GA 31907, U.S.A. Two representative sites (Chiri and Waberro) were selected using random sampling techniques and 16 honey samples were collected to characterize the physicochemical properties of the Harenna forest honey in Bale, Ethiopia. The honey moisture, reducing sugar, sucrose, water insoluble solids, ash, free acid, *hydroxymethylfurfural* contents, electrical conductivity and specific rotation were found to be 17.89 ± 1.02 g 100g⁻¹, 69.48 ± 1.72 g 100g⁻¹, 2.43 ± 1.02 g 100g⁻¹, 0.12 ± 0.08 g 100g⁻¹, 0.19 ± 0.09 g 100⁻¹, 34.57 ± 4.80 meq kg⁻¹, 0.84 ± 0.46 mg 1000g⁻¹, 0.70 ± 0.04 mS cm⁻¹ and -132 ± 15.27 [α]_D²⁰, respectively. All quality indicators analyzed were within the criteria set by the California, European and Ethiopian standards, except for water insoluble solids. This study revealed that the traditional hive has no negative effect on the quality of honey produced if honey harvesting, handling and processing is properly carried out.

OPTIMIZATION OF CO₂ ADSORPTION COMPOSITE MATERIALS FOR CARBON CAPTURE AND SEQUESTRATION TECHNOLOGIES, B. Hasanovic*, A. Gunter*, C. Kim and S.H. Park, School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA 30043. Carbon capture and sequestration (CCS) technologies are needed to resolve massive carbon dioxide (CO₂) emissions from coal power plants to mitigate global climate change. We investigated CO₂ separation technologies based on Pressure Swing Adsorption (PSA) using composites of solid sorbents. Composite materials for CO₂ adsorption were made using sodium hydroxide coated silica, amine-tethered solid and lithium zirconate. Laboratory scale experiments were conducted to compare reaction kinetics of the composite adsorbent materials and pure magnesium silicate (olivine). Based on the CO₂ concentration changes along sorption time, kinetics models were obtained from the reactions between CO₂ and the adsorbents in the presence/absence of water vapor for the application of CCS technology to power plants emitting gas mixture containing water vapor. While water vapor generally increases the adsorbents' adsorption capacity up to certain water vapor concentration level and starts decreasing after

the point, the composite adsorbent materials show complex behavior depending on the amounts of each component in the composite, initial CO₂ concentration, and operating temperature. The research is being conducted to optimize the operating conditions and component percentage of the composites to maximize the CO₂ capture capacity of the CO₂ adsorbent.

CATALYST- AND SOLVENT-FREE HIGH YIELDING ULLMANN'S COUPLING REACTIONS, D. Mitchell* and G. Mandouma, Department of Natural Sciences, Albany State University, Albany, GA 31705. Results of several examples of catalyst-free and solventless Ullmann's coupling reactions using high speed ball milling conditions are reported. Biaryl synthesis, an important tool in medicinal chemistry, has been achieved by various synthetic methods including Ullmann's coupling of *chlorinated nitroaromatics*. The latter makes extensive use of *copper* and high boiling solvents to be effective. The use of high speed ball milling method permitted to circumvent both added catalyst and elevated temperatures. High yields of biaryls were associated with reactions conducted in a custom-made *copper* vial as source of catalyst, together with a *copper* ball. Coupling, under these conditions, were performed with simple and complex *nitroaromatic* systems such as *polychlorinated nitrobenzenes*, *nitrobenzo[c]cinnolines*, and *dinitrobiphenyls*.

THE ANALYSIS OF THE RELEASE RATE OF SALICYLIC ACID IN LIQUID STOMACH RELIEF SUSPENSIONS, A.S. Durden*, Kennesaw State University, Kennesaw, GA 30144. *Bismuth subsalicylate* is the active ingredient in stomach relief suspensions, like original Pepto-Bismol. *Salicylic acid* is a byproduct of the reaction of *bismuth subsalicylate* with gastrointestinal juices in the digestive tract. *Salicylic acid* is also an active ingredient in stomach relief suspensions that was included in the total concentration of *salicylic acid* released from the stomach relief suspensions. Six samples of approximately 1ml of liquid Pepto-Bismol were dispensed into 900 mL of degassed deionized water or 0.1 M HCl at 37°C. At 10 and 60 minutes, samples were extracted from the dissolution and filtered for analysis. The percent recovered of *salicylic acid* from the solution was greater using the 0.1M HCl than using DI water. The release of *salicylic acid* from the suspension occurred at a faster rate at 50 RPM than at 100 RPM. The same method was used to analyze the release rate of Leader Brand and Life liquid stomach relief suspension. A greater amount of *salicylic acid* was released from the dissolution of Leader in 0.1 M HCl than in water at both RPMs. But the release rate from Leader was not as quick and consistent as with Pepto-Bismol. More dissolution test was done with Leader and Life brand to test for consistency. After conducting several trials of Leader and Life dissolutions in DI water at 50 RPM, the suspensions rapidly released *salicylic acid* consistently. It was concluded that release rate of *salicylic acid* from Leader and Life brand are consistent like the name brand suspension Pepto-Bismol.

EXPLORING ORGANIC ACID CHLORIDES AS SUPERHYDROPHOBIC COATINGS, Xiaomei Zheng, Courtney Seay, Kwaichow Chan, Liqiu Zheng and Louise Wrenford, Albany State University, Albany, GA 31705. Super-hydrophobicity has been an important research topic in the past decade because of its potential in commercial applications. In this research, surface of metal plates, e.g. iron, has been treated with *Copper* (II) solution via redox process, followed by a hydrophobic coating to achieve superhydrophobicity. Factors affecting superhydrophobicity being investigated include the concentration of organic coating solutions, galvanic deposition time of *Copper*, and the length of carbon chain of the organic acid chlorides used as an outer protecting coating. The effect of hydrophobicity was then determined by the contact angle of water droplets resting on the treated iron plates. The higher the contact angles the better is the hydro-

phobicity. At angle $> 150^\circ$, the surface becomes superhydrophobic. We discovered the organic coating *dodecanoyl chloride* created the best superhydrophobic plates as compared to those of lower carbon-chain *acid chlorides* in the same class. The best contact angle measured was 154° . Other organic coating processes produced apparent superhydrophobicity, but fail to meet the criteria. This concludes that the organic compounds with longest carbon chains in the tested compounds produce the best superhydrophobic coatings.

Section III: Earth & Atmospheric Sciences
Bailey Science Center, Room 1023
Alfred J. Mead, Presiding

8:00 DEVELOPING A CLASSIFICATION SCHEME AND DIGITIZING PROTOCOL FOR ARTIFICIAL FEATURES ALONG ESTUARINE SHORELINES IN SOUTH CAROLINA**, Albert S. Killingsworth*¹, A.R. Middleton*² and C.W. Jackson^{1,3}, ¹Department of Geology and Geography, Georgia Southern University, Statesboro, GA 30460-8149, ²Jiann-Ping Hsu College of Public Health, Georgia Southern University, Statesboro, GA 30460-8149 and ³Applied Coastal Research Lab, Georgia Southern University, Savannah, GA 31411. Estuarine shorelines are mobile coastal features that often impact populated upland areas and adjacent structures due to chronic erosion. Shoreline armoring is often used to protect property and other structures such as docks, piers, and bridges from further erosion. Many studies have conducted mapping of these stabilized structures using head-up digitization in ArcGIS with aerial imagery. Recently, a project was conducted in the South Carolina Low Country to map historical estuarine shorelines and calculate erosion and accretion rates using AMBUR. Additionally, artificial shoreline features were mapped along both upland and tidal channel shorelines in order to determine which structures are most vulnerable to shoreline erosion. In order to facilitate the analyses, a new classification scheme was devised by developing a modified hierarchical system from existing schemes in North and South Carolina. This new system catalogues hard structures in a way that is more flexible and expandable to accommodate new or previously unmapped structure types and facilitates GIS-based querying and analysis within AMBUR. Within the GIS, features are attributed by classification type, date of imagery, and quality of imagery used. Features are represented either as polygons, polylines, or points depending on what is most applicable for analysis with shoreline change data in AMBUR. Structures like bulkheads and revetments are shown best as polylines, while docks and bridges are displayed as polygons. A primary goal of the mapping phase of the project is to provide a technique that is repeatable and expandable to include a variety of artificial shoreline features found world-wide. Ultimately, using historical imagery datasets, the study aims to provide historical rates of shoreline armoring of these artificial features.

8:15 ASSESSING VULNERABILITY OF ARTIFICIAL STRUCTURES ALONG ESTUARINE SHORELINES IN SOUTH CAROLINA**, Adam R. Middleton*¹, A.S. Killingsworth*² and C.W. Jackson^{2,3}, ¹Jiann-Ping Hsu College of Public Health, Georgia Southern University Statesboro, GA 30460-8149, ²Department of Geology and Geography, Georgia Southern University, Statesboro, GA 30460-8149 and ³Applied Coastal Research Lab, Georgia Southern University, Savannah, GA 31411. Estuarine shorelines are found within mobile coastal environments that change both spatially and temporally in response to processes such as seasonal wave climate, impacts of large storms such as hurricanes, and sea level change. With increasing development and armoring along

estuarine/upland shorelines, rates of coastal erosion can often increase and become exacerbated by anthropogenic activities in addition to natural processes. The estuarine shoreline in the Lowcountry of South Carolina has seen an increase in residential and commercial development that will continue to rise in the future. This means that there will be a continual rise in the number of people living on and near these active shorelines in South Carolina. An increasing number of artificial structures like docks, bridges, and causeways will continue to be built to meet the demands of the area. The integrity of some of these structures along with the structures that have already been there for years may be compromised due to erosion. In order to reduce the risk of injury or harm, identification of these structures is important. The current project incorporates geographic information systems (GIS) and remote sensing techniques with aspects of public health and environmental justice to assess the vulnerability of these structures. Historic shorelines were derived from various aerial photography and rates of erosion were calculated using AMBUR. Structures in the study area were also identified, digitized, and classified using a new classification scheme developed in an earlier phase of the project. By overlaying the rates of erosion and accretion with the shoreline structures shapefile, structures that are at risk of deterioration can be identified.

8:30 WATER QUALITY AT THREE BLACKWATER STREAM SITES, SOUTH GEORGIA, C.R. Nimmo* and D.M. Thieme, Valdosta State University, Valdosta, GA 31698. Water quality conditions are reported for three blackwater streams in the central region of South Georgia based upon measurements from September to December, 2012. Data collected on a weekly basis included air and water temperatures, pH levels, dissolved oxygen, and electrical conductivity. The Winkler method using sodium thiosulfate titration was used for dissolved oxygen, and all of the measurements followed the procedures of the Georgia "Adopt-a-Stream" program. The three locations were on the Withlacoochee River, Okapilco Creek, and Piscola Creek, all of which are in Brooks County. While the Withlacoochee River can be considered "unimpaired" at this location, the two creeks are examples of "impaired" streams mostly as a result of agricultural runoff. Results show consistently lower dissolved oxygen, pH, and electrical conductivity for the impaired locations in spite of fluctuations with rainfall and temperature during period of study.

8:45 EFFICACY OF FILTRATION METHODS TO REMOVE CONTAMINANTS IN DRINKING WATER AND CONTAMINANT TRANSPORT IN GROUNDWATER AQUIFERS**, Alicia Estabrook and Samuel Mutiti, Georgia College & State University, Milledgeville, GA 31061. Despite all the technological advancement and progress made over the decades, contaminated drinking water remains a source of health problems in the world. In some places recontamination of municipally treated water can also occur after leaving the treatment plant and potentially cause health problems. As a result, at-home treatment of drinking water right before consumption is becoming the order of the day. This study compares three treatment methods for the removal of heavy metals, chlorine, microorganisms, and nanoparticles. The effectiveness of three commercial water filters, and four sediment columns to remove contaminants was assessed. Bacteria disinfection at five different temperatures was also investigated. This study also investigates contaminant transport in groundwater using different groundwater models. The models represented sand, gravel, clay, confined and unconfined aquifers. Preliminary results show that the three activated commercial filters were somewhat successful in reducing their target contaminants but not all contaminants of concern were removed. Heating water to a temperature of at least 60°C is effective in deactivating bacteria, but may not necessarily be true for other microorganisms. Knowledge of what treatment

method works best for particular contaminants is useful in determining which filter to use in any given area/situation.

9:00 GEOCHEMICAL EVOLUTION OF GROUND AND SURFACE WATER THROUGH A WETLAND SYSTEM**, Jenna B. Flitcroft*, C. Mutiti and S. Mutiti, Biological and Environmental Sciences, Georgia College, Milledgeville, GA 31061. Wetlands that are adjacent and/or connected to streams are very important in maintaining stream water quality. Such wetlands are particularly important when they serve as headwaters of streams and rivers. This study seeks to understand the geochemical evolution of water as it moves through an elongated wetland system in Milledgeville, GA. The wetland boundary was delineated using a combination of field observations and remote sensing. Water samples were collected at various locations along the surface water flow path within the wetland, the adjoining lake, and the stream emanating from the lake. Piezometers were installed to sample groundwater and quantify its contribution to the wetland. Phosphate levels were generally higher than what is typical of this region. However, phosphate, pH, and iron concentrations decreased downstream while nitrate and nitrite concentrations increased. The water, as expected, became more oxygenated downstream. Iron concentrations were lower than the average for surface waters. The wetland also harbors a sizeable amount of obligate and facultative wetland plant species. Over 100 unique plant species including woody trees and shrubs, grasses, sedges, rushes and other herbaceous plants have been collected. The spatial distribution and connectedness of the plants, animals and geochemistry is being investigated.

9:15 STRATIGRAPHY OF LATE EOCENE SEDIMENTARY UNITS IN BALDWIN COUNTY**, Lori Berry*, Alfred J. Mead and Samuel M. Mutiti, Georgia College & State University, Milledgeville, GA 31061. Baldwin County, Georgia is bisected by the Fall Line of Georgia with surface exposures of igneous and metamorphic bedrock of the Piedmont to the north and Cenozoic sediments of the Coastal Plain to the south. These Coastal Plain sedimentary units are late Eocene in age and locally overlie the Piedmont bedrock. Historically, these beds have been identified as either the Barnwell Formation, Upper Sand Member of the Barnwell Formation or the Cooper Marl. Most recent classification of the beds has elevated the unit to the Tobacco Road Sand Formation and is recognized as a time equivalent of the Ocmulgee Formation to the west-southwest. Since these deposits lie north of the Georgia kaolin belt, extensive analysis of the Fall Line sedimentary units is lacking. Some geologic maps simply show the Baldwin County deposits as undifferentiated Cretaceous through recent sands and gravels. Tobacco Road Sand exposures in Baldwin County are characterized by a series of cut and fill fluvial channels with Piedmont derived gravels and locally derived clasts of kaolin. The purpose of this study is to create an elevation map for the exposed units, explore the varied sedimentology of this unit and utilize ArcGIS to display the attributes of these beds.

9:30 A PRELIMINARY ANALYSIS OF MARINE MACROFOSSILS FROM EOCENE LIMESTONE IN JONES COUNTY, GEORGIA**, Shane J. Benton* and Alfred J. Mead, Georgia College & State University, Milledgeville, GA 31061. Eocene-aged limestone deposits across central Georgia have been identified as Ocala Limestone, Tivola Limestone, Utley Limestone or Sandersville Limestone. Correlation of limestone outcrops has been hampered by a lack of exposure and locally severe weathering. In the present study, an abundance of macrofossils has been collected from two exposed limestone deposits in Jones County, Georgia. These exposures are variably weathered and exhibit silica replacement. Although a regional geologic map indicates the presence of Barnwell Group sediments in the area of these outcrops, the most likely stratigraphic affiliation is

with the Tivola Limestone, a northeast trending tongue of the Ocala Limestone Group. While the Tivola Limestone is known to occur in Bibb, Twiggs and Wilkinson Counties to the south-southeast, it is not known to occur in Jones County. Macrofossils and bulk sediments were collected from both localities. Bulk sediments were screen washed through U.S. Standard Sieve Series 5, 16, 20, 35 and 230 screens. Concentrate was examined for the presence of fossil material using a Meiji Dissecting Microscope. Initial analysis indicates the presence of one vertebrate and approximately 20 invertebrate taxa.

9:45 TOOTH AGE AND GROWTH RATE IN THE MOSASAUR *TYLOSaurus PRORIGER*** , Zachary T. Ansley*¹, K.M. Smith¹ and M.D. D'Emic², ¹Georgia Southern University, Statesboro, GA, 30458 and ²State University of New York at Stony Brook, Stony Brook, NY, 11794. *Tylosaurus proriger* is one of the largest mosasaurs (REPTILIA: SQUAMATA), an extinct group of marine reptiles that lived during the Late Cretaceous period. Mosasaurs, like most other reptiles, constantly replaced their teeth throughout life. The purpose of the study is to document tooth growth rate in *T. proriger* and to compare this rate to other mosasaurs in order to obtain a better understanding of tooth formation time across the family Mosasauridae. The subject of this study is a near-complete *T. proriger* specimen from the Campanian Pierre Shale Formation, South Dakota, mounted in the Georgia Southern Museum (Statesboro, GA). To obtain tooth formation time, daily lines of dentin deposition (incremental lines of von Ebner) will be counted on a thin section of a maxillary tooth of *T. proriger*. Tooth growth rate (in mm/day) will be calculated by dividing tooth height by formation time. This growth rate can be used as a proxy for determining the growth rate of teeth of other mosasaurs without destructively sampling, provided tooth growth rate is found to be similar across mosasaurs. Obtaining tooth growth rates of many mosasaurs contributes to the study of their feeding ecology and evolution.

10:00 Section Business Meeting

POSTERS

BIOGEOGRAPHY AND STABLE ISOTOPE ECOLOGY OF AMERICAN MASTODONS (*MAMMUT AMERICANUM*) FROM THE ATLANTIC COASTAL PLAIN: EVIDENCE FROM A NEW MASTODON FROM NORTH CHARLESTON, SOUTH CAROLINA** , C.M. Brussell*¹, K.M. Smith¹, F. Rich¹ and K.M. Brown², ¹Georgia Southern University, Statesboro, GA 30460 and ²College of Charleston, Charleston, SC 29424. American mastodons (*Mammuth americanum*) have been recovered from late Pleistocene (Rancholabrean) sediments across North America, with numerous occurrences in the southeast. Stable isotope analysis of tooth dentin and enamel from this species has produced a substantial amount of data on the ecology of Floridian mastodons, but less is known about the ecology of mastodons in South Carolina and Georgia. The compositions of Rancholabrean fauna in South Carolina, Georgia, and Florida are similar, so it is likely that environmental conditions during this time were similar across these states as well. Differential distribution of mastodons in the southeast could be based on taphonomy, but climatic conditions could also be a factor. During the Last Glacial Maximum (LGM), the area between the Southern Appalachian Mountains and the Atlantic Ocean was likely a thermal enclave, an area of warmer temperatures and increased biodiversity. Here we map known occurrences of Atlantic Coastal Plain mastodons from before, during, and after the LGM to explore the potential effects of the thermal enclave on mastodon biogeography. We also report the recent discovery of an in situ mastodon from North Charleston, South Carolina, and apply methods of stable isotope analysis to its molar

enamel and dentin. These analyses will provide evidence of the animal's diet, nutritional status, habitat and climate. A palynological analysis of the surrounding matrix will be used to date the specimen relative to the LGM and provide further paleoenvironmental data. Results from these analyses will be compared to existing ecological data on southeastern mastodons in order to investigate factors responsible for the unequal distribution of the species in this region.

COMPARATIVE ANALYSIS OF GROUND PENETRATING RADAR (GPR) USING BIDIRECTIONAL AND UNIDIRECTIONAL SURVEY PROFILES, Clara R. Rucker*, W.B. Hart* and Z.T. Ansley*, Georgia Southern University, Statesboro, GA 30458. Ground penetrating radar (GPR) is a sensing technique that uses pulses of high frequency radio waves transmitted into the ground. Reflections of anomalies in the subsurface are measured via two-way travel times. These reflections and travel times produce a two-dimensional profile of the surveyed target area. GPR is a non-invasive and cost effective way of locating subsurface features and buried utilities such as power lines, fiber optic cables, pipelines, and irrigation lines. A geophysical survey was conducted using both bidirectional and unidirectional profiles in order to determine which method yielded more accurate results. Georgia Southern University's Physical Plant needed to supplement their data on irrigation mainlines beneath the Kiwanis Softball field at the campus Sports Complex. The study used a cart-mounted MALÅ X3M unit with a 500 MHz antenna to survey a 1000 square meter grid within the outfield. Profiles were taken in a SW-NE and a NW-SE direction to examine the shielding effect inherent in the orientation of the unit's antenna. The imaging software GPR-SLICE® was used to convert these two dimensional profiles into a three-dimensional model of the subsurface within the target area. The data was processed and filtered to provide an accurate image of the buried irrigation lines, including depth and a directional trend of each line. The survey found strongly-reflecting pipe-like anomalies at 70 cm, 165 cm, and 290 cm. Bidirectional profile lines and extensive filtration techniques provide a more complete subsurface image than the unidirectional profiles.

A COMPARISON OF $\delta^{18}\text{O}$ AND δD SOUTH BEACH MIAMI OCEAN WATER TO SW FLORIDA ESTUARIES**, J.Y. Acevedo* and W. Feng, Valdosta State University, Valdosta, GA 31698. Oceanic water samples have been collected using 4 ml glass vials from five sites along South Beach Miami to test possible differences between open beach and estuary environments. The samples were taken during the months of May and June of 2012. The sampling area covers a distance of ~300 m of the coast line. Eight samples were analyzed for their oxygen ($\delta^{18}\text{O}$) and hydrogen (δD) isotopic compositions. With the exception of one sample, analysis results show a range for $\delta^{18}\text{O}$ values of 0.9 to 1.4‰ and a range of 7 to 10‰ for δD values. In comparison, published $\delta^{18}\text{O}$ values of samples collected in May and June of 1998 from the SW Florida estuaries show oxygen ranges of 1.7 to 2.2‰ (Blackwater River), 1.1 to 1.8‰ (Henderson Creek) and 1.8 to 2.4‰ (Faka-Union Canal). South Beach Miami water samples are similar to samples from Henderson Creek, but are generally more negative than estuary samples. This may be due to the more pronounced evaporative effect of the estuary environment, which tends to increase $\delta^{18}\text{O}$ values of the water. One sample collected on June 21st has a $\delta^{18}\text{O}$ value of 3.3‰ and δD value of 14‰. This is significantly higher than all other analyzed samples, and seems to represent a gradual increase of stable isotopic compositions of the water over a two month period. This distinct different $\delta^{18}\text{O}$ and δD values, if correct, may indicate a unique event occurred during sample collection time, which will be further investigated in this study.

THE PREVALENCE AND POTENTIAL SOURCES OF ESTROGEN, *E. COLI*, AND COLIFORM BACTERIA IN FISHING CREEK AND THE OCONEE RIVER**, Tyler V. Mattix* and Samuel Mutiti, Biological and Environmental Sciences, Georgia College & State University, Milledgeville, GA 31061. The presence of estrogen and bacteria in surface water bodies is a major concern in most urban areas. Numerous studies have shown that exposure to even small amounts of environmental estrogen can have adverse health effects on humans and aquatic organisms. This study assesses the levels of 17 β -estradiol, EE2, *Escherichia coli*, and bacteria along portions of Fishing Creek and the Oconee River in Milledgeville, Georgia. Samples were collected from six sites along Fishing Creek, three along the Oconee River, and one from a faucet in the research lab. These samples were tested for the presence of bacteria and estrogen. All stream samples tested positive for estrogen and bacteria. Water from the faucet tested positive for estrogen and negative for bacteria. The highest concentrations of 17 β -estradiol were 3.4 ng/mL in Fishing Creek and 1.3 ng/mL in the Oconee River. The Oconee River had significantly lower *E. coli* levels compared to Fishing Creek. All sites along Fishing Creek had coliform concentrations >2419.6 cfu/100 mL., but only one site had *E. coli* concentrations >2419 cfu/100 mL. An assessment of the sources, final concentrations of EE2 and local implications of these findings are being carried out.

**Section IV: Physics, Mathematics, Computer Science,
Engineering and Technology
Bailey Science Center, Room 1025
Hasson M. Tavossi, Presiding**

8:00 AN APPROXIMATION METHOD FOR THE SOLUTIONS TO NONLINEAR OSCILLATOR EQUATIONS OF MOTION, ¹Kale Oyediji¹ and Ronald E. Mickens², ¹Morehouse College, Atlanta GA 30314-3773 and ²Clark Atlanta University, Atlanta, GA 30314. We present an updated methodology for calculating approximations to the solutions of nonlinear systems for which all the motions are bounded and oscillatory. This procedure represents the solutions in terms of polar variables (θ, r) rather than the usual planar coordinates ($x, y = dx/dt$). However, doing so results in a pair of coupled, very nonlinear, first-order differential equation for ($d\theta/dt, dr/dt$), which in general cannot be solved explicitly in terms of a finite number of elementary functions. We show, using a nonlinear iteration procedure, that a sequence of differential equations may be constructed such that their solutions provide approximations to the solutions of the original oscillatory differential equation. An explicit, nontrivial example is given to illustrate the general method and the analytical solution is compared to an accurate numerical solution.

8:15 SCIENTIFIC LITERACY IN PHYSICS, Bob Powell, University of West Georgia, Carrollton, GA 30118. Scientific literacy is a topic of current interest. It is discussed in academic publications, books, and papers given at professional meetings. Universities are asking that scientific literacy be taught, especially in courses for non-science majors. There are many interpretations about the meaning of the phrase. Operational ways of defining scientific literacy include making sure the students are aware of applications of the concept to their lives or the incorporation of real-life examples in instruction. Physicists typically give applications of physical principles to the real world. We probably need to be more aggressive in how we describe the applications and need to develop assessment strategies. This presenter is currently being more diligent to incorporate scientific literacy in courses in honors physics and honors astronomy and to do modest assessments.

8:30 ANALYSIS OF RAPID COOLING OF BIOMATERIALS CERAMICS*, Barry Hojjatie¹, David Gibson¹ and Ahmad Saatchi², ¹Valdosta State University, Valdosta, GA 31698 and ²Georgia Institute of Technology, Atlanta GA 30332. The objective of this study was to develop mathematical and computational models for rapid cooling of dental ceramic disks subjected to convective cooling from relatively high initial temperatures and to validate the computational models. The disks were subjected to convective boundary conditions from the top surface and the edges. MATLAB and ANSYS computer program development packages were employed to create computational programs based to the mathematical models in order to predict and analyze the temperature distribution within each disk. We are also exploring the application of the Intel Visual Fortran and MS Visual Studio to incorporate the IMSL Subroutines into the computational solutions of the mathematical models for comparison of the results with other methods. Parametric analyses were performed to determine the influence of materials properties, geometric dimensions, and boundary conditions. Computational results obtained were validated based of a comparison with the results obtained from cooling experiments. The results of this study indicate that the thickness and initial thermal conditions of the disks has a significant influence in the cooling profiles and large temperature variation may produce undesirable tensile stresses and produce premature failure in ceramics.

8:45 IMPROVING THE ANODE PERFORMANCE BY ELECTRO-DEPOSITING PB-SN ALLOY, AMORPHOUS SI, AND MNO ON ELECTROSPINNING-DERIVED CARBON NANOFIBER WEBS IN LITHIUM ION BATTERIES, A. Saatchi¹, B. Hojjatie², E. Ghanbari³, A. R. Saatchi³ and J. Moazenni⁴, ¹Georgia Institute of Technology, Atlanta, GA 30332, ²Valdosta State University, Valdosta, GA 31698, ³University of Akron, Akron, OH and ⁴Isfahan University of Technology, Isfahan, 84156, Iran. The subject of Batteries is one of the important issues in our everyday life, and is the bottle neck in portable applications. In fact energy storage and conversion (*i.e.* Batteries) is the basis of the vital topic of energy conservation and environment protection (*e.g.* solar cell, electric cars, *etc.*). In this study the history of the Parthian or Baghdad Battery, 2000 years ago to present day chemical batteries is briefly reviewed. The main focus of the study was on the electrochemical basis which created various types of present day batteries and will continue innovations in this field such as molten metal batteries for energy storage and advanced high power biological Batteries. Additionally, the recent research in the field of Li ion Batteries to improve anode performance was reviewed. Finally we explored a new method for preparing electrospinning-derived Carbon Nanofiber (CNF) Webs with Electrodeposited Sn-Sb Alloy, amorphous Si, and MnO₂ as an anode material of Lithium Ion Batteries. The results of this study indicate that the amorphous Si on CNF presents the highest capacity and cycle ability.

9:00 VISUALIZING THE CUBICS' BAND ENERGIES AND FERMI SURFACES IN SOLID STATE PHYSICS, Javier E. Hasbun, Department of Physics, University of West Georgia, Carrollton, GA 30118. In an effort to improve students' abilities to comprehend material presented in a solid state physics course, in addition to providing a bridge between classroom lectures and research, I have developed applications to calculate and visualize important material. One of the most challenging tasks in solid state is to calculate the density of states of a solid, for example, where the band structure is needed. Integrations over the bands in k-space are quite challenging. I demonstrate the steps to carry out its computation suitable for undergraduate student use. The approach is applied to the simple cubic structures. The method used is based on employing the band structure's Green's function and using the k-space Brillouin-zone ray approach [1] combined with a complex integration method [2]. Because Green's function contains information

about the system's spectrum, the density of states can naturally be used for this purpose. The topics discussed in this presentation will be incorporated in a solid state textbook that's currently being developed. [1] An-Ban Chen, Phys. Rev. B, Vol. 16, 3291 (1977). [2] Hasbun, Javier, <http://meetings.aps.org/link/BAPS.2009.MAR.L29.12>

9:15 A BRIEF HISTORY OF THE SARA CONSORTIUM, Kenneth S. Rumstay, Valdosta State University, Valdosta, GA 31698. The Southeastern Association for Research in Astronomy (SARA) was formed in 1989 in response to an opportunity to acquire the No.1 0.9-m telescope at the Kitt Peak National Observatory, located fifty-six miles southwest of Tucson, Arizona. SARA was successful in that endeavor, and has grown from its original four institutions (including the University of Georgia and Valdosta State University) to a current eleven members in seven states. About two dozen astronomers routinely observe remotely from their homes or campuses, using the KPNO telescope to acquire astronomical data in support of research programs in nearly all branches of observational astronomy. In 20120 SARA assumed operation of a 0.6-m telescope at the Cerro Tololo Inter-American Observatory in Chile, providing access to the southern sky. SARA is now negotiating to assume operation of the 1.0-m Jacobus Kapteyn Telescope on the island of La Palma. The members of SARA are strongly committed to undergraduate education, and have since 1995 operated a summer Research Experience for Undergraduates program. Funded by the National Science Foundation, this program provides an opportunity for qualified undergraduate students from around the country to work one-on-one with astronomers at the SARA institutions. To date 187 students have participated in this program, and we look forward to welcoming a new group of talented individuals in May.

9:30 ASTEROID PHOTOMETRY IN THE SARA REU PROGRAM, FROM 1999 TO 2012, M. A. Leake, Valdosta State University, Valdosta, GA 31698. Over the last decade, undergraduate students selected by the author for the Research Experience for Undergraduates (REU) program conducted by the Southeastern Association for Research in Astronomy (SARA) have observed several asteroids, processed the photometry from those objects and others observed by the author, and determined light curves and light curve fragments. This data has been presented at the SARA REU programs and at national American Astronomical Society meetings, and has been published in online journal JSARA (<http://jsara.org>) since 2007. Highlights of the light curves determined will be presented. The light curves are used to determine rotation rates of both primitive asteroids and asteroids needing observation (e.g., on Brian Warner's CALL list) and to amass enough data to determine asteroid orientation and shape. Spectroscopy of the brighter of these objects will be conducted, with the further goal of determining the spectrum of a particular side of the asteroid. These efforts complement those by amateurs and professionals across the globe, organized by Warner, Pravec, Harris and others. They provide convenient and doable projects for summertime research, and introduce the student to observations, reductions, further analysis, and, in particular, a small sample of the field of astronomy. SARA REU participants in the past 12 years include Renata Violante, Dicy A. Saylor, Liza Kaminski, Eric Hausel, Elise Jutzeler, Chase Rollins, Thomas J. Wark, Elizabeth Jeffrey, J. P. Noguees, and Kevin Freitas. Latest work supported by NSF AST-1004872.

9:45 CHANGES IN JUPITER'S GREAT RED SPOT IN 2010 AND EARLY 2011, Richard W. Schmude, Jr.*, Gordon State College, Barnesville, GA 30204. The longitude and latitude of the north, south, east and west edges of the Great Red Spot (GRS) were measured 158 times between April 19, 2010 and February 6, 2011. All

measurements were made with the software package WinJupos. These measurements were used to determine the size and position of the GRS. It is concluded that the north-to-south dimension of the GRS fell from 12.5° in May to 10.5° in August and rose back to 12° by December. A larger scatter in the data prevents me from making a definite conclusion for the east-to-west dimension; however, I believe that it fell from 17° in May to 16° in August. The GRS also oscillated in longitude with a period of ~ 90 days and with amplitude of one degree. This oscillation is consistent with previous studies (Rogers, *The Giant Planet Jupiter*, 1995, p.194). The GRS latitude drifted further south at a rate of about 0.05 degrees per month during the study period.

10:00 **Section business meeting**

10:45 **LIGHT CURVE OF JUPITER**, Richard W. Schmude, Jr.*, Gordon State College, Barnesville, GA 30204. Twenty-two brightness measurements of Jupiter were made on the nights of November 8-9 and 9-10, 2012. The objective of this work was to construct a light curve of that planet as it made its 9.9 hour rotation. All brightness measurements were made with an SSP-3 solid-state photometer transformed to the Johnson I band (peak transmission of 840 nm). One conclusion from this work is that Jupiter's light curve was nearly flat during the study period. Any cyclic brightness change was less than 0.03 stellar magnitudes (or less than $\sim 3\%$). During this time, Jupiter's average brightness (in stellar magnitudes) was $I = -3.148 \pm 0.012$. This is about 0.04 magnitudes (or 4%) brighter than expected (Mallama and Schmude, 2012, *Icarus* Vol. 220, p.92-97).

11:00 **CHARACTERIZATION OF IRREGULAR POROUS MATERIALS BY ULTRASOUND: APPLICATION TO LUNG-TISSUE MODELING**, Hasson M. Tavossi and Jared C. Harris*, Department of Physics, Astronomy and Geosciences, Valdosta State University, Valdosta, GA 31698. Porous medium of random distribution of the pore sizes of irregular shapes is a good physical-model for the human lung tissue. Different binary mixtures of solid spheres and liquid filled pores are made to model lung tissue in the laboratory. The mechanical characteristics of the lung model, such as its modulus of elasticity, sound waves speed, sound absorption spectrum, and wave attenuation by scattering as a function of frequency are investigated. The goal of this research is to obtain experimental data in both time and frequency domains, and by numerical analyses, of the findings. In order to determine a robust method for the health monitoring of lung tissue, as well as damaged zones in other irregular porous materials, to distinguish between healthy and damaged, or altered zones in the tissue, or material, and to locate these damaged or altered zones and their relative sizes.

11:15 **MEASUREMENTS OF THE NONLINEAR INTERACTION BETWEEN COUNTERPROPAGATING ALFVÉN WAVES**, D.J. Drake¹, J.W.R. Schroeder², G.G. Howes², C.A. Kletzing², F. Skiff² and T.A. Carter³, ¹Valdosta State University, Valdosta, GA 31698, ²University of Iowa, Iowa City, IA 52242 and ³University of California at Los Angeles, Los Angeles, CA 90095. Alfvénic wave turbulence plays an important role in mass and energy transport in many astrophysical plasma environments. Most turbulence theories have been established using ideal plasma models, such as incompressible MHD. These models predict that the nonlinear interaction of two primary, counterpropagating Alfvén waves will produce a secondary daughter wave with $k_1 + k_2 = k_D$ and $\omega_1 + \omega_2 = \omega_D$. However, there has been no experimental verification of these theoretical results. In this presentation, we will present the first experimental evidence supporting the use of such models for weakly collisional plasmas which are relevant to various space and astrophysical plasma environments.

11:30 COMPUTER APPROXIMATIONS OF NORMAL DISTRIBUTION, Jin Wang and Said C. Fares, Valdosta State University, Valdosta, GA 31698. The normal distribution is the most important and widely used distribution in both research and practice. The central limit theorem gives it exceptional application in so many fields. Unfortunately, the closed forms of its cumulative distribution function (CDF) and inverse do not exist. How to calculate normal CDF and inverse is an important issue in computing normal probability, quantile function, and confidence interval and testing critical values. We use Error function to provide an efficient numerical approximation to calculate normal CDF and inverse values. A simple practical procedure is derived for generating normal random variates in computer simulation.

11:45 OCCURRENCE OF NEGATIVE RESISTIVITY IN A HIGH TEMPERATURE SUPERCONDUCTOR, Ben de Mayo, University of West Georgia, Carrollton, GA 30118. High temperature superconductivity was discovered in 1987, but its theoretical description has been elusive. We have been studying the effects of temperature and magnetic fields on the electrical resistivity in three samples of bismuth strontium calcium copper oxide (BSSCO), one of the main high temperature superconductors. Recent results have revealed that, as a sample warms from liquid nitrogen temperatures (LN2, about 69 K at our altitude), its resistivity decreases from zero (the superconducting state) to a negative value, then it is more or less constant for a several seconds, and finally it increases above zero as the temperature rises. Application of a magnetic field increases the resistivity by a constant field-dependent amount in the LN2 regime. The region of negative resistivity is associated with the purported transition of a rigid magnetic vortex array in the LN2 temperature regime to a fluid-type array as the vortex lattice "melts." The dependence of the negative resistivity on the current through the superconductor was also determined. The resistivity was measured with the standard 4-point probe method; the LabView data acquisition/analysis system was used to obtain the data; and Microsoft Excel was used to analyze them. Supported by the Georgia Space Grant Consortium-NASA.

POSTERS

IRON-BASED SUPERCONDUCTIVITY: A STUDY OF SrFe_2As_2 , David L. George^{*1}, Luan P. Nguyen^{*1}, Walter Uhoya² and Gary N. Chesnut^{1,1}University of West Georgia, Carrollton, GA 30118 and ²University of Alabama at Birmingham, Birmingham, AL 35294. High temperature iron based superconductors are of particular interest due to their high critical temperatures and potential applications. The superconductor SrFe_2As_2 was recently studied with neutron diffraction techniques to a temperature of 89 K and a pressure of 4.3 GPa. The purpose of these experiments was to examine the nuclear and magnetic structures which play a key role in the property of superconductivity. The structural phase transition from tetragonal to orthorhombic was observed at $T_o = 196$ K with an increase in orthorhombic distortion with decreasing temperature. The neutron diffraction experiments revealed subtle, but interesting results at elevated pressures.

DOCUMENTING WAVE FIELD CONSISTENCIES ACROSS SMALL SCALE SEISMIC ARRAYS**, Clay F. Tuggle* and C. Poppeliers. Seismic arrays are used to measure the spatial and temporal changes of a seismic wave field. They do this by recording the wave field in numerous locations on the earth simultaneously. In the case where the size of the array is only a fraction of a measured wavelength, we can determine the wave's spatial gradients and surface rotational motions. However, in order to calculate these parameters, there is an explicit assumption that the wave field is uniform across the array.

We test this assumption in the first order by comparing time averaged spectral density for a small scale, high density, three-component seismic array. We find that at low frequencies, the power spectral density is relatively uniform across the array, indicating that the uniform wave field assumption is valid. However, the wave field tends to become non-uniform at higher frequencies, which is consistent with frequency dependent wave field scattering.

MEASUREMENT OF THE FORCES BETWEEN TWO PERMANENT MAGNETS USING A PRECISION LINEAR MECHANICAL FEED, Natalee Hiite*, Jessica Rattray*, and Ben de Mayo, University of West Georgia, Carrollton, GA 30118. Magnetism is one of the most economically important and least understood phenomena of solid state physics. For example, a system of maglev trains would save not only energy but also transit time. Better magnets could greatly improve the system's efficiency. In this study, we measured the attractive and repulsive forces between a pair of permanent magnets at room temperature. A linear feed machine screw graduated in increments of one one-thousandths of an inch and an Ohaus Adventurer SL balance of stated precision ± 0.001 g were used. The distances covered varied from approximately 1 cm to 10 cm in steps of 0.001 inches (0.00254 cm). The magnets were of the rare earth (neodymium) type and were coated with nickel plating. This pair of magnets had physical dimensions 1.25 cm diameter and 0.60 cm height, and magnetic field strengths at their surfaces were between 52 mT and 61 mT as determined using a Daedalon flux density meter EP-15. The repulsive forces varied from around 0.001 N at 10 cm to the limit of the balance (0.5 N). The data were compared to an expected $1/r^2$ -type dependence. Supported by the Georgia Space Grant Consortium-NASA.

TESTING THE FEASIBILITY OF A BLADELESS WIND TURBINE, Ian Agnew and Taylor Ray, Georgia College & State University, Milledgeville, GA 31061. Over the last two decades wind turbines have proven themselves globally as a reliable, renewable, and clean energy source. Even though wind turbines are simpler in design and do not pollute during operation as compared to conventional energy sources, many improvements can still be made. The design of a bladeless wind turbine offers potential improvements such as cost savings, reduction of operating noise level, simplification of the manufacturing process, reduction of maintenance costs, and incorporation of eco-friendly features. In order to analyze various turbine designs, a wind tunnel with a 30.3cm x 30.3cm test section was constructed at Georgia College. Several different wing sections are being evaluated, for the turbine design, for aerodynamic efficiency over a Range of Reynolds numbers. Other factors like Pressure coefficients and overall drag profile of the designs will also be analyzed.

Section V: Biomedical Sciences
Bailey Science Center, Room 3017
Seyed H. Hosseini, Presiding

9:00 **VIBRIO CHOLERA GHOST ENHANCE *CHLAMYDIA*-SPECIFIC IMMUNE RESPONSES VIA THP-1 CELL ACTIVATION****, April Stevens^{1,2}, Roshan Pais², Francis Eko², Qing He² and Godwin Ananaba¹, ¹Department of Biological Sciences, Clark Atlanta University, Atlanta, GA 30314 and ²Department of Microbiology, Biochemistry, and Immunology, Morehouse School of Medicine, Atlanta, GA 30310. *Chlamydia trachomatis* (CT) is an obligatory intracellular pathogen that causes genital *Chlamydia* infection, one of the most common bacterial sexually transmitted diseases (STD)

worldwide. An efficacious chlamydial vaccine is needed and should induce broad-based long lasting immunity. Previously our lab has shown that the novel recombinant *Vibrio cholera* ghost (rVCG) delivery platform possesses potent immunostimulatory properties. Here we hypothesize that VCG activate THP-1 cells leading to the secretion of tumor necrosis factor-alpha (TNF α). THP-1 cells are a cell line derived from human acute monocytic leukemia cells and have been accepted as a model system for studying the response of tissues to biomaterials. In the current study we assessed the ability of VCG to activate THP-1 cells leading to the secretion of TNF α , an early cytokine released during bacterial infections e.g. *Chlamydia* infection. Methods: To determine secretion levels of TNF α , we performed dose and kinetic experiments to establish the optimum conditions for the production of TNF α proinflammatory cytokine. THP-1 cells were pulsed with VCG at various dosages and for various times, and the secretion of TNF α was measured by capture antibody ELISA. Results: VCG stimulate THP-1 cells to secrete the proinflammatory cytokine, TNF α . Also, stimulation of THP-1 cells by VCG to secrete TNF α is dose-dependent. Conclusion: The results indicate that VCG enhance *Chlamydia*-specific immune responses via THP-1 cell activation in a dose-dependent manner. This work was supported by PHS grant AI41231 from National Institutes of Health (NIH) and Grant #1 C06 RR18386 from National Centers for Research Resources.

9:15 EFFECTS OF LIGHT EXPOSURE AND VITAMIN D ON THE DEVELOPMENT OF MYELIN BASIC PROTEIN IN THE MYELIN SHEATH OF NEURONAL AXONS IN JUVENILE ZEBRAFISH**, Callie Holloway* and Linda G. Jones, Young Harris College, Young Harris, GA 30582. Higher latitudes and one's relative exposure to sunlight have been correlated with the incidence of multiple sclerosis (MS). This degenerative autoimmune disorder targets the myelin sheath of nerves, an important component of which is myelin basic protein (MBP). In this study we assessed the levels of MBP by Western blotting using a rabbit polyclonal antibody against MBP and a chromagenic secondary antibody. Our preliminary experiments have confirmed our previous findings that zebrafish (*Danio rerio*) embryos raised in the dark for seven days post fertilization (dpf) express more MBP than do those raised with exposure to a full-spectrum light source. In that exposure to sunlight is associated with the production of vitamin D, we also investigated whether treatment with vitamin D would alter the levels of MBP found in zebrafish embryos in the two different light exposure groups. Our results to date suggest that exposure to vitamin D enhances the level of MBP found in embryos exposed to light but reduces the level in embryos raised in the dark. We are in the process of confirming these findings and determining a dose-response of this effect of vitamin D. Funding for this project was from the Young Harris College Undergraduate Research Initiative.

9:30 ALTERATION OF GLUT1 AND GLUT4 IN L6 MUSCLE CELLS IN RESPONSE TO GLUCOSE LEVELS AND INSULIN**, Cameron Medina* and Linda G. Jones, Young Harris College, Young Harris, GA 30582. The uptake of glucose into skeletal muscle cells is mediated by the glucose transporters, GLUT1 and GLUT4, the latter being subject to insulin regulation. In that obesity and diabetes are associated with changes in the levels and/or cellular location of the transporters, we are investigating whether the levels of available glucose (1000 mg/L or 4500 mg/L) with or without insulin (3-300 nM) will alter the levels of the transporters in cultured L6 muscle cells. L6 cells are being cultured under standard conditions and subcultured as needed to avoid confluency. Cell lysates from L6 cells incubated under experimental conditions for 48 hours will be subjected to SDS-PAGE and Western blotting in order to determine whether amounts of the transporters are altered. In order to determine whether insulin treatments and/or levels of glucose promote a differential translocation of the transporters, immunocyto-

chemistry (ICC) will be performed on cells fixed in the culture dishes following the same experimental design. A fluorescent secondary antibody will be used to visualize cellular location of GLUT1 and GLUT4. Funding for this project was from the Young Harris College Undergraduate Research Initiative.

9:45 CHEMOTAXIS OF NEUTROPHILS IN A TAIL-FIN WOUND MODEL IN JUVENILE ZEBRAFISH**, Emalyn Cork^{*1}, Kacey Miller^{*1}, Chris Heard^{*2} and Linda G. Jones¹, ¹Young Harris College, Young Harris, GA 30582 and ²Georgia College & State University, Milledgeville, GA 31061. The chemotaxis of neutrophils to damaged tissue is an important inflammatory process. Hydrogen peroxide (H₂O₂), known for its oxidative damage at higher concentrations, is thought, at low concentrations, to provide the chemotactic signal to attract neutrophils to the wound site. More specifically, endogenously produced hydrogen peroxide has been implicated in the mediation of the chemotaxis of neutrophils to a tail-fin wound in zebrafish, a widespread model for studying the regenerative and inflammatory responses to wounds. In this study, we examined the chemotactic response to H₂O₂, administered exogenously while wounding, to determine whether such treatment enhanced neutrophil migration to the wound site. Four day post fertilization (pdf) zebrafish were wounded using a 26 g needle in the presence or absence of 0.3% H₂O₂. At selected time points, fish were anesthetized, fixed and stained using Sudan Black. Neutrophils at the wound site were then counted under a light microscope. Our results to date suggest that 0.3% H₂O₂ promotes a significant increase in the number of neutrophils that migrate to the wound site compared to wounding alone. We plan to confirm these data and to determine whether the addition of the antioxidants glutathione or catalase inhibit the enhanced migration of neutrophils to the wound site. Funding for this project was from the Young Harris College Undergraduate Research Initiative.

10:00 Section Business Meeting

POSTERS

PLANT BASED AS ANTIFUNGAL AGENT AGAINST *ASPERGILLUS* SPECIES IN GEORGIA PEANUTS**, Reesheda Gilbert*, Department of Biology and Physics, Kennesaw State University, Kennesaw, GA 30144 and College of Health Sciences, University of Northampton, UK. *Aspergillus* species has shown to be a cumbersome invader of storage grains, peanuts, and nut trees. This commonly encountered fungus contaminates food, plants, and feed for commercially raised animals. Specifically *A. flavus* and *A. parasiticus* are two species of *Aspergillus* that naturally produce aflatoxins that infect peanuts and can be carcinogenic. In the United States, a total 20ppb is the maximum permitted level for human consumption. Research has shown that aflatoxin exposure of (>6000mg) leads to acute toxicity while prolonged exposure to minute doses were carcinogenic). *A. flavus* is the most common strain of *Aspergillus* that causes crop contamination and manifesting as a common threat to peanut industries worldwide. Safe and ecological friendly methods for controlling *A. flavus* with antimicrobial compounds such as essential oils are being explored to substitute chemically based fungicides. Although genetically modified organisms are being persuaded as another method of control, they are not cost-effective. Essential oils derived from aromatic plants such as cinnamon and clove have clinically displayed antifungal characteristics. Our study tested the antifungal effects of cinnamon and clove oil vapors separately. *A. flavus* spores were exposed to different concentrations at 24, 72, and 96 h and incubated for seven days. Exposure time correlates with both the growth of *A. flavus* and zone of inhibition. Further studies should focus on active ingredients of vapors to show their potential as biological control agents.

Acknowledgements for this study are presented to the following: funding provided by NSF and LSAMP Peach Grants, Department of Biology and Physics at Kennesaw State University, Dr. K. Gkatzionis, Northampton, UK, Army Lester and Premila Achar, Kennesaw State University, and Dr. Seenivasa, University of Mysore India.

NLRP 3 INFLAMMASOME ASSEMBLY IS REQUIRED FOR CASPASE ACTIVATION DURING *CHLAMYDIA* INFECTION**, Danielle N. McKeithen^{*1,2}, Yusuf Omosun¹, E. Caroline Kibakaya^{*1}, Francis O. Eko¹, Joseph U. Igietseme^{1,3}, Godwin A. Ananaba² and Qing He¹, ¹Department Microbiology, Biochemistry, and Immunology, Morehouse School of Medicine, Atlanta, GA 30310, ²Department of Biology, Clark Atlanta University, Atlanta, GA 30314 and ³Centers for Disease Control & Prevention (CDC), Atlanta, GA 30333. *Chlamydia*, which induces inflammation and infertility in women, is a major infectious bacterial agent that causes sexually transmitted disease (STD) worldwide. The purpose of this study is to determine the role of the inflammasome in bone marrow dendritic cells (BMDCs) of Interleukin 10 knock out (IL-10KO) mice *Chlamydia* infection. BMDCs were harvested from wild type (WT) and IL-10KO mice and pulsed with *C. muridarum*. Our results showed higher inflammasome, pro-caspase-1, and, pro-IL -1 β expression in IL-10KO DCs, but no difference in the inflammasome assembly at early infection time point. After 2hr infection there was reduced co-localization of NALP3, ASC, and, caspase 1 in IL-10KO DCs. The NLRP3 inflammasome sub-aggregates are highly expressed in IL-10KO mice, but at the macro-molecular level appear to form incomplete aggregates leading to a reduction in activated NLRP3 inflammasomes. While in WT there appears to be robust activation of most inflammasomes, thus leading to increased apoptosis. This research is supported by Title II Grant# 22210J and NIH#1SC1AI03041-01A1.

AN ASSESSMENT OF THE TOXICITY OF NOVEL ANALOGUES OF PERSIN**, Heather D. Perry*, David N. Aban*, Thomas D. Crute and Richard D. Griner, Georgia Regents University, Augusta, GA 30904. Persin is a compound produced in avocado leaves that has been shown previously to be cytotoxic to mammary epithelium and to induce apoptosis in several breast cancer cell lines. However, at slightly higher doses administered *in vivo*, persin demonstrated cardiotoxicity. Thus, the search for safer analogues has been ongoing. Specifically, our lab has synthesized analogues of persin in an effort to identify other compounds that share persin's ability to induce apoptosis in breast cancer cells. Two analogues, a secondary alcohol synthesized from oleic acid (CG1) and its derived acetate (CG2) have been tested against the human breast cancer cell line MCF-7. In initial screenings, as little as 30 μ M of CG1 reduced cell viability to only 3% of control, while as much as 1mM CG2 had no impact on cell viability (96% of control). It will now be important to determine if these compounds are acutely toxic or if they are inducing apoptosis. Thus, assays for specific markers of apoptosis will be conducted. If apoptosis is detected, additional studies will examine the ability of these compounds to stabilize/bundle microtubules and to elicit an increase in cellular ceramide levels as have been shown for persin. Ultimately a link between the three events of increased ceramide levels, bundling of microtubules, and initiation of apoptosis will be sought. Synthesis of additional analogues is planned, and these will be screened and tested in a similar manner.

ANTIMICROBIAL PROPERTIES OF EGG WHITE ON THE BACTERIA *AEROMONAS HYDROPHILA*, *STAPHYLOCOCCUS AUREUS*, AND *ESCHERICHIA COLI***, Natalie Mellem*, Joshua Butler*, Stephen Gitau*, Army Lester and Donald McGarey, Kennesaw State University, Kennesaw, GA 30144. Background: The antimicrobial properties of egg white have long been documented; however the mechanism of this

natural process is not well understood. The objective of this study was to determine the lethal point of egg white on various concentrations of the bacteria *Aeromonas hydrophila*, *Escherichia coli* and *Staphylococcus aureus*. Methods: One milliliter of egg white from three-day-old fertilized eggs was aseptically transferred to sterile test tubes. *Aeromonas hydrophila*, *Staphylococcus aureus* and *Escherichia coli* at cell counts ranging from 1×10^3 to 1×10^6 colony forming units (CFUs) were inoculated into the egg white, and incubated and cultured over a three-day period. In a separate experiment, 1×10^3 to 1×10^6 CFUs of these bacteria were inoculated 1cm from the developing embryo in a shell-less environment and tracked for three days for embryo survival and bacterial persistence. Results: In egg white inoculated with 1×10^3 to 1×10^5 cells (1 CFU/microliter up to 100 CFUs/microliter egg), no bacteria were recovered after 24 hours. At 5×10^5 CFUs (500 CFUs/microliter egg white) a severe drop in population within 24-48 hours, then cell repopulated in 50% of the tubes. At 1×10^6 cell (1000 cells/1 microliter of egg white) the antimicrobial action of egg white was overwhelmed with no reduction in bacterial CFUs. In the shell-less egg experiment, 1×10^3 CFUs of each bacterium was lethal to the developing embryo. Discussion: Results clearly show that egg white has antimicrobial properties that destroy pathogen at concentrations of 100 CFUs/microliters or less, but appears to reach a lethal concentration (50%) at 500 CFUs/microliters. Inoculation of 1×10^3 CFUs 1 cm away from the embryo is lethal, most likely as the inoculation is on the yolk and avoids the antimicrobial action of egg white.

RNA INTERFERENCE (RNAI) STRATEGIES TO REDUCE FITNESS OF INSECT PESTS**, Neha Reddy*¹ and Wayne B. Hunter², ¹Lincoln Park Academy, Ft. Pierce, FL 34950 and ²United States Depart. Agriculture-ARS, Ft. Pierce, FL 34945. RNA interference (RNAi) is a naturally occurring cellular process that results in the down regulation of targeted messenger RNA transcripts. RNAi was utilized to reduce the fitness of an insect pest, the Asian citrus psyllid, (*Diaphorina citri*), which transmits a deadly disease of citrus trees. Citrus greening disease (Huanglongbing) has resulted in the loss of over \$3 billion and over 6,000 jobs since 2006. We designed a double stranded RNA (dsRNA) treatment which was administered to psyllids using a cut plant feeding assay. Each of the three trials was comprised of four cages of plant shoots which absorbed the dsRNA, and two cages of plant shoots in water only. Each cage consisted of 12 adult psyllids. Observations of mortality were taken daily for 11 days. Prior to insect exposure, the set up of plant shoots in cages were screened for three days for any signs of wilting or contamination. Only healthy looking plant cuttings were used in the experiment. Initial trials showed that the dsRNA treatment induced significant insect mortality over controls. RNAi approaches are highly specific due to their design based on insect sequences, thus demonstrating tremendous potential as a means of pest management. Studies are still in progress.

STUDY OF THE GENE REGULATORY NETWORK FOR SEA URCHIN PIGMENT CELLS DEVELOPMENT**, Antonio C. Ortiz* and Cristina Calestani, Valdosta State University, Valdosta, GA 31698. Embryogenesis is a remarkably dynamic and precisely regulated process, and the exact genetic programming required has not been entirely uncovered. We utilize *Strongylocentrotus purpuratus* to study the process of cell differentiation during embryogenesis. Our objective is to gain further understanding of the gene transcriptional regulation of differentiation genes, using as a model the development of larval pigment cells, which are part of the larval immune system. We study cis-regulatory elements, more specifically those controlling the expression of the differentiation gene *polyketide synthase (pks)* in pigment cells. Comparative genomics was performed utilizing the software FamilyRelationsII, MEME, and SANN in order to predict cis-regulatory

modules and putative DNA-binding sites in the -3kb region of the *pks* promoter. The SANN and MEME analyses were done utilizing five co-expressed pigment cell genes: *flavin-monooxidase 1, 2, 3, sulfotransferase*, and *pks*. Furthermore, we compared them in two additional sea urchin species: *Allocentrotus purpuratus* and *Strongilocentrotus franciscanus*. From these analyses we will select putative sites to test via site-directed mutagenesis within the -3kb promoter. We then utilized the Yeast-One-Hybrid system to identify putative transcription factors that bind to the *pks* promoter. As a result of this screen Otx and Eve have been identified and will be confirmed by site-directed mutagenesis and gene knock-down approaches.

PERFLUOROOCCTANOIC ACID (PFOA) DECREASES STEROIDOGENESIS IN MOUSE LEYDIG TUMOR CELLS**, S. Tadros* and J.D. Cannon, Augusta State University, Augusta, GA 30904. Perfluorooctanoic acid (PFOA) is a synthetic long-chain perfluorinated chemical that has been widely used in consumer and industrial products, such as pesticides, non-stick cookware, and weather- and fire-resistant clothing. PFOA has been identified as an environmental contaminant and recently has been suggested to be an endocrine disruptor. The goal of the present study is to examine the effect of PFOA on steroid production in mouse Leydig Tumor cells (mLTC-1). Cells were treated with concentrations of PFOA ranging from 100nM to 100 μ M for 24h before being stimulated for 4h with human chorionic gonadotropin (hCG). Media was collected and progesterone measured using an ELISA (ALPCO). PFOA concentration of 100 μ M reduced hCG-stimulated progesterone synthesis by over 70% compared to hCG-stimulated controls. Twenty-four hour treatment of cells with the above concentrations showed no significant decrease in cell viability, as measured by the CellTiter-Blue® Cell Viability Assay (Promega), suggesting that the decline in steroidogenesis was not due to reduced cell numbers. It is expected that repeating the above experiments will result in the same findings, confirming that PFOA does in fact decrease progesterone production in mLTC-1 cells. Because this compound is environmentally persistent, further studies should be done to examine its effect on human health, including reproductive health, and to understand its mechanism of action.

Section VI: Philosophy and History of Science
Bailey Science Center, Room 2020
E.T. McMullen, Presiding

9:00 **QUANTUM STATES ARE NEITHER REAL NOR NON-REAL, BUT SEMI-REAL**, Dennis W. Marks, Valdosta State University, Valdosta, GA 31698. Philosophical theories about the existence of reality can be tested experimentally. One critical experiment is a four-stage sequential Stern-Gerlach experiment measuring the x-, then the y-, then the x-, then the y-components of the spin of a particle. Based on the idea that there is something definite "out there" prior to its being measured, realists expect measurements to be repeatable. They therefore would predict that the product of the four measurements should be +1. Based on the idea that any conceivable possibility is possible, non-realists would predict that the product should be ± 1 . In fact, the product is always -1, refuting both realism and non-realism. The minus sign is a consequence of the anticommutativity of the spin operators, which requires the use of quantum logic, rather than classical logic. The wave function, being a superposition, represents possibilities, not actualities. Since the square of the wave function is the probability of a particle being some-where, the wave function represents the (square) root of being. The product of two possibilities is an actuality. Possibilities thus have an ontological status more fundamental

than actualities. It makes philosophical and mathematical sense to ascribe an ontological status of “semi-real” to possibilities. The author is sincerely grateful to Dr. Jim Hill, VSU Professor of Philosophy, for wonderful discussions over the decades on this and many other topics.

9:30 EMERGENT BEHAVIOR, Ronald E. Mickens, Clark Atlanta University, Atlanta, GA 30314. Major debates have taken place over the significance of fundamental physical theories and their roles in analyzing, understanding, and predicting the properties of the “less-fundamental” sciences. The corresponding set of both methodological and philosophical issues is directly tied to the apparent hierarchical structure of science and attempts to explain this feature of nature by means of the “reductionist hypothesis”. (A good presentation of one viewpoint on this matter is the article: P.W. Anderson, “More is Different”, *SCIENCE*, Vol. 177 (#4047, 4 August 1972), pps.393-396.) Our major goal is to introduce into this discussion on examination of the concept of “emergent behavior” and how its use impacts the above indicated issues. In particular, we show the inter-relationships among fundamental theories, pure and applied mathematics, and computation.

10:00 **Section business meeting**

10:30 LYELL AND WHERE THE PAST IS NOT EXPLAINED BY THE PRESENT, Tom McMullen, Georgia Southern University, Statesboro, GA 30460. The subtitle to Charles Lyell’s famous ‘Principles of Geology’ (1830-1833) is “being an attempt to explain the former changes of the earth’s surface, by reference to causes now in operation.” In other words, the present is the key to the past. But what things in Charles Lyell’s present could not explain what he knew of the past? For one example, by 1810 an integrated bibliography about polystrate fossils existed and in 1819, enough were known for Jakob Noggenrath to publish a monograph on them. The best-known polystrate fossil was a fossil tree stem at least 37 feet long that was found in Craighleith Quarry near Edinburgh in 1830. It lay at about a forty-five-degree angle and penetrated ten to twelve layers of sandstone. Underneath the tree was a coal bed. To George Fairholme (1789–1846), the forty-five-degree angle meant that the Craighleith tree had to have been rapidly deposited, or else it would have fallen, due to gravitational force, to a horizontal position. Therefore he concluded the sandstone layers as well as the underlying coal deposit were likely to have formed during a rapid cataclysmal event. It appears he is right. No one has observed the formation of polystrate fossils from Lyell’s time up to our present. The Craighleith tree in particular, and polystrate fossils in general, falsify the idea that geological processes in the past can be explained by those operating in the present.

11:00 THE HISTORY OF DREDGING IN THE ST. MARYS RIVER, KINGS BAY NAVIGATION IMPROVEMENTS, AND AMELIA ISLAND BEACH RE-NOURISHMENT, Elliott O. Edwards, Jr., Chatham County School System, Savannah, GA 31401. Dolostone rock was discovered scattered along the ocean-side beach of Amelia Island. The identification of this rock led the author to look into the history of dredging in this area. This paper will review the design and construction of nine miles of navigation channel improvements at Kings Bay Naval Submarine Base to accommodate the Ohio class submarines; dredging and disposal of material St. Mary’s River Project; the Amelia Island Island-Wide Beach Monitoring Project; a chronology of historical shoreline protection efforts, and shore stabilization of Amelia Island. The dolostone rock was easily spotted resting on the beach surface in various sizes and colors. The Amelia Island beach has been a source of fossil identification and the relative importance to the geology of the

Florida Coast for many years. The identification of this rock was found to be dolostone (a fossiliferous sandy dolomite and fossiliferous sandy limestone) the rocks that form the upper confining unit for the Floridan Aquifer System. The rock's presence is the result of beach re-nourishment and dredging of the St. Mary's River.

Section VII: Science Education
Bailey Science Center, Room 2021
Ollie Irons Manley, Presiding

9:00 THE EFFECT OF HAND-HELD TECHNOLOGY ON STUDENT ENGAGEMENT AND ACHIEVEMENT**, D.B. Addison* and R.A. Cooper, Brenau University, North Atlanta Campus, Norcross, GA 30071. The purpose of this study is to describe how students use hand-held technology devices such as: iPads, netbooks, smart phones, and laptops for learning and the effect it has on student engagement and achievement in a sixth grade science classroom. The "Bring Your Own Technology" (BYOT) Initiative set forth by Forsyth County, encourages students to use these devices for learning, and is a reversal of previous county policies, prohibiting students from using these devices during the school day. This research involves 110 students and four units of science instruction. There are 55 students in group one and 55 students in group two. For units one and two, group one will use technology and group two will not. For units three and four, all students will use technology. Activities for both groups will be comparable. All students will engage in discussions, labs, simulations, research, and assessments for each unit of study. The group one results from the units using technology will be compared to the group two results from the same units without technology. Achievement will be measured using pretest and posttest scores for each unit. Engagement will be measured by the number of formative assessments completed and turned in on time and the number of discipline slips given. The use of hand-held technology devices may increase engagement and/or achievement, while preparing students for the 21st century by promoting critical thinking, creativity, communication, and digital citizenship.

9:15 PRELIMINARY RESULTS EXPLAINING THE DISCORD BETWEEN CHEMICAL, BACTERIAL AND BIOLOGICAL MONITORING OF IMPAIRED CABIN CREEK**, Ryan D. Haire*, Jennie Thaeter* and M.C. Fermin-Ennis, Gordon State College, Barnesville, GA 30204. Over the past two years, chemical, biological and bacterial tests have been used to monitor Cabin Creek in Griffin, Georgia. The creek is currently classified as impaired, which means it does not meet its intended use of swimming and fishing. Chemical and bacterial testing indicated normal levels for dissolved O₂, pH, phosphate, nitrates, ammonia, conductivity, chloride, hardness, alkalinity and *E. coli*; yet, biological testing results indicated that the creek was still severely impaired. Only 2 types of macroinvertebrates were found in the creek; and they were the ones most resistant to pollutants. This disconnect in the results finally got some clarification when a red precipitate was collected and analyzed. With water levels so low this summer, the red precipitate covering a segment of the creek was more visible. This insolubility in the water was the reason why the AAS approved chemical and bacterial methods for water monitoring did not correlate with the biological results. Basic spectrochemical analyses indicate a match with two types of rayon. Tests are currently being done to determine the effects of rayon on the population of macroinvertebrates commonly found in the creek. Monitoring of the creek and the presence of the red precipitate will be continued. The concentration of the red precipitate is believed to be a better predictor of the health of the stream.

9:30 SOURCES OF KNOWLEDGE ABOUT BIOLOGY FOR CHILDREN AT A COMMUNITY GARDEN, Judy Orton* and M. Renken, Georgia State University, Atlanta, GA 30303. Community gardens are pieces of land gardened by a group of people who provide children the opportunity to learn about plants and animals. This information can be transmitted through various sources. As such, the present research considers various sources of knowledge for children to learn about biology at a community garden. The research is based upon an ongoing, yearlong, ethnographic inquiry at a community garden located in a large city in the Southeast. Over the course of the past year, three sources of information through which children learn about biology have emerged. These sources of knowledge are adults (e.g., parents and garden teachers), peers (e.g., other children visiting the garden), and first-hand observation. We found that adults, including garden class teachers and parents, often provided children with information about a specific concept (e.g., role of worms in the composting process). Peers often provided children with information about a concept based on their own previous experience with living things, both within and beyond the garden context. Finally, first-hand observation was a common source of knowledge for children at the community garden. Through first-hand observation, children learned about garden concepts, often hands-on experiences with living things at the garden. To conclude, community gardens are unique in that they provide children visitors the informal, yet rich opportunity to learn about biology through multiple sources of knowledge.

9:45 INCREASING LITERACY AMONG URBAN STUDENTS IN SECONDARY SCIENCE CLASSROOMS THROUGH LITERACY INTEGRATION METHODS IN THE ERA OF COMMON CORE, A.S. Oyenuga* and Ollie Manley, Georgia State University, Atlanta, GA 30303. Much of the current educational landscape is focused on closing the achievement gap among urban students. To ensure all students have an equal opportunity to succeed beyond secondary school, institutions have implemented the Common Core Standards with a focus on improving literacy in science and other subjects. Although literacy integration has been studied in the past, previous research has not addressed the quality of literacy integration methods in science and their ability to satisfy the standards of Common Core. The purpose of this research is to review the available literature to compare the content and effectiveness of science notebooks and traditional laboratory reports as tools to increase literacy among urban students in secondary science classrooms. The literacy integration devices will be judged by their ability to satisfy four of the common core literacy integration standards: L11-12RST1, L11-12RST2, L11-12WHST1, and L11-12WHST2. It is expected that there will be differences in the extent to which the literacy integration devices fulfill the standards of Common Core, and their perceived impact on urban students' literacy rates. The assessment of the overall evidence determines that science notebooks offer more opportunities for students to exercise their literacy skills, but it is envisaged that literacy integration methods in urban science classrooms could be further researched and expanded.

10:00 **Section Business Meeting**

10:30 HOW DO SUPPLEMENTED DIETS AFFECT THE NUTRITION AND TROPHIC INTERACTIONS OF AN ANIMAL MODEL?, Evan Lampert, University of North Georgia, Oakwood, GA 30566. A semester-long guided inquiry project was developed for Biology 1107, the first course of the major's introductory science sequence at University of North Georgia. *Trichoplusia ni* (Lepidoptera), a generalist herbivore, larvae were selected as a model organism for our project. Larvae were reared on artificial diets supplemented with a source of either carbohydrates, lipids, or proteins selected by

student teams. Response variables were selected by students, based on the hypothesized effects of these nutrients on the nutritional status and survival of the animals. Mass and size gain were the most often selected variables, and generally improved on the diets supplemented with sugars and proteins, including some types of proteins these herbivores have never been exposed to such as mycoproteins. Interestingly, many lipid supplements reduced feeding, and some fatty acids interfered with pupation. Students were taught to analyze data themselves with t -tests and χ^2 tests. Overall, this project received favorable reviews and required students to develop skills needed in scientific careers rather than memorization. We expanded the use of model organism-based research projects in introductory science courses and encourage their use throughout our institution and peer institutions in Georgia.

10:45 TEACHING ETHNOMATHEMATICS AND INDIGENOUS MATHEMATICAL KNOWLEDGE SYSTEMS THROUGH CULTURAL IMMERSION, Iman C. Chahine, Georgia State University, Atlanta, GA 30303. A handful of research has shown the importance of integrating cultural practices that resonate with students' ethnic and background experiences in everyday instruction. Particularly in teacher education courses, there has been an unprecedented focus on valorizing the use of community-based, culturally-oriented learning experiences in light of the diverse demographics that thrive in schools today. Notwithstanding the extensive literature that urged the utilization of cultural immersion experiences as means of increasing cultural sensitivity for students across disciplines, little effort has been documented about the usefulness of immersion for teaching mathematics. In this study, we explore the design and implementation of an immersion-based instructional model, a newly designed program that focuses on teaching an emergent field in mathematics called *ethnomathematics* through cultural immersion in indigenous contexts. The primary purpose of the program is to examine how different cultural groups interpret mathematical concepts in ways that are quite different from what we might expect from typical mathematical texts. During immersion, students engage in participative forms of inquiry investigating the ethnomathematical ideas that transpire in out-of-school settings. Throughout the program, students are encouraged to experiment with innovative ideas, to make their experimental thinking public and to develop new epistemologies that guide the teaching and learning of nonconventional mathematics. We argue that affording students the opportunities to participate in study abroad experiences can lead to significant gains in students' intellectual development and an enhanced awareness and respect for cultural diversity.

11:00 SUPPLEMENTAL PROBLEM-SOLVING SESSIONS AND THEIR IMPACT ON STUDENT SUCCESS IN THE INTRODUCTORY PHYSICS SEQUENCE, Julie Talbot, University of West Georgia, Carrollton, GA 30118. Optional supplemental problem-solving sessions have been offered for the Principles of Physics I and II courses for several semesters now. These sessions give students an extra opportunity to solve difficult physics problem in a cooperative-learning setting. Over the past three semesters, 122 students have taken the Principles of Physics I course. The number of D's, F's and Withdrawals (DFW rate) for those who attended the supplemental sessions regularly was 22.5%. The DFW rate for those who did not attend regularly was 74.5%. More recently, the supplemental sessions have been extended to the Principles II course. While there is less data available for the Principles II course, the same trend holds: the DFW rate for those who attended the supplemental sessions regularly was 20%. For those who did not attend regularly, the DFW rate was 43.8%. In both courses, the workshop has had a strong positive impact on student success.

11:15 FACULTY'S PERCEPTION OF THEIR PREPARATION TO TEACH IN AN ONLINE PROGRAM, Ollie Manley and Gladys Yarbrough, Georgia State University, Atlanta, GA 30303. A major change is occurring on college and university campuses around the world. These institutions are offering courses in an online format, and faculty are being asked to teach these in either a synchronous or asynchronous format. Faculty are reluctant to teach in an online format because they perceive that their preparation is inadequate, and many of them are unfamiliar with the software that is used to design and implement the courses. In this study e-mails were sent to the faculty in the College of Education at an urban university requesting their participation. Faculty members who agreed to participate were sent a survey. These surveys were distributed electronically with directions for responding to the forms. Faculty was given the option to decline participation in this study. The independent variables for this study are: Years of teaching experience and faculty rank. The dependent variable, faculty's perception of their preparation to teach in an online program was subdivided into three dependent variables: Content knowledge, instructional resources, and time required for course design and teaching. The results suggest that the respondents had similar views about on-line teaching as compared with traditional face-to-face teaching. Many of them prepared for the online courses in the same way in which they prepared for the traditional face-to-face courses. Respondents did not feel that the professional development provided for on-line training was sufficient and thought that the support should be on-going. In conclusion, the results confirmed the following: Technical support and professional development are still areas of concern for faculty who are now required to use new technologies in their teaching.

11:30 USING MULTIPLE INTERVENTION INSTRUCTIONAL SUPPORT IN PRECALCULUS CONCEPTS TO ADVANCE UNDERGRADUATE STUDENTS' SUCCESS IN CALCULUS, Iman C. Chahine and Mark Grinshpon, Georgia State University, Atlanta, GA 30303. While improving STEM (Science, Technology, Engineering, and Mathematics) education in the United States has been a critical national concern, the pipeline of students entering STEM does not meet the current demand for future scientists and engineers. One of the reasons identified for this attrition has been students' underperformance in calculus classes and their inadequate preparation in precalculus content. Hence, addressing this national need requires research and development of the best pathways to remediate the teaching of precalculus and calculus concepts, which would translate into efficient models of providing support to students in learning the content. The purpose of this research is to examine the effects of using multiple interventions *i.e.*, online assessment and learning modules in basic precalculus concepts on enhancing college students' performance in Calculus. This study employs Knowledge Space Theory (KST) as a theoretical and methodological framework to guide the analysis of performance on tests. Preliminary results of the research study showed positive correlation between students' knowledge of precalculus skills and their success in the Calculus course. This correlation emphasizes the need for development of efficient intervention models. We argue that a hybrid approach, combining online modules with tutoring sessions, has a potential for positive change in students' success in Calculus and other advanced mathematics courses.

Section VIII: Anthropology
Bailey Science Center, Room 2022
Susan Kirkpatrick Smith, Presiding

8:15 ENVIRONMENTAL ASSESSMENT OF VINEYARD MOUNTAIN TRAIL, ALLATOONA DAM ARMY CORPS OF ENGINEERS LAND, O. Pisano and W. Van Horne, Kennesaw State University, Kennesaw, GA 30144. Vineyard Mountain is located adjacent to the Allatoona Dam in Bartow County on land regulated by the Army Corps of Engineers. A publicly accessible trail is maintained at the site and the land has been protected from development since the creation of the dam. In May 2012 initial data for this study was collected as a project for ANTH 4430: Environmental Anthropology, a course taught at Kennesaw State University. This data was collected to inventory the flora of the site and to assess its ecological importance. This report provides an analysis of this data, identifying the ecological communities present at the site, their significance, and recommendations concerning land use. The study determined that while not necessarily rare, these ecological communities show just some of the richly diverse ecosystems that exist in Georgia and that this area should be reserved for light recreational use as well as educational purposes.

8:30 THE UTILITY OF REMOTE SENSING TECHNIQUES FROM THE DABBS SITE: A LOOK AT THE EFFICIENCY OF THE GROUND PENETRATING RADAR AND MAGNETOMETER**, J. Turner*¹, K. Smith*¹, S. Henry¹, T. Powis¹ and S. Skaggs², ¹Kennesaw State University, Kennesaw, GA 30144 and ²Georgia Southern University, Statesboro, GA 30458. The Dabbs Site, a multi-component village, located in Cartersville, Georgia, is situated within a mile of the Leake Site and two miles from the Etowah Indian Mounds. A preliminary geophysical survey was conducted at the site. Both Ground Penetrating Radar (GPR) and magnetometry were employed to locate possible features that could link all three sites together temporally. Excavation units were placed where anomalies were detected with both instruments. Groundtruthing of the anomalies have produced positive results. This paper focuses on the utility of using remote sensing techniques on the Dabbs Site to efficiently and more accurately locate features than traditional survey techniques such as surface collection and shovel testing.

8:45 “YEAH, BUT CAN IT KILL YOU?” UNDERSTANDING ENDOMETRIOSIS IN THE ATLANTA AREA, A. N. Day*, Georgia State University, Atlanta, GA 30302. This paper contributes to a growing body of literature on women with endometriosis, a gynecological condition in which a tissue similar to the endometrium, or lining of the uterus which is shed during menses, grows elsewhere in the body particularly in the pelvic cavity. This condition has been linked to many symptoms, including chronic pain, depression, anxiety, and infertility. Despite a growing body of medical literature on the disease, it is still not well known by the general population or fully understood by the medical community. Issues that still persist are that causation is still unknown, treatments are highly debated and contested, and that the doctor-patient relationship for women with this illness suffers greatly. This paper incorporates a biomedical understanding of endometriosis with Emma Whelan’s idea of these women as an epistemological community, Leon Anderson’s concept of analytic autoethnography, and the narratives of sufferers in Atlanta. The work primarily draws upon individual interviews, a focus group, and readings of medical and social science literature in order to better understand the illness, how women discuss it, experience it, and form communities around it. Findings show that women of dissimilar socioeconomic backgrounds approached and discussed the disease distinctively from one another with three phases; however, the three phases

of coping with this illness, the discovery, quest, and revelation phases, were present in all participants, no matter their background.

9:00 ULTRASTRUCTURAL INVESTIGATIONS FOR PALYNOLOGICAL EVIDENCE IN ARCHAEOLOGICAL MATERIALS: CALCULUS OF AN OLD KINGDOM MUMMY FROM ABYDOS, EGYPT**, I.H. Garrison* and A.S. Brown*, University of Georgia, Athens, GA 30602. In the spring of 2012, an archaeological sample consisting of three teeth from an Old Kingdom mummy, presumably from Abydos, Egypt, was successfully investigated in an attempt to isolate and analyze pollen and phytoliths possibly contained in the calculus (fossilized plaque) of the teeth. The samples were disaggregated and then analyzed using a University of Georgia (UGA) scanning electron microscope-energy dispersive spectrometer (SEM/EDS) at the UGA Center for Advanced Ultrastructural Research. It was determined that archaeopalynological samples can be recovered by employing these methods. A tentative identification of a pollen grain, isolated and imaged using the SEM/EDS, was returned as that of the grass *Poaceae*. To further corroborate and extend the initial study's results, a second round of investigation has been conducted using the protocols established in the initial study. With an eye towards refinement in the protocol, a 3Å thick gold coating was added to the samples to capture finite architectural detail while imaging with SEM/EDS to aid in more definitive identifications of pollen and phytoliths. It is hoped that these data will bear on regional paleoclimate and paleoenvironment, as well as increase archaeological data concerning early historic Egyptian agricultural society and social structures as seen through a dietary lens. This research has been made possible by UGA departmental funding.

9:15 PHYLOGENETIC RELATIONSHIPS BETWEEN THE UPPER MOLARS OF SAHELANTHROPUS TCHADENSIS AND LATE MIOCENE HOMINIDS AND HOMINIDS**, L.D. Lund* and F.L. Williams, Georgia State University, Atlanta, GA 30302. *Sahelanthropus tchadensis* is considered to be the earliest known hominid and a possible Last Common Ancestor (LCA) of the *Homo/Pan* divergence. There has been much debate surrounding the phylogenetic assignment of this taxon considering the implications of our understanding of human origins. The Toumaï fossil represents the only specimen of the taxon with only additional isolated teeth and no post-cranial skeletal material that has been found or assigned to the taxon. Toumaï exhibits characteristics that are both primitive and derived, which is likely of a possible LCA candidate that is temporally 7 mya and found in Chad. The purpose of this paper is to consider the phylogenetic relationships of *S. tchadensis* to extant and extinct hominoids and to hominids. Linear metric measurement comparisons of the upper molars between *S. tchadensis* and specific hominoids and hominids are currently unavailable. A Principal Component Analysis (PCA) was analyzed for statistical comparison of the mesiodistal metric measurements of the upper molars of *S. tchadensis*, *Gorilla gorilla*, *Pan troglodytes*, *Paranthropus robustus*, and *Australopithecus africanus* to analyze the size and shape differences for interpretation of phylogenetic relationships between the taxa. This analysis provides more data in support of *S. tchadensis* as a possible LCA of the *Homo/Pan* split exhibiting a mosaic of primitive and derived characters.

9:30 AGENCY AMONG THE SAVANNAH CULTURE 1100AD TO 1250AD: A SPATIAL ANALYSIS OF MISSISSIPPIAN BURIAL MOUND SITES ON THE GEORGIA COAST**, B. McCarley*, Georgia State University, Atlanta, GA 30303. During the Middle Mississippian period (1100AD-1250AD), the Savannah people began assembling conical burial mounds along the Georgia Coast. These settlement sites are mostly lost to the Live Oak hammocks and palmettos that span the Ogeechee and Savannah Rivers

from the coast to some 25 miles inland. By using LIDAR data, I have located three burial mounds in Bryan County, GA that have subsequently been identified as belonging to the Savannah people-- identified through the ceramic complex known as the Savannah Complex. Past archaeological research of surrounding Savannah settlements reveal anomalous settlement patterns associated with river swamps. But why did the Savannah people choose swamps rather than pristine creeks or rivers? By taking the data found at my site in Bryan County and plotting it on a map along with other similar sites in the region, agency becomes clear as we will see a methodical pattern of settlement, brought on, perhaps by a new sense of self or embodiment among these late prehistoric people.

9:45 MEASURING POST-INUNDATION EROSION OF ARCHAEOLOGICAL SITES IN LAKE OCONEE - TWO CASE STUDIES, T.J. O'Connor*, University of Georgia, Athens, GA 30602. Georgia has a mottled history with the damming of rivers for hydroelectric power and water reservoir creation. Inundation has left the terrestrial sites of Dyar Mound (9Ge5) and the Joe Bell (9Mg28) exposed to fluctuating water levels in Lake Oconee. Various erosional and lacustrine processes have taken their toll for the past 35 years. In some cases these forces can increase site preservation, but they can also lead to artifact destruction and displacement. Therefore, conservation of these inundated sites requires new parameters for site distribution and new definitions of site size in order to correctly identify the preserved sections. Using a comparative approach, pre-inundation levels of artifact and site conservation were ascertained through the interviews, photographs and reports. Then, coring, sediment analysis, systematic survey and collection established the effect of erosion and inundation on modern conservation levels. By comparing pre and post-inundation conservation levels, an idea of the level of impact on these sites can be postulated. These sites do not need to be written off because they are underwater. Erosion is taking a large toll on these sites, but based on my research, I conclude that these sites still contain valuable information. New methods for future site stabilization of underwater terrestrial cultural resources. This will help to establish the specifications of conservation methods for the mitigation of the detrimental impact caused by inundation.

10:00 **Section Business Meeting**

10:30 THE ETHICAL TREATMENT OF HUMAN REMAINS IN THE MUSEUM CONTEXT, S. J. Roberts*, Kennesaw State University, Kennesaw, GA 30144. How the dead and their bodily remains should be treated is a point of contention between many stakeholders, including scientists, descendants, and the public, sometimes involving clashing world views. One of the places many human remains have come to rest- and is therefore a point of interest to the stakeholders- is the museum. This paper examines multiple values of human remains: informational, cultural, and educational, and how the museum brings these values together and is a place where human remains should be treated with respect. The right attitude, training, and willingness of the museum professionals is required to have higher standards for treatment of human remains, but it is the interaction and collaboration between professionals, descendants, and the public, as seen in the museum context, that makes truly respectful treatment possible.

10:45 PRELIMINARY RESULTS OF INTENSIVE ARCHAEOLOGICAL SURVEY AT THE LINCOLN TRAIL SITE (9BN17) IN BRYAN COUNTY, GEORGIA**, R.O. Sipe*. The Lincoln Trail site (9BN17) is an Irene phase (AD 1350-1580) village located in southeastern Bryan County, Georgia within the Richmond Hill Wildlife Management Area. Prior surface survey (ca. 1973, 2010) indicated an extensive artifact scatter and complex of shell middens in a marsh-edge environment, yet little was known of the site's

nature and no subsurface survey was conducted. In July 2012 the author led a Georgia Southern University archaeological field school to determine the site's boundaries, identify areas of artifact concentration, and to evaluate the overall importance of the site. The site was systematically shovel tested, revealing numerous middens, intact cultural features, and an overall site size that measured 1,300 meters (north-south) by 450 meters (east-west). As a largely intact Irene phase village, Lincoln Trail has great potential to expand our understanding of Late Mississippian period life on the Georgia coast.

11:00 POPULATION CORRELATION: SITE SIZE IN THE MEWAR PLAIN, NORTHWEST INDIA**, C. Syfrett, Kennesaw State University, Kennesaw, GA 30144. Archaeologists continuously debate what methods should be used to determine demographics of archaeological sites. It has been hypothesized that some Chalcolithic (c. 3000-1700 B.C.E.) sites within the Mewar Plain of northwest India were heavily populated based on the size of the occupied land area. However, systematic studies have not yet been done in the Indus and the Ahar Banas cultural complexes to accurately assess this correlation. Using site size and population data from modern villages and continuously occupied habitation mounds, this paper will develop a model for estimating demographics of archaeological sites.

11:15 MAN OR MOUNTAIN? COMPARING CONSTRUCTED AND GEOGRAPHIC DEFENSES IN RAJASTHAN, INDIA**, D. Balinger, Kennesaw State University, Kennesaw, GA 30144. Medieval (Middle) Period fortresses and city walls in Rajasthan, India defended the citizens and their kings within, and many still remain standing today. Drawing from recent exploration and observation of gateways, walls, waterways, construction methods, and natural barriers this paper will compare the geographical and constructed defenses of these fortifications. The study will focus on the fortresses of Kumbhalgarh, Chittorgarh and the city of Udaipur to evaluate how they were defended and how they were breached.

POSTERS

DENTAL MICROWEAR ANALYSIS OF THE LA CAPILLA DEL NINO SERRATINO SITE OF EARLY-CONTACT PERIOD PERU, K. T. Brooks*¹, F.L'Engle Williams¹, B.L. Turner¹ and H.D. Klaus², ¹Georgia State University, Atlanta, GA 30303 and ²Utah Valley University, Orem, UT 84058. Dental microwear analysis using low-magnification stereomicroscopy was conducted on a subset of the burial population (n=17) of the La Capilla del Nino Serratino of the La Capilla Santa Maria Magdalena de Eten site in the Lambayeque Valley of Peru dated from the late pre-contact to early contact period. This analysis revealed a substantial number of fine scratches and smaller pits, indicating a diet predicated on grasses, and foods with fracture resistant particles. However, only a limited degree of heavy use-wear features were observed indicating that the individuals examined did not exhibit extremes in hard-object consumption. Linear regression of fine scratches and coarse scratches show a significant relationship ($p = 0.014$), but no other pair-wise combination of features show statistical significance. A cluster analysis including all pits and all scratches shows a single outlier (individual 136); additionally two others (133 and 146) are distinct from the cluster containing all other individuals. Results of the dental microwear analysis are compared to previous oxygen and carbon stable isotope analyses of bone and tooth enamel carbonate of the same individuals to further reconstruct the dietary proclivities in this late pre-contact to early contact population.

RECONSTRUCTING THE DIETARY BEHAVIORS OF *PARAPAPIO JONESI* FROM THE STERKFORTEIN AND SWARTKRANS CAVES OF PLIO-PLEISTOCENE SOUTH AFRICA USING DENTAL MICROWEAR, C.J. Garland* and F.L. Williams, Georgia State University, Atlanta, GA 30303. Dental microwear has become an effective tool to reconstruct paleoecology and the dietary behaviors of extinct primates. To determine whether any temporal changes occurred in the dietary behavior of the extinct baboon, *Parapapio jonesi*, dental microwear traits were examined from the South African sites of Sterkfontein and Swartkrans using a low-magnification stereomicroscope. The specimens included *P. jonesi* (n=5) from Sterkfontein Member 4 and *P. jonesi* (n=5) from Swartkrans Member 1. For comparative purposes, the dental microwear features of the extant *Papio ursinus* (n=5) were also observed and recorded. The results indicate that *Pp. jonesi* had a mixed diet at Sterkfontein, most likely consisting of fruit and underground storage organs (USO's). This is evident in the high pit count and low scratch count and is consistent with previous isotopic analyses and paleoecological reconstructions. However, dental microwear features of *Pp. jonesi* from the Swartkrans site indicate a mixed diet with the incorporation of more grassland components, evident by a slightly lower frequency of pits and a higher frequency of fine scratches. These results are not consistent with isotopic evidence, which indicates a diet consisting of less C4 foods at Swartkrans in comparison to Sterkfontein. However, this contradiction may possibly result from *Pp. jonesi* exploiting more C4 USO's at Sterkfontein.

ANALYSIS OF PUNCTURE PIT POSITION AND USE WEAR IN PRIMATES FROM LIGHT MICROSCOPY OF DENTAL MICROWEAR FEATURES**, M.A. Sams* and F.L. Williams, Georgia State University, Atlanta, GA 30303. Puncture pits have been associated with seed and hard object predation in primates (Godfrey *et al.*, 2004) and in other mammals (Semperebon *et al.*, 2004), but the relationship between puncture pits and other dental microwear features has never been fully addressed. The focus of this study is to identify patterns of use wear features associated with puncture pits independent of taxon. The South African fossil primates from circa two million years ago are sampled because of their excellent preservation. Differences in ecological settings are inferred for the Pliocene cave of Sterkfontein and the Pleistocene cave of Swartkrans, providing two distinct habitats and presumably dietary proclivities for the four genera examined, *Australopithecus* (Hominini), *Papio* and *Parapapio* (Papionini) and *Cercopithecoides* (Colobinae).

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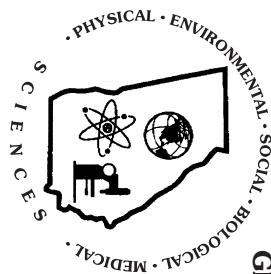
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