

**GEORGIA JOURNAL OF SCIENCE**


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OFFICE OF THE PRESIDENT

February 21, 2005

Dear Georgia Academy of Science Members:

Welcome to Gordon College. It is our privilege to host the 82nd annual meeting of the Georgia Academy of Science.

Gordon College has a beautiful campus with state-of-the-art facilities that I hope will make this year's meeting a memorable one for you. If possible, I suggest that you also explore Barnesville and the surrounding area while you are here. There are many nice restaurants and quaint businesses in our community.

I hope you enjoy your time here and will visit us again.

Sincerely,

Lawrence V. Weill  
 President



## GAS President's Comments and Report from the Academy Council

Well, I can't believe it, but we are at the end of my tenure as President. I have thoroughly enjoyed serving the Academy and getting to know so many of you more personally. Thank you for your participation and support over the past year. Additionally, I would like to thank all of those members that helped plan such a great Annual Meeting. I am confident that this year's meeting is going to be a great one. I hope to see you all there.

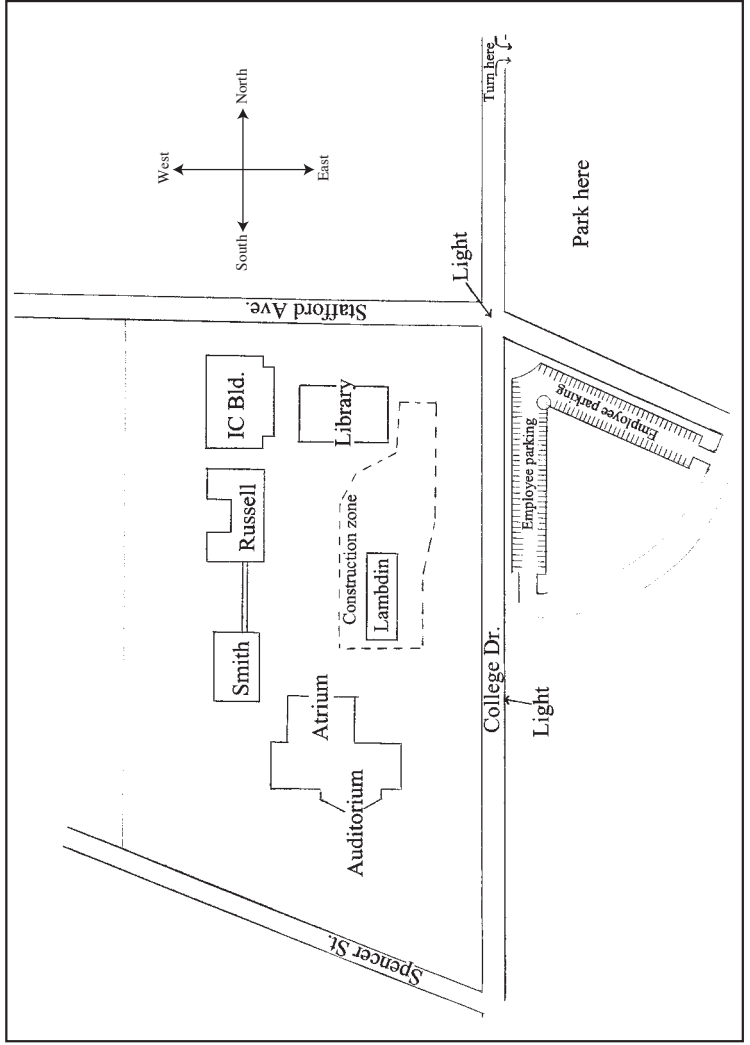
In closing, I would like to remind you of some of the most important efforts of this year's Council. Please do your part to help increase membership numbers by actively promoting the Academy whenever possible (departmental meetings, university meetings, presentations, speaking with your students, etc.). If you need help, use the GAS web site as a tool. Additionally, please consider running as a section leader or council member in the future, & voice your willingness to serve. Also, please get involved with planning the next annual meeting, if you are interested. And lastly, if you have ideas of projects that the council needs to address, please contact a council member.

Have a wonderful time at the meeting & I hope to see you all return next year!

Cynthia S. Mayer, President



### Gordon College Map



**GEORGIA ACADEMY OF SCIENCE  
 EIGHTY-SECOND ANNUAL MEETING  
 GORDON COLLEGE  
 BARNESVILLE, GA  
 APRIL 1-2, 2005**

### PROGRAM

#### FRIDAY, APRIL 1, 2005

- 11:00-12:00 COUNCIL MEETING (Academy members welcome)  
IC-205
- 12:40 PRESIDENT'S WELCOME  
IC-321
- 12:00-5:00 REGISTRATION AND EXHIBITS  
IC- First floor lobby
- 1:00-5:00 PAPER PRESENTATIONS: Sections I, II, III, IV, and V  
IC - See the following list of presentations
- 2:00-5:00 POSTER DISPLAY  
IC - Second floor lobby
- 5:30-7:00 PRESIDENT'S RECEPTION  
Russell Hall Lobby
- 7:30-9:00 DEMONSTRATIONS OF SCIENCE  
Gordon College Faculty

**FRIDAY PAPER PRESENTATIONS**

\*Denotes student presenter

\*\*Denotes student "in progress" research

**Section I: Biological Sciences****IC - 318****Mark S. Davis and Terry D. Schwaner, Presiding**

- 1:00 CANINE DISTEMPER VIRUS IN SOUTHWEST GEORGIA RACOONS\*\*, Krista A. Cox\* and J. Mitchell Lockhart
- 1:15 *TRYPANOSOMA CRUZI* IN SOUTHWEST GEORGIA OPOS-SUMS\*\*, Jessica L. Gillis\* and J. Mitchell Lockhart
- 1:30 *TRYPANOSOMA CRUZI* IN SOUTHWEST GEORGIA RAC-COONS\*\*, Berrien Waters\* and J. Mitchell Lockhart
- 1:45 DETECTION OF THE CAUSATIVE AGENTS OF LYME DIS-EASE, EHRlichiosis, AND STARI IN INDIVIDUAL SOUTH-ERN BLACK-LEGGED TICKS COLLECTED FROM WHITE-TAILED DEER OF THE PIEDMONT NATIONAL WILDLIFE REFUGE\*\*, Joshua Ellis\*, Melissa Harrison, Jackie Delash, Brian Sparks, Green Berry Starnes, IV, and Alan F. Smith
- 2:00 THE INCIDENCE OF THE CAUSATIVE AGENTS OF LYME DISEASE, STARI, AND EHRlichiosis IN MALE LONE STAR TICKS COLLECTED FROM FIVE MIDDLE GEORGIA COUN-TIES\*\*, Melissa Harrison\*, Jackie Delash, Green Berry Starnes, IV, Brian Sparks, and Alan F. Smith
- 2:15 PRELIMINARY STUDY OF TREE DISTRIBUTION PATTERNS AND DIVERSITY IN A TROPICAL DRY DECIDUOUS FOR-EST OF YUCATAN, MEXICO, A. Rachel Prakash\*, Jeffrey Pittman, and Paula C. Jackson
- 2:30 POPULATION GENETICS OF GOPHER TORTOISES AT MOODY AIR FORCE BASE, GEORGIA\*\*, David I. Mederos\*, John F. Elder, Gregory Lee, and J. Mitchell Lockhart
- 2:45 ANALYSIS OF BODY SHAPE VARIATION OF RELATED TAXA OF *HYBOPSIS* (*CYPRINIDAE*) USING DISTORTION COORDINATES\*\*, P. Faith Owens\*, Christopher E. Skelton, and William P. Wall
- 3:00 **Break**

- 3:15 THE USE OF ARTIFICIAL SUBSTRATE TO STUDY THE COLONIZATION PATTERNS OF MACROINVERTEBRATES IN A MIDDLE GEORGIA STREAM\*\*, Chris Pace\*, Joshua Ellis, Brian Sparks, Katie Smith, and Alan F. Smith
- 3:30 EFFECTS OF NANO-SIZED PARTICLES OF COPPER OXIDE (CuO) ON *SELENASTRUM CAPRICORNUTUM* (CHLOROPHYTA), A. E. Sanford\*, J. A. Nienow, and T. J. Manning
- 3:45 FRESHWATER MUSSELS (*UNIONIDAE*) OF THE LITTLE OCMULGEE RIVER SYSTEM, GEORGIA\*\*, Brooke N. Hawk\*, Christopher E. Skelton, and C. Nathan Webb
- 4:00 A SURVEY OF THE BATS OF BALDWIN COUNTY, CEN-TRAL GEORGIA\*\*, Michael Bender\* and Dennis Parmley
- 4:15 DISTRIBUTION OF DRAGONFLIES (*ANISOPTERA*) IN BALDWIN COUNTY, GEORGIA, Stephen R. Parrish\*
- 4:30 PRELIMINARY ASSESSMENT OF THE FRESHWATER MUS-SEL FAUNA (*UNIONIDAE*) OF THE BROAD RIVER SYSTEM, GEORGIA\*\*, Stephanie S. Westmoreland\* and Christopher E. Skelton
- 4:45 REVERSE GENETICS MADE AVAILABLE TO UNDER-GRADUATES: TILLING THE *DET2* GENE\*\*, Emily Deanna Salman\* and Ryan Becker

**Section II: Chemistry****IC - 417****Kenneth Martin, Presiding**

- 2:30 PHOTOCHEMICAL PROPERTIES OF NON-BENZENOID TETRASUBSTITUTED PORPHYRINS, Mark Wehunt\*, Amber Everett, Adegboye Adeyemo, and James LoBue
- 2:45 PHOTOCHEMICAL PROPERTIES OF SUBSTITUTED TETRAPHENYL PORPHYRINS, Amber Everett\*, Mark Wehunt, Adegboye Adeyemo, and James LoBue
- 3:00 **Break**



- 3:15 PHYTOCHEMICAL INVESTIGATION OF *SARGASSUM FLUITANS*, Delicia L. Emanuel\*, J. Richard Carter, James A. Nienow, and James T. Baxter
- 3:30 REDUCTION OF KETONES IN SOLUTION AND ON DRY SILICA, Flynt Goodson\*, Giso Abadi, and John T. Barbas
- 3:45 SIMPLE AND SPEEDY SYNTHESIS OF POLY(*p*-PHENYLENE ETHYNYLENE)S USING ACETYLENE GAS, Kevin P. Gwaltney, Kimberly A. Kellett, Daniel R. Durham, Igal Maasen, James M. Gilbert, and Uwe H. F. Bunz

**Section III: Earth and Atmospheric Science**  
**IC - 421**  
**Mark Groszos, Presiding**

- 2:00 A PRELIMINARY ANALYSIS OF AN EOCENE FOSSIL FAUNA FROM THE IMERYS SHEPPARD MINE, WASHINGTON COUNTY, GEORGIA\*\*, Joseph W. Sheffield\*, Alfred J. Mead and Bob J. Pruett
- 2:15 A PRELIMINARY DESCRIPTION OF THE PLEISTOCENE HERPETOFAUNA FROM CLARK QUARRY, BRUNSWICK, GEORGIA\*\*, Joshua L. Clark\*, Kelly A. Clark\*, Alfred J. Mead, Dennis Parmley and Robert A. Bahn
- 2:30 *BISON LATIFRONS (ARTIODACTYLA)* FROM THE PLEISTOCENE OF BRUNSWICK, GEORGIA, Robert A. Bahn\* and Alfred J. Mead
- 2:45 OCHNA LIKE FRUIT FROM THE PALEOCENE OF NORTH DAKOTA, Mark A. Brewer\*, Melanie L. DeVore and Kathleen B. Pigg
- 3:00 **Break**
- 3:15 MAPLE FRUITS FROM THE PALEOCENE OF NORTH DAKOTA, Alex Kittle\*, Melanie DeVore, Bill Wall and Kathleen Pigg
- 3:30 ENVIRONMENTAL SCANNING ELECTRON MICROSCOPY AS A TOOL TO EVALUATE MODERN AND FOSSIL MICROBIAL TAPHONOMY, Phillip M. Cole\* and Julie K. Bartley



**Section IV: Physics, Mathematics,**  
**Computer Science And Technology**  
**IC - 321**

**A. Lazari, Presiding**

- 2:00 SYSTEMATIC ERRORS IN THE EXPERIMENTAL MEASUREMENT OF THE CHARGE TO MASS RATIO OF THE ELECTRON, Zade J. Coley, George E. Keller and James C. Espinosa.
- 2:15 ACOUSTIC FIRE CONTROL IN MICROGRAVITY\*\*, Zade Coley, Matt Herron, Elizabeth Nelson, Dmitriy Plaks, and James Espinosa.
- 2:30 A RETARDED CORRECTION TO **NEWTON'S LAW OF GRAVITY**, Gary Hunter, James Espinosa, and Julie Talbot.
- 2:45 USING *MATLAB* TO SIMULATE THE DYNAMICS OF A THREE BODY SYSTEM, Heidi L. Lesser, and J. E. Hasbun.
- 3:00 SIMPLIFIED WATER BALLOON LAUNCHER, L. Andrew Block and J. E. Hasbun.
- 3:15 THE EXPERIMENTAL VERIFICATION OF THE *DE BROGLIE HYPOTHESIS*, Gary L. Hunter, George E. Keller, and James C. Espinosa.
- 3:30 A COMPARISON OF THE ELECTRIC BREAKDOWN PROCESSES IN WATER AND HEAVY WATER\*\*, Dmitriy Plaks and James Espinosa.
- 3:45 SIMULATION OF  $m$  ELECTRONS INTERACTING WITH  $n$  IMPURITIES IN AN EXTERNAL ELECTRIC FIELD IN NANODEVICES, Max F Perkins and J. E. Hasbun.
- 4:00 COMPUTERIZED UNDERDAMPED HARMONIC OSCILLATOR EXPERIMENT, Clayton W. Huff, and J. E. Hasbun
- 4:15 USING WELL KNOWN PROBABILITY DENSITY FUNCTIONS IN CALCULUS, Stacey Pittman, and Andreas Lazari





**Section V: Biomedical Sciences  
IC - 410**

**Pamela Moolenaar-Wirsiy, presiding**

- 1:00 NEW METHODS FOR VACCINE DESIGN AND EVALUATION AGAINST *CHLAMYDIA*. Joseph U. Igietseme\*, Francis Eko, Qing He, Godwin Ananaba, Teresa Brown, Claudiu Bandea, Godwin Ifere, Deborah Lyn and Carolyn M. Black, National Center for Infectious Diseases, CDC, Atlanta GA 30333 and Morehouse School of Medicine, Atlanta, GA 30310.
- 1:30 ISOLATION, PURIFICATION & CHARACTERIZATION OF ANTI-STENOTROPHOMONAS MALTOPHILIA IMMUNOGLOBULINS \*\* Freeman Smalls<sup>1</sup>, D.L. Scott<sup>2</sup>, E. Archibold<sup>2</sup>; <sup>1</sup>Clark Atlanta University Atlanta, GA 30314, <sup>2</sup>Biotechnology, Atlanta, GA 30314 and Morehouse College, 30314.
- 2:00 *TRYPANOSOMA BRUCEI* INFECTION MODULATES APOPTOTIC GENES AND GENE PRODUCTS IN THE MOUSE SPLEEN\*\*, Eric B. Darrington, Dennis Spencer, Ikowa Irune, and Jonathan K. Stiles
- 2:30 THE EFFECT OF ESTROGEN ON *CHLAMYDIA* INFECTION AND CHEMOKINE EXPRESSION\*\*, Erika L. Barr, Tesfaye Belay, Frances O Eko, Joseph Igietseme, and Godwin Ananaba
- 3:00 MAXIMAL CEREBELLAR EXPRESSION OF CYTOKINES AND ADHESION MOLECULES IN FATAL PEDIATRIC CEREBRAL MALARIA\*\* Henry Armah, Alfred K. Doodoo, Edwin K. Wiredu, Andrew A. Adjei, Richard K. Gyasi, Yao Tettey and Jonathan K. Stiles
- 3:30 IMMUNOHISTOCHEMICAL EVALUATION OF CASPASE 9 IN ORAL CANCER, Baldev Singh, J. Borke and R. Abdelsayed
- 4:00 EXPRESSION AND FUNCTIONAL ROLE OF RANTES CHEMOKINE IN MALARIA, Bismark Y. Sarfo, R. K. Gyasi, A. A. Adjei, H. Armah, I. Irune, A. Quarshie, J. W. Lillard Jr and J.K. Stiles



**SATURDAY, APRIL 2, 2005**

- 7:30-10:30 REGISTRATION  
IC - First floor lobby
- 7:30-12:00 PAPER PRESENTATIONS AND POSTER DISPLAYS  
Paper presentations: IC - 3<sup>rd</sup> and 4<sup>th</sup> floors  
Poster displays: IC - Second floor lobby
- 10:00-10:30 SECTION BUSINESS MEETINGS  
IC - 3<sup>rd</sup> & 4<sup>th</sup> floors
- COFFEE BREAK  
IC - First floor lobby
- 12:00 ACADEMY LUNCHEON, PLENARY SESSION AND SPEAKER  
*Atrium and auditorium*
- FIELD TRIPS AFTER  
Field Trip to the Old Jail Museum - leave from auditorium



**SATURDAY PAPER PRESENTATIONS**

\*Denotes student presenter

\*\*Denotes student "in progress" research

**Section I: Biological Sciences****IC - 318****Mark S. Davis and Terry D. Schwaner, Presiding**

- 7:30 CORRELATION OF SEX, AGE, AND BODY MASS WITH HOOF SIZE IN WHITE-TAILED DEER FROM THE PIEDMONT WILDLIFE REFUGE, GEORGIA, Ben Batchelor\* and Alfred J. Mead
- 7:45 A PRELIMINARY ASSESSMENT OF DIVERSITY AMONG SELECTED TAXA OF *DYTISCIDAE* USING MANDIBULAR MORPHOLOGY AND GEOMETRY, Christy C. Cecil\*, W. P. Wall, and E. H. Barman
- 8:00 A COMPARATIVE ANALYSIS OF THE LARVA OF *RHANTUS CALIDUS* (FABRICIUS) (*COLEOPTERA: DYTISCIDAE*), B. R. Lemieux\*, E. H. Barman, and B. P. White
- 8:15 A PRELIMINARY REPORT ON THE MANDIBULAR MUSCULATURE OF THE MATURE LARVA OF *THERMONECTUS BASILLARIS* (HARRIS) (*COLEOPTERA: DYTISCIDAE: ACILIINI*) AS A CONSEQUENCE OF STEMMATAL ENLARGEMENT, Angeline Mouton\*, W. P. Wall, and E. H. Barman
- 8:30 AN ANALYSIS OF VARIATION IN LATERAL CRANIAL ARCHITECTURE OF RELATED TAXA OF *DYTISCIDAE* (*COLEOPTERA*) USING DISTORSION COORDINATES (CARTESIAN TRANSFORMATIONS), Shannon N. Shepley\*, W. P. Wall, and E. H. Barman
- 8:45 BEAVER (*CASTOR CANADENSIS*) IMPACTS ON PLANT COMMUNITIES IN SOUTHERN GEORGIA\*\*, Jessica R. Brzyski\*
- 9:00 DETERMINING THE PREVALENCE OF *TRYPANOSOMA CRUZI* IN THE BALDWIN COUNTY, GEORGIA, POPULATION OF OPOSSUMS (*DIDELPHIS VIRGINIANA*) USING POLYMERASE CHAIN REACTION\*\*, Emily Parrish\*, H. Reed, D. Bachoon, and A. Mead

- 9:15 REINTRODUCTION OF FIRE IN A LONG-UNBURNED MOUNTAIN LONGLEAF PINE FOREST – IMPACTS ON FINE ROOT AND MYCORRHIZAL DYNAMICS\*\*, Brianna E. Bennett\*, and J. J. Hendricks
- 9:30 CARBON SOURCE AND SINK CONTROLS ON MYCORRHIZAL FUNGI PRODUCTION IN A LONGLEAF PINE FOREST, Stephanie E. Sims\*, and J. J. Hendricks
- 9:45 THE OCCURRENCE AND DISTRIBUTION OF *HETERANDRIA FORMOSA* (*TELEOSTEI, POECILIIDAE*) IN LOWNDES COUNTY, GEORGIA, Jason C. Chaney and David L. Bechler
- 10:00 **Section Business Meeting**
- 10:30-12:00 Poster Session

**POSTERS****IC- Second floor lobby**

\*Denotes student presenter

\*\*Denotes student "in progress" research

- DIEL PATTERNS OF INVERTEBRATE DRIFT IN A MIDDLE GEORGIA STREAM, Andrew Bigham, Melanie A. Hall\*, and Diana Turner
- A PRELIMINARY ANALYSIS OF THE RELATIONSHIP BETWEEN NUTRIENT LEVELS AND RELATIVE ALGAL ABUNDANCE IN MIDDLE GEORGIA LAKES AND PONDS\*\*, Jenniffer Corriea, Gypsy Long, Emily Salman\*, and Emily Woodard
- GENETIC VARIATION IN FOUNDER POPULATIONS OF THE MEDITERRANEAN GECKO, *HEMIDACTYLUS TURCICUS*, ACROSS THE SOUTHERN UNITED STATES\*\*, Ashleigh DeVries\* and Terry D. Schwaner
- ISLAND BIOGEOGRAPHY ON THE SCALE OF A POND ECOSYSTEM\*\*, Kelly Floyd, Annie Harris, Kyle Hunt\*, and Sara Noone
- INGESTION RATES OF FIVE SPECIES OF PACIFIC ECHINODERM LARVAE FED NATURAL AND ARTIFICIAL DIETS, Colleen A. Fox\* and Sophie B. George
- NUCLEOTIDES AFFECT REPRODUCTIVE OUTPUT AND LARVAL DEVELOPMENT OF THE SEA URCHIN *LYTECHINUS VARIEGATUS*, Sophie B. George, J. M. Lawrence, and Addison Lawrence

DIATOM DIVERSITY IN ENRICHED AND NON-ENRICHED MICROCOSMS FROM A MIDDLE GEORGIA POND\*\*, Marisa Hadley\*, Christina Schmidt, Kassie York, and Cavina Anderson

NEUROGENESIS IN RESPONSE TO PHOTO-STIMULATION IN CRAYFISH (*PROCAMBARUS CLARKII*) DEUTOROCEREBRUM\*\*, Ihunanya C. Mbata\*, Barry K. Rhoades, and Wanda T. Schroeder

A POPULATION OF *CYPRIPEDIUM ACAULE* (PINK LADYSLIPPER) AT KENNESAW STATE UNIVERSITY, A. Rachel Prakash\* and H. D. Sutton

LARVAL DENSITY AFFECTS GROWTH AND DEVELOPMENT OF THE SEA URCHIN *LYTECHINUS VARIEGATUS*. (ECHINODERMATA: ECHINOIDEA), Carla A. Terry\* and Sophie B. George

GENETIC VARIATION IN MAINLAND AND ISLAND POPULATIONS OF THE GREEN TREE FROG, *HYLA CINEREA*, IN THE SOUTH CAROLINA LOW COUNTRY, Adam White\*, Brandon Pinson\*, and T. D. Schwaner

EFFECTS OF SUBSTRATE AND TEMPERATURE ON AFLATOXIN PRODUCTION OF *ASPERGILLUS FLAVUS* AND *ASPERGILLUS PARASITICUS* IN PEANUTS, Premila Achar and Andres Sanchez, Kennesaw State University, Kennesaw, GA 30144.

THE INFLUENCE OF ELEVATION ON STOMATA DENSITY, Kamal Aderibigbe, Kimberly Bollinger\*, Lesli Duvall\*, Gayla, Prince\*, and Mark Davis, North Georgia College & State University, Dahlonega, GA 30597.

PREDATION ON APOSEMATIC AND NON-APOSEMATIC SNAKE REPLICAS IN NORTHERN GEORGIA, Brandi Barrett, Brandi Owen\*, Angela Pastore, Kyle Wilbanks\*, and Mark Davis, Department of Biology, North Georgia College & State University, Dahlonega, GA 30597.

**Section II: Chemistry**  
**IC - 417**  
**Kenneth Martin, Presiding**

9:00 POSTER SESSION (Posters will be on display from 9:00 a.m. to 12:00 p.m.)

10:00 **Section business meeting**

10:45 STEPPING OFF THE STAGE: STUDENT CENTERED LEARNING IN THE CHEMISTRY CLASSROOM, Andrew R. Bressette

11:00 THE EVOLUTION OF THE RESEARCH EXPERIENCE FOR UNDER-GRADUATES IN THE CHEMISTRY DEPARTMENT OF BERRY COLLEGE FROM 1974 TO 2004, Larry G. McRae

11:15 USING *SPARTAN* TO EXPLAIN SPLITTING OF *D* ORBITALS IN VARIOUS CRYSTAL FIELDS, Kenneth L. Martin

11:30 INTERACTIVE VISUAL LEAST SQUARES METHOD WITH EXCEL PROGRAM, Myung-Hoon Kim and Michelle Song Kim

**POSTERS**  
**IC -Second floor lobby**

EVALUATION OF THE VISCOSITY OF OKRA GUM WITH THE ADDITION OF FRUCTOSE OR SUCROSE, Jasmine M. Cook\*, Sarah N. Bryl, Paul F. Cerpovicz, and Joelle E. Romanchik-Cerpovicz

THE SYNTHESIS OF LACTONES VIA BAEYER-VILLIGER OXIDATION BY MICROWAVE AND SOLID-STATE SYNTHESIS, Mayisha Ealey\* and Nripendra Bose

A SPETROSCOPIC STUDY OF ELECTROLYTE EFFECTS ON ALPHA-CRYSTALLIN CONFIGURATION\*\*, Kamika Felder\*, Candis Mayweather\*, and Lisa Hibbard

SYNTHESIS, CHARACTERIZATION AND LUMINESCENCE STUDIES OF LANTHANIDE(III) COMPLEXES\*\*, Zewdu Gebeyehu, Hirofumi Motegi\*, and David E. Zelmon

MOLECULAR MODELING STUDIES OF CONFORMATIONALLY CONSTRAINED ANALOGS OF MEFLOQUINE, Al M. Panu and Shylah Kirch\*

SYNTHESIS OF 2,7-DISUBSTITUTED-3-((E/Z)-PENTA-2,4-DIENYL) QUINOLINE-4-CARBOXYLIC ACID, Al M. Panu, Bhavin Patel\*, and Madeleine Ndomo\*

COMPARISON OF FATTY ACID LIGANDS IN HUMAN HNF4- ACTIVITY AND ITS ROLE IN DIABETES\*\*, Allen Stokes\* and Karen Duda

**Section III: Earth and Atmospheric Science**  
**IC - 421**  
**Mark Groszos, Presiding**

8:30 A WATER QUALITY TREND STUDY OF THE YAHOOOLA CREEK RESERVOIR AND ITS TRIBUTARIES, Jason Ryncarz\* and Robert Fuller





- 8:45 THE AFFECT OF STORMS ON WATER QUALITY OF STREAMS OF WEST GEORGIA.\*\* Eric G. Phillips\* and Curtis L. Hollabaugh
- 9:00 SEDIMENTATION IN VESICLES; INTERPRETATION OF GEOPETAL FABRICS IN AMYGDALOIDAL AGATES\*\*, Jake L. Holloway\* and Timothy M. Chowns
- 9:15 **Break**
- 9:30 THE MINERAL HERITAGE PROJECT – A CALL TO ACTION TO PRESERVE MINERAL OCCURANCES IN THE STATE OF GEORGIA, David Babulski
- 9:45 A UNIQUE OPEN FRAME GIMBAL VARIATION OF THE MICROSCOPE UNIVERSAL STAGE FOR USE WITH MINERAL PHOTOMICROGRAPHY AND MINERAL ANALYSIS, David Babulski
- 10:00 **Section Business Meeting**
- 10:30 TEMPORAL VARIATION OF LEACHABLE METALS IN COASTAL SOILS OF GEORGIA, Gian S. Ghuman, S. Paramasivam, and Kenneth S. Sajwan
- 10:45 CLIMATIC IMPLICATIONS OF 52 YEARS OF ICE-MARGIN LOSS IN SELECTED GLACIERS OF THE BEARTOOTH PLATEAU IN SOUTH-CENTRAL MONTANA, Edward E. Chatelain
- 11:00 LINKING ENVIRONMENTAL SCIENCE AND GLOBAL ISSUES EMPLOYING READING, WRITING, REEFS, ROCK IGUANAS AND RUM, Beth Rushing, Dwight Call and Melanie DeVore
- 11:15 PHOTO-MOSAICS AND PHOTO CLUSTERS-WIDENING THE HISTORICAL GEOLOGIST'S WINDOW INTO THE PAST, Edward E. Chatelain and Cecilia S. Barnbaum
- 11:30 A NEW WINDOW INTO VALDOSTA STATE UNIVERSITY'S VIRTUAL FOSSIL MUSEUM, Edward E. Chatelain and Cecilia S. Barnbaum



**POSTERS**  
**IC - Second floor lobby**

- DESIGN OF A THERMOCOUPLE-BASED SOIL THERMOMETER, Richard P. Faucett and Eric C. Brevik
- GEOMORPHIC CHANGES TO BARRIER ISLANDS NEAR PENSACOLA DUE TO HURRICANE IVAN, Katrina M. Pate, Eric C. Brevik, and Paul C. Vincent
- A WATER QUALITY SURVEY OF THE WHITEWATER CREEK WATERSHED, MACON AND TAYLOR COUNTIES, SOUTHWEST GA\*\*, Tara Peavy, Ian Brown, Harold Harbert, William Tietjen and Thomas Weiland
- CARBON SEQUESTRATION IN LAKE LOUISE, SOUTHERN GEORGIA, Angela Wall, Amie Leandro, Eric C. Brevik, James A. Hyatt, and Gary L. Wood

**Section IV: Physics, Mathematics,  
Computer Science And Technology**  
**IC - 321**  
**A. Lazari, Presiding**

- 8:00 STUDENT STATISTICAL ANALYSIS OF STUDENT EDUCATIONAL RESOURCE FACILITY (SERF) AT REINHARDT COLLEGE, Richard Summers.
- 8:15 THE RIEMANN HYPOTHESIS, Gary Lewellen.
- 8:30 DO STUDENTS IN COLLEGE ALGEBRA PERFORM BETTER IN A THREE DAY LECTURE VERSUS A TWO DAY LECTURE, Andreas Lazari.
- 8:45 INSTITUTIONAL RESEARCH CONCERNING THE SUCCESS OF STUDENTS IN MATH 1113, PRE-CALCULUS, DeWitt More and Teresa Betkowski.
- 9:00 PHOTOELECTRIC MAGNITUDE MEASUREMENTS OF THE LUNAR ECLIPSES ON MAY 16, 2003 AND OCT. 28, 2004, Richard W. Schmude, Jr.
- 9:15 BRIGHTNESS MEASUREMENTS OF SATURN IN LATE 2004, Richard W. Schmude, Jr..
- 9:30 SURPRISES ON URANUS, Richard W. Schmude, Jr.





9:45 AN ALTERNATIVE APPROACH TO SOLVE THE “15-PUZZLE”? K.C. Chan.

10:00 **Business Meeting**

10:30 A BINARY REPRESENTATION OF THE GEOMETRY OF SPACE-TIME, Dennis W. Marks.

10:45 A CONVENIENT GENERAL ANGLE FORMULA FOR THE PERIOD OF A PENDULUM, J. E. Hasbun.

11:00 NUMERICAL ANALYSIS OF A LINEAR OSCILLATOR HAVING “VOLLEYBALL AERODYNAMICS DRAG” DAMPING, 'Kale Oyedeji<sup>1</sup>, S.A. Rucker<sup>2</sup> and R.E. Mickens<sup>3</sup>.

**POSTERS**  
**IC - Second floor lobby**

STRENGTH EVALUATION OF POROUS AND BRITTLE MATERIALS USING ULTRASONIC AND FINITE ELEMENT METHODS\*\*, Barry Hojjatie, Kathryn Hall, and Steven McDonald.

**Section V: Biomedical Sciences**  
**IC - 319**  
**Pamela Moolenaar-Wirsiy, Presiding**

7:30 NOVEL APPROACHES FOR VACCINE DELIVERY AGAINST STDs, F. O. EKO<sup>1</sup>, Q. He<sup>1</sup>, G. Ifere<sup>1</sup>, G. Ananaba, <sup>2</sup>D. Lyn, <sup>1</sup>C. Black, <sup>3</sup>J. U. Igietseme<sup>3</sup>; <sup>1</sup>Morehouse School of Medicine, Atlanta, 30310, <sup>2</sup>Clark Atlanta University, Atlanta 30314; and <sup>3</sup>Centers for Disease Control and Prevention (CDC), Atlanta, GA 30333.

8:00 EXPRESSION OF KERATINOCYTE TRANSGLUTAMINASE (TGASE1) IN VAGINAL EPITHELIUM OF MICE DURING DIFFERENT STAGES OF ESTROUS\*\*, Yo-Leigh A. Gardner, A. B. Redwood and W. T. Schroeder

8:15 THE EFFECT OF ALL-TRANS RETINOIC ACID ON GENE EXPRESSION PATTERNS IN *ORYZIAS LATIPES* EMBRYOS\*\*, Uschi Auguste and Holly Boettger-Tong

8:30 ESTROGEN INDUCED EXPRESSION OF KERATINOCYTE TRANSGLUTAMINASE IN RAT VAGINAL EPITHELIUM\*\* Abena B. Redwood, Y. Gardner and W.T. Schroeder



8:45 METHEMOGLOBIN AND SKELETAL MEMBRANE PROTEIN ALTERATIONS IN RAT ERYTHROCYTES EXPOSED TO PARA-IODO-PHENYLHYDROXYLAMINE, Harriett King, Harpal Singh, Elissa T. Purnell and Melva Coles

9:00 **Break**

9:15 THE EFFECTS OF A SEALED CULTURE VESSEL ON THE DEVELOPMENT AND SURVIVAL OF SHELL-LESS CHICK EMBRYOS. Mariyam Durojaiye\*, Daina Ngugi, Folasade Ademosu, Tosin Olaleye, and Army Lester

9:30 DETERMINING THE CONCENTRATION AND PERIOD FOR WHICH THE ANTIBIOTICS VANCOMYCIN, PENICILLIN, AND OXACILLIN HAVE A BACTERICIDAL EFFECT ON BOTH RESISTANT AND SENSITIVE STRAINS OF *STAPHYLOCOCCUS AUREUS* AND SELECTED ENTEROCOCCAL STRAINS\*\*, Cecile M. Ewane and Don Davis

9:45 **Business meeting**

10:30 EARLY EXPRESSION OF CHEMOKINES AND RELATED GENES IN HELA CELLS DURING *CHLAMYDIA TRACHOMATIS* INFECTION, Tesfaye Belay, E. L. Barr, K. S. Kimbro, F. EKO, J. U. Igietseme and G. A. Ananaba

11:00 DIFFERENTIAL TRANSCRIPTION OF HOST GENES DURING GENITAL *CHLAMYDIA* INFECTION, G. Ananaba, E. Barr, K. Kimbro, T. Belay, T. Okou, G. Nwankwo, G. Ifere, F. Eko, Q. He, and J. Igietseme

11:30 IDENTIFICATION OF IMMUNO-REGULATORY FACTORS THAT PROMOTE T-CELL ACTIVATION BY PROTEOME ANALYSIS, Qing He, Francis O. Eko, Amy Martin, Deborah Lyn, Godwin A. Ananaba, Carolyn M. Black and Joseph U. Igietseme

**POSTERS**  
**IC - Second floor lobby**

WOUND HEALING OF GINGIVAL FIBROBLASTS (GF) AND PERIODONTAL LIGAMENT FIBROBLASTS (PDL) UNDER CYCLICAL MECHANICAL STRAIN (CMS)\*\*, Douglas Lancaster, Michael E. Dinos, James C. McPherson, III, Gary Swiec, Mark Peacock and Augustine H. Chuang





THE EFFECT OF PLURONIC F68 ON WOUND HEALING OF PERIODONTAL LIGAMENT FIBROBLASTS IN LOW ALCOHOL CONDITION, Augustine H. Chuang, Royce Runner, Carol Lapp, Bharati Bhatt and James C. McPherson, III

THE EFFECT OF SODIUM LAURYL SULFATE (SLS) ON IN VITRO GINGIVAL FIBROBLASTS (GF) WOUND HEALING\*\*, Justin Bordlemay, James C. McPherson, III; Gary Swiec and Augustine H. Chuang

ESTABLISHMENT OF A CRITICAL SIZE CRANIAL DEFECT IN THE MOUSE, J. J. Dalle Lucca, Royce R. Runner and James C. McPherson, III

A 3 mm CRANIAL BONE DEFECT AND ITS ROLE IN ESTABLISHING A CRITICAL SIZE DEFECT IN THE MOUSE, Royce R. Runner, J. J. Dalle Lucca and James C. McPherson, III

STRENGTH OF NORIAN CRS BONE CEMENT IN A CRANIAL DEFECT\*\*, Richard L. Williams<sup>1</sup>, Royce R. Runner<sup>2</sup>, Gary D. Swiec<sup>1</sup>, and James C. McPherson, III<sup>2</sup>

**Section VI: Philosophy & History of Science**  
**IC - 322**

Tom McMullen, Presiding

8:30 A HISTORICAL SKETCH OF "FACTORS WALK RETAINING WALL" AND AN INVESTIGATION INTO THE CAUSE OF THE WALLS EROSION, Elliott O. Edwards

9:00 THOMAS SHAW (C. 1694-1751), AN EARLY EIGHTEENTH CENTURY NATURALIST IN THE BARBARY AREAS AND THE HOLY LAND, Vivian Rogers-Price, George A. Rogers and Marvin Goss

9:30 VERTEBRATE FAUNAL REMAINS FROM THE MINNIS-WARD SITE (SS-3), SAN SALVADOR, BAHAMAS: PRE-COLUMBIAN DIET AND FISHING TECHNIQUES OF THE PEOPLE WHO ENCOUNTERED COLUMBUS, J.P. Blick and D.C. Brinson

10:00 **Business meeting**

10:30 C.D. LEAKE'S WORLD-VIEW-DRIVEN TRANSLATION OF HARVEY'S *DE MOTU CORDIS*, Tom McMullen

11:00 MATHEMATICS AND SCIENCE, Ronald E. Mickens



11:30 DISPERSION OF INDIAN SCIENTIFIC KNOWLEDGE FROM ANTIQUITY TO MODERNITY, Bhagyavati

**Section VII: Science Education**  
**IC - 410**  
**Rebecca Penwell, Presiding**

8:30 COMPARATIVE ANALYSIS OF HIGH SCHOOL GEOMETRY TEXTBOOKS, Ronald E. Mickens

8:45 STUDENT'S RETENTION OF SCIENCE CONTENT THROUGH VARIOUS ASSESSMENT MEASURES \*\*, Nabulungi Bolton\* and Benita Flournoy

9:00 THE DEVELOPMENT OF CONCEPTS IN MIDDLE SCHOOL CHILDREN \*\*, Paul Camp, Akilah Bonner\*, Evelyn Conley\*, Lauren Thomas\*, and Tenicka Turnquest\*

9:15 USING A SKILL MATRIX AS A PREDICTOR OF STUDENT SUCCESS ON A PHYSICAL SCIENCE END OF THE COURSE (EOCT) EXAMINATION\*\*, Ernest Kelly\* and Bonita E. Flournoy

9:30 A CASE STUDY OF K-12 STUDENTS AND PRE-SERVICE SCIENCE AND MATHEMATICS TEACHERS' PERCEPTION OF A SERVICE LEARNING PROJECT IN SCIENCE EDUCATION, Ollie Manley

9:45 **Break**

10:00 **Business Meeting**

10:30 USING GROUP EXAMS AS A LEARNING TOOL IN GEOLOGY COURSES, Polly A. Bouker

10:45 MATHEMATICAL PROOFS AND CONCEPTUALIZATIONS, Sandra Rucker

11:00 REALTIME ELVIS IN THE CLASSROOM: USING *LabVIEW* IN THE INTRODUCTORY PHYSICS LABORATORY, Julie Talbot and James Espinosa

11:15 COMPARING STUDENT SATISFACTION WITH GROUP AND INDIVIDUAL CASE STUDIES IN HUMAN ANATOMY AND PHYSIOLOGY. John V. Aliff





- 11:30 AUTHENTIC POPULATION STUDY FOR BIOLOGY STUDENTS USING BOX TURTLES, David L. Bechler and Leslie S. Jones
- 11:45 ENRICHING PRE-COLLEGE SCIENCE AND MATHEMATICS TEACHERS' RESEARCH SKILLS USING RESEARCH SCIENTISTS AS MENTORS, Bonita E. Flournoy

### FRIDAY PAPER PRESENTATIONS

\* Denotes Student Presentation

\*\* Denotes In Progress Student Presentation

#### Section I: Biological Sciences

IC - 318

Mark S. Davis and Terry D. Schwaner, Presiding

1:00 CANINE DISTEMPER VIRUS IN SOUTHWEST GEORGIA RACCOONS\*\*, Krista A. Cox\* and J. Mitchell Lockhart, *Biology Department, Valdosta State University, Valdosta, GA, 31698*. A member of the family *Paramyxoviridae*, canine distemper virus (CDV) causes canine distemper, a significant viral disease in raccoons and fur animals, producing morbidity and mortality in unvaccinated populations worldwide. Although dogs are the most commonly affected species, CDV is also seen in raccoons, foxes, ferrets, and minks. Comparatively, canine distemper is now rare in many industrialized countries due to vaccination. Transmission of the virus occurs via an aerosol-droplet route, direct contact, or possibly contact with contaminated objects. Approximately 365 raccoons from 2003 and 2004 were obtained from three southwest Georgia plantations as part of an ongoing USDA – Wildlife Services bobwhite-quail predator project. Of the 365 samples, 116 (31.8%) tested positive for CDV by indirect immunofluorescent assay utilizing commercial antigen coated slides. Comparisons of seasonal, host sex, and host age data will be evaluated. These data suggest considerable levels of canine distemper virus are present in southwest Georgia.

1:15 *TRYPANOSOMA CRUZI* IN SOUTHWEST GEORGIA OPOSSUMS\*\*, Jessica L. Gillis\* and J. Mitchell Lockhart, *Biology Department, Valdosta State University, Valdosta, GA, 31698*. *Trypanosoma cruzi* is a protozoan parasite causing a disease that affects many in Central and South America, but only few in the United States. The disease is transmitted by triatomine insects of the *Reduviidae* family. *T. cruzi* is predicted to occupy numerous mammalian hosts such as raccoons, coyotes, opossums, deer and dogs. Over 1,000 opossums were acquired from three Southwest Georgia plantations as a result of an ongoing USDA – Wildlife Services bobwhite-quail predator project. DNA



isolations were performed on frozen opossum heart tissue and samples were examined for the presence of *T. cruzi* via polymerase chain reaction. Approximately 20% have tested positive for *T. cruzi* as of the submission date. Seasonal, host sex, and host age data will also be analyzed. These results suggest that there are significant levels of this parasite in southwest Georgia opossum populations.

1:30 *TRYPANOSOMA CRUZI* IN SOUTHWEST GEORGIA RACCOONS\*\*, Berrien Waters\* and J. Mitchell Lockhart, *Biology Department, Valdosta State University, Valdosta, Georgia, 31698*. *Trypanosoma cruzi*, a parasite known to cause Chagas' disease, has been thought to occupy several mammalian hosts including canines, opossums, and raccoons. Although most cases of Chagas' disease are found in Central and South America, the theory that *T. cruzi* utilizes hosts that live in the United States prompted the urge to determine the prevalence of the parasite in these animals. More than 200 raccoons were obtained from three isolated regions in south Georgia and north Florida as part of a USDA-Wildlife Services bobwhite quail predator removal study. DNA from frozen raccoon heart samples was tested for the presence of *T. cruzi* using polymerase chain reaction. For 2004, 42 of 210 samples (20.0%) have tested positive. These data will be compared with data collected in 2003 and will be analyzed using various natural history variables. Collectively, data from these 2 years suggest that there are considerable levels of *T. cruzi* in wildlife populations in these locations.

1:45 DETECTION OF THE CAUSATIVE AGENTS OF LYME DISEASE, EHRlichiosis, AND STARI IN INDIVIDUAL SOUTHERN BLACK-LEGGED TICKS COLLECTED FROM WHITE-TAILED DEER OF THE PIEDMONT NATIONAL WILDLIFE REFUGE\*\*, Joshua Ellis\*, Melissa Harrison, Jackie Delash, Brian Sparks, Green Berry Starnes, IV and Alan F. Smith. *Department of Biology, Mercer University, Macon, GA 31207*. Over 1000 adult and nymphal ticks were collected from the carcasses of freshly harvested, white-tailed deer (*Odocoileus virginianus*) at the check station during two prescribed hunts (Oct. 21-23 and Nov. 4-6, 2004) in the *Piedmont National Wildlife Refuge (Jones Co. and Jasper Co., GA)*. *Southern black-legged ticks (Ixodes scapularis)* comprised the overwhelming majority of the tick species, although lone star ticks (*Amblyomma americanum*) were well represented (~10%). Maintained individually at -20 °C, total genomic DNA was extracted from single specimens and aliquots provided templates for the PCR-generation of agarose-gel-electrophoretic identifiable amplicons. Primers were designed from specific gene sequences as follows: a 378-bp *Borrelia* spp. FLA-1 gene fragment; a 459-bp *Borrelia burgdorferi* (Lyme disease) rOmpA gene fragment; a 247-bp *Ehrlichia* spp. 16s rRNA gene fragment; and a 900-bp *Ixodes* spp. nuclear ribosomal gene cluster fragment (ITS2). The rOmpA and FLA-1 amplicons allowed us to distinguish between the two ixodid-borne borreliae since OmpA is absent in *B. lonestari*. The presence of the *Ixodes*-specific amplicon served as an added control and confirmed the quality of the genomic extraction. The identity of the PCR



products was confirmed by sequencing of the agarose gel-purified amplicons. Faculty Research and Development Grants from the College of Liberal Arts, Mercer University provided funding for this project.

2:00 THE INCIDENCE OF THE CAUSATIVE AGENTS OF LYME DISEASE, STARI, AND EHRLICHIOSIS IN MALE LONE STAR TICKS COLLECTED FROM FIVE MIDDLE GEORGIA COUNTIES\*\*, *Melissa Harrison\**, *Jackie Delash*, *Green Berry Starnes, IV*, *Brian Sparks*, and *Alan F. Smith*, Department of Biology, Mercer University, Macon, GA 31207. During the spring through fall months over a two-year (2003 - 2004) period, male lone star ticks (*Amblyomma americanum*) were collected from five middle Georgia counties (Bibb, Jones, Houston, Monroe, and Crawford) by sweeping vegetation with cotton batting or from the carcasses of recently harvested white-tailed deer (*Odocoileus virginianus*) during prescribed hunts. Ticks were maintained individually at -20°C. Total genomic DNA was extracted from single specimens and aliquots provided templates for the PCR-generation of agarose-gel-electrophoretic identifiable amplicons. Primers were designed from specific gene sequences as follows: a 378-bp *Borrelia* spp. FLA-1 gene fragment; a 459-bp *Borrelia burgdorferi* (Lyme disease) rOmpA gene fragment; a 247-bp *Ehrlichia* spp. 16s rRNA gene fragment; and a 158-bp *A. americanum* ubiquitin gene fragment. The two sets of *Borrelia* primers allowed us to distinguish between the *B. burgdorferi* and *B. lonestari* spirochaetes since the latter lacks the rOmpA gene. Moreover, inclusion of the lone star tick-specific PCR step served as an additional control accounting for the quality of the genomic extraction: *Borrelia*- and/or *Ehrlichia*-free samples could then be readily distinguished from poorly-extracted or absent templates. The identity of the PCR products was confirmed by sequencing of the agarose gel-purified amplicons. Faculty Research and Development Grants from the College of Liberal Arts, Mercer University provided funding for this project.

2:15 PRELIMINARY STUDY OF TREE DISTRIBUTION PATTERNS AND DIVERSITY IN A TROPICAL DRY DECIDUOUS FOREST OF YUCATAN, MEXICO, *A. Rachel Prakash\*<sup>1</sup>*, *Jeffrey Pittman<sup>1</sup>*, and *Paula C. Jackson<sup>1</sup>*, <sup>1</sup>*Kennesaw State University, Kennesaw, GA 30144*. The dry deciduous forest of the Yucatan has been studied very little in comparison with its rainforest counterparts. The main factor influencing the forest is its seasonal rainfall and, potentially, subterranean water sources called *cenotes*. In this study we investigated how the following ecological parameters differed with distance to a cenote: 1) spatial distribution patterns (even, clumped or random) of six tree species with differing patterns of leaf production and loss (deciduous species: *Bursera simaruba* and *Acacia gauderi*; briefly deciduous species: *Phyllostylon brasiliense*, *Piscidia piscipuda*, and *Lysiloma latisiliquum*; and the evergreen species: *Gymnopodium floribundum*); 2)  $\alpha$ -diversity; and 3) whether there was a difference in rank abundance of species among sites. Two study sites were selected, one near, the other far (more than 800 m) from a cenote. At each site four 10 m x 10 m quadrats were randomly established, and coefficients of variation (CV= variance/mean)

were used to determine spatial distribution patterns of species. Diversity was estimated with the Shannon index, and all species were ranked at each site based on abundance. Sites differed in diversity and in the rank order of abundance of each species. For all species studied, distribution patterns were not significantly different from random probably due to the small sample size.

2:30 POPULATION GENETICS OF GOPHER TORTOISES AT MOODY AIR FORCE BASE, GEORGIA\*\*, *David I. Mederos\**, *John F. Elder*, *Gregory Lee*, and *J. Mitchell Lockhart*, Biology Department, Valdosta State University, Valdosta GA, 31698. Gopher tortoises (*Gopherus polyphemus*) are a threatened species in Georgia and a basic understanding of natural history and population genetic parameters is vital for successful management of the species. Knowledge of population genetics can provide important information concerning normal movement and artificial translocation of animals and perhaps diseases they may carry. DNA was isolated from the blood of 15 gopher tortoises from different colonies found on Moody Air Force Base, Georgia. Using microsatellite analysis from nine different VNTR loci we were able to establish the gene flow between colonies, genetic distance, and map out phylogenetic trees between different sub-populations. Data from an additional 80 animals will be generated and included in the final analysis.

2:45 ANALYSIS OF BODY SHAPE VARIATION OF RELATED TAXA OF HYBOPSIS (CYPRINIDAE) USING DISTORTION COORDINATES\*\*, *P. Faith Owens\**, *Christopher E. Skelton*, and *William P. Wall*, Georgia College & State University, Milledgeville, GA 31061. The minnow genus *Hybopsis* is represented by three species in Georgia (*Hybopsis amblops*, *H. lineapunctata*, and *H. rubrifrons*) and one or two undescribed forms. Recent analyses suggest that both potential undescribed forms are closely related to *Hybopsis winchelli* from Alabama and Mississippi. We analyzed the shape of the presumed undescribed forms and compared those with nominal *H. winchelli* as well as a primitive member of the group (*Hybopsis amblops*). We first generated digital photographs for each specimen studied then measured standard length on each fish which was then used as the standard for all other measurements in the computer analysis. Intra and inter-specific variation was analyzed using a variety of statistical methods (cluster analysis, principal components, discriminant analysis). Morphological variation was also determined visually using distortion coordinate analysis. The systematic and biogeographic implications of our findings will be discussed.

3:00 **Break**

3:15 THE USE OF ARTIFICIAL SUBSTRATE TO STUDY THE COLONIZATION PATTERNS OF MACROINVERTEBRATES IN A MIDDLE GEORGIA STREAM\*\*, *Chris Pace\**, *Joshua Ellis*, *Brian Sparks*, *Katie Smith*, and *Alan F. Smith*, Department of Biology, Mercer University, Macon, GA 31207. Typical Middle Georgia streams are subject to high levels of silt deposition. In

response, decreased substrate availability limits biological diversity. Previous colonization studies have utilized transient, biodegradable substrates such as wood and leaf packs, the use of which introduces two or more confounding variables (e.g., nutrients, mutable surfaces). In our experiment, we increased only the substrate availability through the introduction of non-nutritive, non-degradable, synthetic "leaf packs" (syn., pods). Six PVC-anchored stations, each with 12 sets of pods, were placed within a segment of a second-order stream, Hurricane Creek (Brender Demonstration Forest, Jones Co.) during the summer of 2003. Pods consisted of polypropylene and nylon leaf-sized fragments constrained by monofilament netting. Over the course of six months, pods from each station were randomly collected from each station, preserved, and later examined for the presence of macroinvertebrates. Physical parameters (e.g., pH, discharge, temperature, DO) were concurrently recorded at each station during pod harvesting. Identifications to the level of genus, where feasible, or morphospecies, provided pertinent data for the calculation of diversity indices for correlations with the physical parameters as well as elucidating changes in community structure over time. Faculty Research and Development Grants from the College of Liberal Arts, Mercer University, provided funding for this project.

3:30 EFFECTS OF NANO-SIZED PARTICLES OF COPPER OXIDE (CuO) ON *SELENASTRUM CAPRICORNUTUM* (CHLOROPHYTA), A. E. Sanford\*, J. A. Nienow, T. J. Manning, Valdosta State University, Valdosta, GA 31698. Concerns have been raised recently about the potential hazardous effects of nanomaterials in the environment. To test the validity of these concerns, we investigated the effects of nano-sized particles of copper oxide (CuO) on the growth of the green alga *Selenastrum capricornutum*. Cultures were grown in liquid BBM solution supplemented with 2, 4, 8, or 40 mg of nano-sized or regular-sized particles of CuO per 100 mL of culture medium. The size of the population was monitored by periodic direct counts over a period of 14 d. The growth rate of *S. capricornutum* was significantly lower in cultures supplemented with 8 mg/100mL of nano-sized particles of CuO. The effect of nano-sized CuO on growth was less than the effect of adding CuSO<sub>4</sub> solutions. The cause of the decreased growth is not clear. Excess copper is thought to affect photosynthetic electron transport. We tested this hypothesis using pulse-amplitude-modulated (PAM) fluorometry on filtered aliquots of the cultures, but were unable to detect a significant difference in the photosynthetic yield.

3.45 FRESHWATER MUSSELS (*UNIONIDAE*) OF THE LITTLE OCMULGEE RIVER SYSTEM, GEORGIA\*\*, Brooke N. Hawk\*<sup>1</sup>, Christopher E. Skelton<sup>1</sup>, and C. Nathan Webb<sup>2</sup>, <sup>1</sup>Georgia College & State University, Milledgeville, Georgia 31061 and <sup>2</sup>Medical College of Georgia, Augusta, Georgia 30904. The Little Ocmulgee River is a large tributary to the lower Ocmulgee River. Twenty-one sites in the Little Ocmulgee River system were surveyed for freshwater mussels between June and October, 2004. Surveys were conducted visually and by hand-grubbing in appropriate habitats. Surveys were timed and conducted for at least one total hour of search time at each site

(person-hour). All live individuals and dead shells were examined at the survey site and all identifiable specimens were released. Difficult to identify forms were retained for later identification in the laboratory. Retained specimens were euthanized by freezing or by relaxing in a solution of tricaine methane sulfonate (MS-222). Relaxed specimens were preserved in 10% formalin and after rinsing with water, placed in 70% ethanol for permanent storage. Headwater portions of the system were dominated by species of the genus *Elliptio* and *Uniomereus carolinianus*. Lower portions of system harbored "big river" species typical of the Ocmulgee and Altamaha rivers such as *Elliptio dariensis*, *E. hopetonensis*, *E. shepardiana*, and *Lampsilis dolabraeformis*.

4:00 A SURVEY OF THE BATS OF BALDWIN COUNTY, CENTRAL GEORGIA\*\*, Michael Bender\* and Dennis Parmley, Georgia College & State University, Milledgeville, GA 31061. On the basis of published records, 16 species of bats occur in Georgia. Of these, only one, *Tadarida brasiliensis*, is documented from Baldwin County of central Georgia. Records from surrounding counties clearly suggest the probability of at least eight additional species occurring in the county. Due to a lack of documentation of the bat species inhabiting this area, we initiated a survey to compile a species list for Baldwin County. Since June 2004 we have used traditional capture/collection techniques and specimen handling procedures to survey bat populations living in this area. Thus far we have documented six species of bats to include *Pipistrellus subflavus*, *Nycticeius humeralis*, *Lasiurus borealis*, *Lasiurus seminolus*, *Eptesicus fuscus*, and *Tadarida brasiliensis*.

4:15 DISTRIBUTION OF DRAGONFLIES (*ANISOPTERA*) IN BALDWIN COUNTY, GEORGIA, Stephen R. Parrish\*, Georgia College & State University, Milledgeville, Georgia 31061. The distribution of dragonflies (*Anisoptera*) in Baldwin County, Georgia was studied from March to November 2004. Dragonflies were collected and viewed at 12 different sites. When possible, new species were netted, immersed in acetone for a day, dried, and placed in labeled plastic envelopes. Before immersion they were chilled and photographed in posed positions. Dragonfly species were also identified by observation with binoculars. A total of 41 species of *Anisoptera* were found. Some of the less common species found include *Gomphaeschna furcillata*, *Cordulegaster bilineata*, *Celithemis bertha*, and *Anax longipes*. Species found earlier than previously recorded in Georgia are *Epitheca (Tetragoneuria) costalis*, *Celithemis elisa*, *Cordulegaster bilineata*, and *Libellula cyanea*. Late records were established for *Gomphus (Gomphurus) dilatatus*, *Libellula auripennis*, *Libellula luctuosa*, *Boyeria vinosa*, *Libellula incesta*, and *Celithemis elisa*.

4:30 PRELIMINARY ASSESSMENT OF THE FRESHWATER MUSSEL FAUNA (*UNIONIDAE*) OF THE BROAD RIVER SYSTEM, GEORGIA\*\*, Stephanie S. Westmoreland\* and Christopher E. Skelton, Georgia College & State University, Milledgeville, Georgia 31061. Fourteen sites were surveyed for freshwater mussels in the Broad River system of Georgia between 4 August

and 26 September, 2004. Surveys were conducted visually and by hand-grubbing in appropriate habitats. Surveys were timed and conducted for at least one total hour of search time at each site (person-hour). All live individuals and dead shells were examined at the survey site. Because the taxonomy of Atlantic Slope mussels is poorly understood, we kept examples of each discernible form for later identification in the laboratory. Retained specimens were later relaxed in a solution of tricaine methane sulfonate (MS-222), preserved in 10 % formalin and after rinsing with water, placed in 70 % ethanol for permanent storage. Native mussels were found at ten of 14 sites and the exotic Asian clam (*Corbicula fluminea*) was found at twelve of fourteen sites. The mussel fauna was dominated by common members of the genus *Elliptio* and *Unio* *carolinianus*.

4:45 REVERSE GENETICS MADE AVAILABLE TO UNDERGRADUATES: TILLING THE *DET2* GENE\*\*, *Emily Deanna Salman\** and *Ryan Becker*, *Mercer University, Macon, Georgia 31207*. Reverse genetics is a newly emerging field that has developed in response to the influx of genomic data generated from high-throughput technology. A new technique, TILLING (Targeted Induced Local Lesions In Genomes), is a reverse genetic approach that correlates genetic structure to subsequent gene function. In TILLING, an allelic series is generated and the phenotypic responses for the different mutants are examined. An allelic series for the *det2* gene of the model organism *Arabidopsis thaliana* is currently being developed. *Det2* is one of the several light response genes in the photomorphogenic pathway of *A. thaliana*. The phenotypic evaluation of this allelic series will measure hypocotyl response under different light conditions. Part of my research involves modifying the CELI genotyping assay in order to examine the TILLED mutants in an undergraduate setting. TILLING is a useful tool for an undergraduate laboratory as a method for understanding reverse genetics as well as high-throughput technology.

**Section II: Chemistry**  
**IC - 417**  
**Ken Martin, Presiding**

2:30 PHOTOCHEMICAL PROPERTIES OF NON-BENZENOID TETRASUBSTITUTED PORPHYRINS, *Mark Wehunt\*<sup>1</sup>*, *Amber Everett<sup>1</sup>*, *Adegboye Adeyemo<sup>2</sup>*, and *James LoBue<sup>1</sup>*, <sup>1</sup>*Georgia Southern University, Statesboro, GA 30460* and <sup>2</sup>*Savannah State University, Savannah, GA 31404*. Photodynamic Therapy (PDT) utilizes a combination of light with a photosensitizer molecule as a method for the treatment of tumors. We are interested in studying the photochemical properties of a group of tetra-substituted porphyrin molecules for their potential as photosensitizer drugs. The fluorescence quantum yields and luminescence lifetimes of two tetraquinoliny porphyrin derivatives are compared. The luminescence lifetimes of tetra-3-quinolino porphyrin and tetra-4-quinolino porphyrin were 13 ns and 9 ns, respectively. The fluorescence quantum yields of tetra-3-quinolino porphyrin and tetra-4-quinolino porphyrin were

calculated to be 0.14 and 0.27, using tetra phenyl porphyrin (TPP) as a quantum yield reference.

2:45 PHOTOCHEMICAL PROPERTIES OF SUBSTITUTED TETRAPHENYL PORPHYRINS, *Amber Everett\*<sup>1</sup>*, *Mark Wehunt<sup>1</sup>*, *Adegboye Adeyemo<sup>2</sup>*, and *James LoBue<sup>1</sup>*, <sup>1</sup>*Georgia Southern University, Statesboro, GA 30460* and <sup>2</sup>*Savannah State University, Savannah, GA 31404*. Several porphyrins were studied to see if they could be used in photodynamic therapy. In photodynamic therapy an oral or topical photosensitizing agent is used in conjunction with exposure to light. Porphyrin photosensitizers are absorbed by tumor tissue preferentially and once the tumor with porphyrin is irradiated with light, the tumor is destroyed (by the singlet oxygen that forms). In this study, 2- and 4-Amino tetraphenyl porphyrins (TPP) were analyzed by measuring their absorbance, fluorescence, and luminescence lifetimes. The luminescence quantum yields for these two molecules were determined by using tetraphenyl porphyrin as a reference. The quantum yield for 2-Amino TPP was determined to be 0.05 and the 4-Amino TPP was 0.31. Lifetime for 4-Amino TPP was observed at 5.42 ns. The lifetime for 2-Amino TPP could not be effectively determined but appears to be significantly shorter than its 4-Amino partner.

3:00 **Break**

3:30 PHYTOCHEMICAL INVESTIGATION OF SARGASSUM FLUITANS, *Delicia L. Emanuel\**, *J. Richard Carter*, *James A. Nienow*, and *James T. Baxter*, *Valdosta State University, Valdosta, GA 31698*. The chloroform extract of *Sargassum fluitans*, marine brown algae, obtained from the Gulf of Mexico in June 2003, was analyzed using GC-MS. At least fourteen compounds were identified including 1-hexadecene, 3-hexadecene, heptadecanoic acid, and heptadecanoic acid, ethyl ester.

3:45 REDUCTION OF KETONES IN SOLUTION AND ON DRY SILICA, *Flynt Goodson\**, *Giso Abadi*, and *John T. Barbas*, *Valdosta State University, Valdosta, GA 31698*. Cyclic and bicyclic ketones were adsorbed on activated silica by stirring in organic solvents. The solvents were removed under vacuum giving a free flowing powder. Similarly sodium borohydride was adsorbed on activated silica and the solvent removed under vacuum. Mixing the two powders at room temperature resulted in a facile reduction of the ketones with half lives of less than two hours. The two isomeric alcohols obtained from each ketone were analyzed using NMR techniques and their ratios were compared to the same reactions done in solution and to predictions made using molecular modeling. In some cases the ratios in the solid state were identical to those obtained in solution whereas in other cases the ratios were somewhat different, favoring hydride attack from the less hindered side when adsorbed on silica. For example, the reduction of 2-methylcyclohexanone in methanol and on silica gave identical results of 60% *trans*-2-methylcyclohexanol and 40% *cis*-2-methylcyclohexanol. However, the reduction of 4-*tert*-butylcyclohexanone gave 89% *trans*-4-*tert*-

butylcyclohexanol and 11% of the *cis* isomer in methanol but on silica it gave 82% of the *trans* isomer and 18% of the *cis* isomer. Work is continuing with polymer-supported reducing agents.

4:00 SIMPLE AND SPEEDY SYNTHESIS OF POLY(*p*-PHENYLENE ETHYNYLENE)S USING ACETYLENE GAS, *Kevin P. Gwaltney<sup>1</sup>, Kimberly A. Kellett<sup>1</sup>, Daniel R. Durham<sup>1</sup>, Igal Maasen<sup>1</sup>, James M. Gilbert<sup>1</sup>, and Uwe H. F. Bunz<sup>2</sup>, <sup>1</sup>Kennesaw State University, Kennesaw, GA 30144 and <sup>2</sup>Georgia Institute of Technology, Atlanta, GA 30332.* We have further investigated the direct coupling of acetylene and arenes to synthesize poly(*p*-phenylene ethynylene)s (PPEs). A variety of polymers and copolymers were produced. The monomers, acetylene gas and diiodoaryl compounds, are polymerized by a Pd/Cu catalyst. This method conserves two or more steps, thus is more efficient than the conventional metathesis or coupling methods. In addition, the method allows straight-forward synthesis of random copolymers. Dialkyl-PPEs, dialkoxy-PPEs and random copolymers have been synthesized. Copolymers of diiodofluorene with dialkyl or dialkoxy arenes were also synthesized. Catalyst load, reaction temperature and reaction time were varied. Number average molecular weights, measured by gel permeation chromatography with polystyrene standardization, ranged from 3,000 to 84,000. Degree of polymerization was limited by solubility of the monomers and oligomers. Diiodofluorene provided the most difficulty due to insolubility. Characterization included fluorescence, UV-Vis, <sup>1</sup>H NMR, <sup>13</sup>C NMR and IR. Microstructuring was performed using the breath figure method creating a hexagonal array of 0.2-10 mm structures.

### Section III: Earth and Atmospheric Science

IC - 421

Mark Groszos, Presiding

2:00 A PRELIMINARY ANALYSIS OF AN EOCENE FOSSIL FAUNA FROM THE IMERYS SHEPPARD MINE, WASHINGTON COUNTY, GEORGIA\*\*, *Joseph W. Sheffield\*<sup>1</sup>, Alfred J. Mead<sup>1</sup> and Bob J. Pruetz<sup>2</sup>, <sup>1</sup>Georgia College & State University, Milledgeville, GA 31061 and <sup>2</sup>Imerys Clays, Sandersville, GA 31082.* Beginning in the fall of 2004, researchers from Georgia College & State University began a systematic analysis of fossil material from the Imerys Sheppard Kaolin Mine in Washington County, Georgia. The fossiliferous horizon lies immediately above the Tertiary kaolin deposit and is exposed on the pit's highwall. Field observations suggest that the fossiliferous horizon is dominated by *in situ* oyster bioherms. Sections of the deposit have been excavated and examined for faunal composition. The invertebrate fauna is dominated by the oyster *Crassostrea cf. gigantissima*. Additional invertebrates include fragmented *Chlamys*, endocasts of *Turritella*, larger gastropods and wedge clams, and fragmented bryozoans and decapods. The chondrichthyan fauna includes several shark species and at least one mylobatid ray species. Osteichthyan are represented by several vertebrae and spines. The stratigraphic position and

faunal composition suggest that this fossiliferous horizon represents an eastern portion of the Riggins Mill Member of the Clinchfield Formation.

2:15 A PRELIMINARY DESCRIPTION OF THE PLEISTOCENE HERPETOFAUNA FROM CLARK QUARRY, BRUNSWICK, GEORGIA\*\*, *Joshua L. Clark\*, Kelly A. Clark\*, Alfred J. Mead, Dennis Parmley and Robert A. Bahn, Georgia College & State University, Milledgeville, GA 31061.* Excavations at Clark Quarry near Brunswick, Georgia, continue to produce Pleistocene-aged vertebrate fossils. The vertebrate macrofossils are dominated by the large mammals *Mammuthus columbi* and *Bison latifrons*. The herpetofauna are dominated by fragments of turtle carapace and plastron elements and osteoderms. This material represents at least one species of large tortoise and two species of emydid turtles. Osteoderms and numerous teeth indicate the presence of *Alligator mississippiensis*. Natricine snake vertebrae identified thus far include *Nerodia* sp. and *Thamnophis* sp. Three lacertilian vertebrae have been recovered. Anurans are indicated by the presence of ranid vertebrae, ilia, and a maxilla fragment. This herpetofauna suggests a riverine habitat with winter temperatures slightly more moderate than presently exist in the area.

2:30 BISON LATIFRONS (ARTIODACTYLA) FROM THE PLEISTOCENE OF BRUNSWICK, GEORGIA, *Robert A. Bahn\* and Alfred J. Mead, Georgia College & State University, Milledgeville, GA 31061.* Fossil remains of the giant Pleistocene bison (*Bison latifrons*) have been known from Georgia since the mid-1800's. The majority of this material was discovered in spoil piles following dredging of coastal rivers. Some *in situ* bison material was also recovered during the construction of the Brunswick Canal between 1838-39. Previous authors tentatively identified these fossils as belonging to *Bison latifrons* or *Bison* sp. based on post-cranial comparative measurements to *Bison bison*. However, due to the similarity of post-cranial material between these species, no definitive identification could be made. A nearly complete skull of *Bison* was recovered during excavations at Clark Quarry near Brunswick, GA during the summer of 2004. Measurements of horn-cores, the definitive species character, positively identifies the skull as *Bison latifrons*. In addition to the skull, Clark Quarry has produced a minimum of two individuals of *Bison*, based on two right dentaries. Additional material includes: numerous cervical, thoracic, lumbar, and caudal vertebrae, numerous ribs, two scapulae, four humeri, two radio-ulnae, one femur, one tibia, and numerous podials.

2:45 OCHNA LIKE FRUIT FROM THE PALEOCENE OF NORTH DAKOTA, *Mark A. Brewer\*<sup>1</sup>, Melanie L. DeVore<sup>1</sup> and Kathleen B. Pigg<sup>2</sup>, <sup>1</sup>Georgia College & State University, Milledgeville, GA 31061 and <sup>2</sup>Arizona State University, Tempe, AZ 85287-4501.* Compound fruits comprised of five-six single-seeded follicles were first described from the Almont site in Morton County, ND. Additional specimens have been collected from the Kate's Butte site in McKenzie County, ND. Both of these floras are equivalent in age based on the composition of plant megafossil assemblages and contain excellently preserved



fruit and seed material. The follicles are teardrop shaped, 4-7 mm in length and 3-4 mm wide, with 0.2-0.4 mm thick walls. Follicles are radially attached by their constricted side to a thick receptacle. Individual follicles are found in the matrix suggesting that the fruit separated at maturity. The fossil fruit material is most similar to fruits of *Ochna* that are also conrescent and consist of 2-5 clustered single-seeded drupes or capsules. There is currently no complete taxonomic treatment of Ochnaceae and a phylogeny has not been constructed for the family. Ochnaceae is distributed in both the Old World and New World tropics and subtropics. The presence of Ochnaceae in the Paleocene of North America suggests that the family had been a circumpolar element and was represented in more temperate floras in the past and today has survived and radiated in the tropics.

### 3:00 **Break**

3:15 **MAPLE FRUITS FROM THE PALEOCENE OF NORTH DAKOTA**, Alex Kittle<sup>1</sup>, Melanie DeVore<sup>1</sup>, Bill Wall<sup>1</sup> and Kathleen Pigg<sup>2</sup>, <sup>1</sup>Georgia College & State University, Milledgeville, GA 31061 and <sup>2</sup>Arizona State University, Tempe, AZ 85287-4501. Winged fruits are a conspicuous component of Cenozoic floras (e.g. Florissant and Green River). One of the most recognizable types of winged fruits is the samara. Two samara types are represented in the Almont and Beicegel Creek, ND floras from the Sentinel Butte Formation. The first samara type represents the genus *Securidaca* (Polygalaceae). The second samara clearly can be placed in the genus *Acer* (maple, Sapindaceae) and represents the oldest record of fruits belonging to the maples. The *Acer*-like samaras are 2.75-5.50 cm long and 1.5-2.5 cm wide. The fruits belong to the genus based on shape, wing venation and basal attachment scars. The fossil *Acer*-like samaras differ from most modern members of *Acer* based on the presence of a pronounced, elongated stipe. To date, no fossil foliage assignable to this genus has been documented from the Paleocene of North Dakota. However, *Acer* leaves have been described from the uppermost Paleocene of southeastern Alaska. Like the dogwoods (Cornaceae), the maples have a disjunct distribution between eastern North America and eastern Asia. *Acer* also has an eastern North America and eastern Mexican pattern of distribution. In the case of *Acer*, the genus first appeared in the Paleocene and underwent a major radiation in the Eocene. Means of dispersal are clearly significant when examining the radiation of a taxon and the utility of applying aerodynamics to assessing dispersal capability will be addressed.

3:30 **ENVIRONMENTAL SCANNING ELECTRON MICROSCOPY AS A TOOL TO EVALUATE MODERN AND FOSSIL MICROBIAL TAPHONOMY**, Phillip M. Cole\* and Julie K. Bartley, Department of Geosciences, State University of West Georgia, Carrollton, GA 30118. The Environmental Scanning Electron Microscope (ESEM) allows high-resolution imaging of uncoated, delicate, and hydrated samples. Using this tool, fresh microbial cultures can be imaged directly and their surface morphology compared to fossil microbes in

chert or shale. We conducted a series of ESEM analyses of modern and fossil microbes, with the aim of identifying common taphonomic and taxonomic features. Because specimens are uncoated, observed fine-scale surface structures cannot be artifacts of elemental coating, and modern and fossil organic structures can be compared directly. Live cultures of *Eremosphaera* were assessed using the ESEM in environmental mode (hydrated). Uncollapsed cells exhibited the typical smooth-walled structure that characterizes this alga. However, collapsed cells displayed a fine-scale reticulate surface pattern. Some acritarchs possess a similar reticulate texture, which has been described as a taxonomic feature. Our results suggest that this surface pattern could be created by diagenetic processes such as compaction or desiccation. We are currently investigating other algal taxa to determine whether the observed reticulate pattern forms commonly during collapse, or whether its expression is limited to certain algal groups.

## **Section IV: Physics, Mathematics, Computer Science and Technology IC - 321**

### **A. Lazari, Presiding**

2:00 **SYSTEMATIC ERRORS IN THE EXPERIMENTAL MEASUREMENT OF THE CHARGE TO MASS RATIO OF THE ELECTRON**, Zade J. Coley, George E. Keller and James C. Espinosa, State University of West Georgia, Carrollton, GA 30118. An experiment employing inexpensive equipment has been used to determine  $e/m$  for the electron. The results of the experiment are found to be systematically higher than the standard value. The work presented here is the analysis of these systematic errors in terms of the equipment design. Corrections in the calculation of results were obtained that can be attributed to "cheap" design. The justifiable corrections give results that are randomly distributed, to within a few percent, about the standard value of  $e/m$ . The standard value for  $e/m$  equals  $1.7588 \times 10^{11}$  C/kg. The initial results were off 25% to 40% from the standard value as the radius of curvature of the electron path changes from 26cm to 13cm. After applying the corrections, the % error was 0.13% with random deviation. The details of the equipment, procedure, and the raw results will be presented, and the method of inferring the source of the systematic error and calculation of the corrections to be applied will be discussed.

2:15 **ACOUSTIC FIRE CONTROL IN MICROGRAVITY\*\***, Zade Coley, Matt Herron, Elizabeth Nelson, Dmitriy Plaks, and James Espinosa. State University of West Georgia, Carrollton, GA 30118. Our objective is to study the effects of acoustics on a flame in microgravity. Our research may provide a new approach to reducing and extinguishing a combustion reaction in space (where a conventional fire extinguisher is hazardous). We propose to test the following hypotheses: 1) as sound intensity increases, so does the magnitude of the effect on the flame, 2) there is an optimal frequency for maximizing the effects of sound waves on a flame, 3) homogenous flames (found only in



microgravity) can be affected in a single area separate of others, 4) a sustained pulse of sound, rather than a single, brief pulse, can be used to extinguish a flame. Our setup includes an interior cage, inside of which is a candle; four speakers surround the cage, which are used to manipulate the flame. A video camera, infrared camera, light sensor, and microphone are placed in various locations throughout the setup to collect data. A master computer records all data and is later used for data analysis. The experiment will be performed aboard a NASA DC-9 Aircraft. We have written and submitted a proposal to NASA's Reduced Gravity Student Flight Opportunities Program (RGSFOP). Testing done in a 1 g environment indicates hypotheses 1 and 4 are correct.

2:30 A RETARDED CORRECTION TO NEWTON'S LAW OF GRAVITY, Gary Hunter, James Espinosa, and Julie Talbot, *State University of West Georgia, Carrollton, GA 30118*. Historically, the first experimental observation inconsistent with Newton's law of gravity was the precession of the perihelion of Mercury. The orbit of the innermost planet is shifted by a very small but measurable amount due to the intense gravitational force caused by its proximity to the Sun. One of the first theories to correctly account for this precession was Einstein's Theory of General Relativity. As an alternate approach we have modified Newton's law of gravity by assuming that gravity travels at the speed of light. From this assumption, we derived an equation that includes the relative velocity between two objects. An equation of motion for Mercury was solved numerically with Mathematica. The resulting orbit prediction was compared with the measured precession of the perihelion of Mercury. The theoretical prediction for the rate of precession is 43" per century which agrees well with the observed value of 43.11" ± .45" per century.

2:45 USING MATLAB TO SIMULATE THE DYNAMICS OF A THREE BODY SYSTEM\*\*, Heidi L. Lesser, and J. E. Hasbun, *State University of West Georgia, Carrollton, GA 30118*. In a three-body system, Newton's second law of motion is written as,

$$m_i \frac{d^2 \vec{r}_i}{dt^2} = \sum_j \vec{F}_{i,j}, \text{ where } \vec{r}_i \text{ is the } i\text{th body of mass } m_i, \text{ and } \vec{F}_{i,j} \text{ represents the}$$

gravitational force on the  $i$ th body due to the  $j$ th body. In this work we simulate the resulting second order differential equations for a three-body system. We perform simulations under two cases. The first case is that for which two of the more massive bodies, separated by a finite distance, are at rest while a third body orbits them. The simulation is capable of rendering orbits such as the popular figure eight, and the example for which the two massive bodies act as one. The second case is the more numerically involved example of two bodies orbiting the third, more massive body. In this simulation, the case that closely resembles the Sun-Earth-Moon system is one of several possible orbital characteristics. We conclude by presenting the results of the above mentioned orbits as well as others and, in particular, how the initial conditions affect the final orbital shapes. Addi-



tionally, we will discuss the details of the incorporation of the differential equations and their solutions as performed by the MATLAB script used here.

3:00 SIMPLIFIED WATER BALLOON LAUNCHER, L. Andrew Block and J.E. Hasbun, *State University of West Georgia, Carrollton, GA 30118*. In the talk we present a water-balloon launcher designed with a range of about 100 meters. The analysis for its design was made using standard classical mechanics formulas. The project began with a device built at a local high school to launch a water balloon projectile. This launcher happens to stand at about 10 feet high and about 4 feet wide. The disadvantages of the high school model are that its range is highly variable and it is difficult to aim, in addition to the awkwardness of its sheer size. We set out to develop a simplified version with the same or greater capabilities and better accuracy. The analysis began with a desired ideal range of 100 meters. From this range and a set barrel angle, the necessary muzzle velocity was calculated. The calculation further assumed an ideal spherical water balloon as well as windless environmental conditions. The muzzle velocity required defined the needed acceleration and thereby a certain barrel length. Since the apparatus desired was to employ springs rather than elastic bands, the spring constant was thus determined. Preliminary results demonstrate that the current simplified model is indeed capable of launching water balloons more precisely. Yet to achieve the objective range a better launching mechanism is needed as well as a more detailed model to explain the energy transfer process. In conclusion, there are several unknown parameters that our theoretical model does not include and more experimental testing is needed for a detailed understanding of the current launcher prototype.

3:15 THE EXPERIMENTAL VERIFICATION OF THE DE BROGLIE HYPOTHESIS\*\*, Gary L. Hunter, George E. Keller, and James C. Espinosa, *Physics Department, State University of West Georgia, Carrollton, GA 30118*. A simple experiment, utilizing inexpensive equipment to diffract electrons with a graphitized carbon crystal, can predict the de Broglie wavelength of the electron,  $\lambda = h/p$ , to within .6 to 1.5 percent. Experimental measurements of the de Broglie wavelength were made using the diffraction maxima for voltages 2500, 3500, 4000, 4400 volts. The experimental results were compared to the theoretical values,  $\lambda = h/(2meV)^{1/2}$ , for these voltages. Experimental procedure, data, calculations, and results will be presented and discussed in detail.

3:30 A COMPARISON OF THE ELECTRIC BREAKDOWN PROCESSES IN WATER AND HEAVY WATER\*\*, Dmitriy Plaks and James Espinosa, *State University of West Georgia, Carrollton, GA 30118*. Whenever a sufficiently high electric field is imposed on an insulator, dielectric breakdown occurs; lightning in a thunderstorm is a classic example. We are investigating how electric sparks form in heavy water ( $D_2O$ ) in order to test Espinosa's model of dielectric breakdown in regular water ( $H_2O$ ). According to accepted theory, there should be no difference between these two forms of water since they are electronically identical. However Espinosa's model predicts that there should be a big





difference between them. We will measure both the electric field necessary and the time needed to create an electric spark in samples of heavy water and regular water that have identical electrical conductivity. The electrodes will have a point to plate geometry. The conductance of the solutions will be measured with an Omega conductivity meter. The voltage and the current in the water gaps will be measured as a function of time using Pearson transformers. The temporal data will be stored in a digital oscilloscope. If Espinosa's model is correct, we expect heavy water to breakdown at 16 kV/cm, which is half the electric field needed to breakdown regular water.

3:45 SIMULATION OF  $m$  ELECTRONS INTERACTING WITH  $n$  IMPURITIES IN AN EXTERNAL ELECTRIC FIELD IN NANO-DEVICES, *Max F Perkins and J. E. Hasbun, State University of West Georgia, Carrollton, GA 30118*. In this paper we simulate the motion of electrons interacting with impurities through the Coulomb force in addition to an external electric field oriented in the  $x$  direction. The motion takes place in the  $x - y$  plane, and electron-electron interactions are ignored. The general equations of motion are therefore:

$$m \frac{d^2}{dt^2} x_i = - \sum_j^n \frac{Kq^2(x_j - i a)}{((x_j - i a)^2 + (y_j - i b)^2)^{3/2}} + E_x \quad (1), \text{ for the } x \text{ direction, and}$$

$$m \frac{d^2}{dt^2} y_i = - \sum_j^n \frac{Kq^2(y_j - i a)}{((x_j - i a)^2 + (y_j - i b)^2)^{3/2}} \quad (2), \text{ for the } y \text{ direction. Here } x_i \text{ and } y_i \text{ represent the position of the } i^{\text{th}} \text{ electron, with mass } m, \text{ interacting with the } i^{\text{th}} \text{ impurity. The impurity separation is determined according to multiples of crystal lattice constants } a \text{ and } b \text{ as seen in equations (1) and (2) above with } K = 1/4\pi\epsilon_0. \text{ In this simulation the charge of the electrons is } q \text{ and the impurities are assumed to have equal and opposite charge. The simulation has been made possible through the use of the Open Source Physics (OSP) Java library. We will present examples of simulations performed with different parameters. We conclude that the simulations are very useful in demonstrating the multi-body interactions that goes on within nano electrical devices.}$$

4:00 COMPUTERIZED UNDERDAMPED HARMONIC OSCILLATOR EXPERIMENT, *Clayton W. Huff, and J. E. Hasbun, State University of West Georgia, Carrollton, GA 30118*. In this experiment we have digitized the time dependent position of a suspended harmonic oscillator (HO) and analyzed the data using a MATLAB script that incorporates the theoretical formulas corresponding to an under-damped HO. The data was taken using a VERNIER sensor that measures force with respect to time. The sensor was controlled through the VERNIER software and has the capability to start and stop the data recording process. The experimental data is calibrated according to a linear relation that was found to exist between the force and the displacement versus time. A bare HO does not have the capability to damp out quickly, thus a special damper was fabricated, which permitted us to observe a damping effect in a relatively short time span. The data was read by the MATLAB script then plotted. A theoretical

curve was superimposed by the script, which required adjustable parameters to be imputed a priori. This process was repeated several times until a reasonable low error was obtained between theory and experiment. The error was calculated based on the average of the sum of the squares of the differences between the calculated positions and the actual positions. The lowest error obtained in this manner guided us to determine the best fitting parameters. We conclude that this method is a great opportunity to experience the true nature of a harmonic oscillator in addition to the fact that it is a very efficient way to study its damping characteristics.

4:15 USING WELL KNOWN PROBABILITY DENSITY FUNCTIONS IN CALCULUS, *Stacey Pittman, and Andreas Lazari, Mathematics and Computer Science Department, Valdosta State University, Valdosta, GA 31698*. Learning and practicing integration techniques is something required of every calculus student. However, some methods of integration can be difficult and time consuming for students, especially the famous method known as integration by parts. While introduced to calculus students as a means of obtaining a simpler, solvable integral from a more complex integral, integration by parts often involves multiple applications of the method in order to get the problem into a form simple enough to solve. The lengthy and tedious process involved in integration by parts often generates algebra errors that are hard to correct, leaving students frustrated with the method. Students may even find themselves asking if there is a better way to calculate these problems. Luckily, there is a better way. Some integrals can be evaluated using probability density functions (p.d.f's) that tremendously simplify and shorten the work. Moreover, the chance of an algebra error is greatly reduced. Yet, p.d.f's are not taught in calculus. In this paper, I will introduce well-known probability density functions and explain how they can be used as an alternative way for evaluating some integrals in calculus. I will also present an argument as to why p.d.f's should be added to calculus programs.

**Section V: Biomedical Sciences**  
**IC - 410**  
**Pamela Moolenaar-Wirsiy, presiding**

1:00 NEW METHODS FOR VACCINE DESIGN AND EVALUATION AGAINST CHLAMYDIA. *Joseph U. Igietseme\*, Francis Eko, Qing He, Godwin Ananaba, Teresa Brown, Claudiu Banda, Godwin Ifere, Deborah Lyn and Carolyn M. Black, National Center for Infectious Diseases, CDC, Atlanta GA 30333 and Morehouse School of Medicine, Atlanta, GA 30310*. *Chlamydia trachomatis* is the most common bacterial sexually transmitted disease in the United States and several industrialized countries. An effective vaccine will constitute the best approach to control the infection and the complications that include pelvic inflammatory disease and involuntary tubal factor infertility. The objective of these studies was to define the elements of protective immunity against genital chlamydial infection, design specific experimental vaccines,



and evaluate their efficacies in a mouse model of the disease. T cell clones characterized as high IFN- $\gamma$ -secreting CD4 (A-1) and CD8 (B-1) cells transferred significant protection ( $P > 0.0001$  and  $0.002$ , respectively) against genital chlamydial infection, although the CD4 T cell clones conferred a greater level of immunity. Also, mice that cleared their infections had elevated levels of IgA and IgG2a in their cervico-vaginal secretions two weeks after cell transfer, suggesting an adequate T cell help for a humoral immune response. The ability of a clone to resolve an infection was dose-dependent, requiring high IFN- $\gamma$  secretion, and coincided with a timely recruitment and maintenance of a high frequency of T cells in the genital mucosa of infected animals. In conclusion, the immunologic basis for the apparent greater contribution of CD4 than CD8 Th1 cells to chlamydial immunity was associated with the enhanced helper function of CD4 Th1 cells for specific antibody response. Potentially protective vaccine constructs require the delivery of multiple chlamydial subunits, the induction of an early and elevated IL-12, and activation of a high frequency of Th1 cells.

1:30 ISOLATION, PURIFICATION & CHARACTERIZATION OF ANTI-STENOTROPHOMONAS MALTOPHILIA IMMUNOGLOBULINS\*\* Freeman Smalls<sup>1</sup>, D.L. Scott<sup>2</sup>, E. Archibold, Clark Atlanta University Atlanta, GA 30314 D2 Biotechnology, Atlanta, GA 30314 and Morehouse College, 30314. The resistance of *Stenotrophomonas maltophilia* to antimicrobial agents is rapidly becoming a major medical and public health problem. The frequent treatment of *S. maltophilia* borne infections with the same anti-microbial agent over a period of time inherently results in the pathogen developing resistance to the drug. A polyclonal antibody cocktail (D2-DLS01) were used to recover surfaces exposed immunogenic polypeptides (SEIP's) from the cell walls of *S. maltophilia*. Individual SEIP's were characterized and bioinformatics strategies employed to localize immunogenic amino acid sequences. The strategy described in this application for the recovery of immunogenic polypeptides provides invaluable information in reference to what epitope on the surface of a pathogenic microorganism is accessible by the immune system of the said host. Individual *S. maltophilia* surface exposed immunogenic polypeptides were evaluated in growth inhibition studies and enzyme link absorbance assay (ELISA) to determine their applicability as targets for complement independent immunoglobulin neutralization. The data suggest that serial dilution (100-fold increments) of D2-DLS01 antisera ( $10^{-2}$  dilutions) showed significant binding of D2-DLS01 to *S. maltophilia* antigens as compared to controls. The data showed that D2-DLS01 inhibited the proliferation of *S. maltophilia* and several gram negative bacteria suggesting that there are conserved sequences that are common among gram negative bacteria, however D2-DLS01 did not show any inhibition of proliferation on gram positive bacteria (*S. aureus*), suggesting that there are no common conserved sequence among gram negative and gram positive bacteria.

2:00 TRYPANOSOMA BRUCEI INFECTION MODULATES APOPTOTIC GENES AND GENE PRODUCTS IN THE MOUSE SPLEEN\*\*, Eric B. Darrington<sup>1,3</sup>, Dennis Spencer<sup>1,2</sup>, Ikowa Iruene<sup>3</sup>, Jonathan K. Stiles<sup>3</sup>,

<sup>1</sup>Department of Biological Sciences, Clark Atlanta University Atlanta Georgia <sup>2</sup>Department of Biology, Morehouse College Atlanta Georgia, <sup>3</sup>Department of Microbiology, Biochemistry and Immunology, Morehouse School of Medicine Atlanta Georgia, 30310. Human African trypanosomiasis (HAT) is caused by infection with *Trypanosoma brucei*. *T. brucei* infection results in perivascular infiltration, meningoencephalitis, blood brain barrier dysfunction, and apoptosis. The molecular mechanisms mediating these complications are unclear. It has previously been reported that *T. brucei* induces apoptosis in cerebellum and brainstem cells at peak parasitemia; and earlier work suggests that *T. brucei* procyclin might play a role in the up-regulation of the apoptotic genes for Bax, Caspase-3, Caspase-8, and Caspase-9 in infected mouse brain. However, it is not known whether this phenomenon occurs in the other organs of infected hosts. Here, we hypothesized that *T. brucei* infection would affect the expression of specific apoptotic markers. It was observed, that in the animals infected with *T. brucei*, there was enhanced tissue damage coupled with expression of trypanosomal procyclin, Caspase-3, -8, -9 and Bax in spleen tissue. A thorough understanding of the interaction between parasite and host proteins in various host organs is required for full comprehension of the mechanisms that drive the complications associated with *T. brucei* infection. Trypanosomal procyclin's apparent role in the pathology of HAT suggests the possibility that it could be a potential drug target for protection against *T. brucei* infection.

2:30 THE EFFECT OF ESTROGEN ON CHLAMYDIA INFECTION AND CHEMOKINE EXPRESSION\*\*, Erika L. Barr<sup>1</sup>, Tesfaye Belay<sup>1</sup>, Frances O Eko<sup>2</sup>, Joseph Igietseme<sup>\*2</sup>, and Godwin Ananaba<sup>1</sup>, <sup>1</sup>Clark Atlanta University, Morehouse School of Medicine, Atlanta GA 30310 and <sup>2</sup>CDC & Prevention, Atlanta, GA 30333. Diseases caused by *Chlamydia trachomatis* range from acute self-limiting infection to chronic inflammatory condition, which results in inflammatory disease, infertility, and ectopic pregnancy. Although, clearance of *Chlamydia* from the host has been shown to be associated with the recruitment of immune cells such as T-helper type 1 (Th1), it is also believed that the frequency and activity of these cells may be influenced by changes in the levels of the local immunoregulatory factors. The aim of this study was to examine the influence of estrogen on the level of chemokine production during *Chlamydia* infection. We hypothesized that estrogen increases susceptibility to *Chlamydia* infection by decreasing the level of Th1 chemokine expression. HeLa cells were treated with various concentrations of estrogen for 24 hours prior to infection with various concentrations of *Chlamydia* (MoPn) ( $10^6$ ,  $10^7$ ,  $10^8$ ). Following 32 h of infection, supernatant was collected and assayed for the presence of chemokines (RANTES, IP-10 and MCP-1). Inclusion bodies were stained and enumerated using fluorescent microscopy. Increased susceptibility to *Chlamydia* infection and decreased chemokine production was observed in the estrogen treated HeLa cells compared to the controls. These results indicate that estrogen does have some affect on *Chlamydia* infection and may play a possible role in altering chemokine expression. Supported by NIH grants RR03034, A141231.

3:00 MAXIMAL CEREBELLAR EXPRESSION OF CYTOKINES AND ADHESION MOLECULES IN FATAL PEDIATRIC CEREBRAL MALARIA\*\* Henry Armah<sup>1,2</sup>, Alfred K. Doodoo<sup>3</sup>, Edwin K. Wiredu<sup>2</sup>, Andrew A. Adjei<sup>2</sup>, Richard K. Gyasi<sup>2</sup>, Yao Tetey<sup>2</sup> and Jonathan K. Stiles<sup>1</sup>, <sup>1</sup>Morehouse School of Medicine, Atlanta, GA 30310; <sup>2</sup>University of Ghana Medical School, Korle-Bu, Accra, Ghana, and <sup>3</sup>Noguchi Memorial Institute for Medical Research, Legon, Accra, Ghana. Although the role of systemic cytokines and their up-regulation of adhesion molecules in the pathogenesis of cerebral malaria (CM) is well established, the role of local cytokine release remain unclear. Immunohistochemistry (IHC) was used to compare the expression of ICAM-1, VCAM-1, E-Selectin, IL-1 $\beta$ , TNF- $\alpha$  and TGF- $\beta$  in cerebral, cerebellar and brainstem postmortem sections from 10 CM, 5 severe malarial anaemia (SMA), 1 purulent bacterial meningitis (PBM), 2 non-central nervous system infections (NCNSI) and 3 non-infections (NI) deaths in Ghanaian children. Fatal malaria and *Salmonella* sepsis showed significantly higher vascular expression of all 3 adhesion molecules, with highly significant co-localization with sequestration in the malaria cases. However, there was negligible difference between CM and SMA. TGF- $\beta$  showed intravascular and perivascular distribution in all cases, but expression was most intense in the PBM case and CM group. TNF- $\alpha$  and IL-1 $\beta$  showed brain parenchymal staining, in addition to intravascular and perivascular staining, in only the PBM case and CM group. In conclusion, the maximal expression of all 6 antigens studied was in the cerebellar sections of the malaria cases, and IL-1 $\beta$  and TNF- $\alpha$  were expressed in only cases with neurodegenerative lesions (CM and PBM), whilst TGF- $\beta$  is present in all cases.

3:30 IMMUNOHISTOCHEMICAL EVALUATION OF CASPASE 9 IN ORAL CANCER, Baldev Singh, J. Borke and R. Abdelsayed, Medical College of Georgia, Augusta, GA 30912. We have previously reported the role of proto-oncogene Bcl-2 and its congeners in the regulation of programmed cell death (PCD). However the caspases have been implicated to mediate PCD (apoptosis) via intrinsic or extrinsic pathways. The objective of this study was to elucidate the status of Caspase 9 (C-9) in oral squamous cell carcinoma. 5m thick sections of tumors from archival paraffin blocks were examined employing polyclonal antibodies to C-9. Immunoreactivity for C-9 was observed primarily in cytoplasm of 75 % of oral tumors (total 20 specimens). Differentiating tumors exhibited varying degrees of focal reaction, whereas poorly differentiated tumors had a diffuse heterogeneous reaction and focal granularity. The upstream C-9 proenzyme is activated by Apoptosome formation (Intrinsic Pathway). C-9 subsequently activates PCD inducing downstream caspase-3 also expressed in oral tumors as previously reported by us. The expression of these caspases suggests their possible role in oral cancer progression.

4:00 EXPRESSION AND FUNCTIONAL ROLE OF RANTES CHEMOKINE IN MALARIA, Bismark Y. Sarfo<sup>1</sup>, R. K. Gyasi<sup>2</sup>, A. A. Adjei<sup>2</sup>, H. Armah<sup>2</sup>, I. Iruene<sup>3</sup>, A. Quarshie<sup>3</sup>, J. W. Lillard Jr<sup>3</sup>, J. K. Stiles<sup>3</sup>, <sup>1</sup>NMRI, Ghana, <sup>2</sup>UOG Medical School, Ghana, <sup>3</sup>Morehouse School of Medicine, Atlanta, GA,

30310. Malaria infects 300-500 million people and kills >1 million per year. The pathogenesis of malaria is mediated by complex interactions involving co-regulators such as cytokines and adhesion molecules. However, the role of chemokines remains unclear. RANTES is a chemokine involved in the generation of inflammatory infiltrates and mediates degradation of cell-cell junctions, BBB dysfunction, and chemotaxis of *Plasmodium*-infected RBC into and occlusion of microvessels during malaria. Activated T lymphocytes, platelets and endothelial cells also release RANTES when exposed to IRBC's. We hypothesize that RANTES mediates malaria pathogenesis and that blocking RANTES (up regulated during malaria) could minimize or abrogate the severity of the disease. We evaluated plasma and tissue expression of RANTES in a murine malaria model (SW/P. *yoelii* 17X) and compared results with that in human subjects with malaria. Mock and anti-RANTES blocking experiments were then performed to determine the functional role of RANTES in severity and mortality associated with murine malaria. RANTES in plasma from infected and uninfected mice as well as malaria infected (n=64) and uninfected (n=19) humans were determined by ELISA. Tissue expression was evaluated by Western blot analysis using anti-RANTES antibody. RANTES expression in plasma was upregulated 2-3 fold in both human and mice (p< 0.0001) compared with controls. Plasma levels of RANTES correlated positively with levels of *P. falciparum* antigens in infected humans. Parasitemia (4.2x 10<sup>6</sup>/ml  $\pm$  0.2) in mock antibody treated mice was greater (p<0.06) than in mice in with RANTES blocked (1.2x10<sup>6</sup>/ml  $\pm$  0.2 $\pm$ SD). Mean survival of Anti-RANTES antibody treated mice was longer (14 days) while mock antibody treated mice survived for 10 days indicating that blocking RANTES reduced parasitemia associated with *P. yoelii* infection and increased survival. We conclude that malaria induced RANTES mediates severity of the disease.

### SATURDAY PAPER PRESENTATIONS

\* Denotes student presenter

\*\* Denotes student in progress research

#### Section I: Biological Sciences

IC - 318

Mark S. Davis and Terry D. Schwaner, Presiding

7:30 CORRELATION OF SEX, AGE, AND BODY MASS WITH HOOF SIZE IN WHITE-TAILED DEER FROM THE PIEDMONT WILDLIFE REFUGE, GEORGIA, Ben Batchelor\* and Alfred J. Mead, Georgia College & State University, Milledgeville, GA 31061. The distal forelimbs and mandibles of 157 white-tailed deer (*Odocoileus virginianus*) harvested during 2001 on Piedmont National Wildlife Refuge, Georgia, were used to determine the osteometric correlation of sex, age, and body mass with hoof size. The sample contained 55 females and 102 males. The width of the right, front, lateral distal phalanx and the distance from the tip of the dew-claw to the tip of the distal phalanx were

used as measures of hoof size. Linear regressions were carried out on each osteometric parameter for each sex and for the combined sexes. Although minor correlations were observed between female weight vs. dew-claw/h hoof tip length, female weight vs. distal phalanx width, male weight vs. distal phalanx width, and combined sexes weight vs. distal phalanx width, no statistically significant correlations were observed. This analysis suggests that white-tailed deer age, sex, or weight cannot be estimated accurately using the relative size of the hoof.

7:45 A PRELIMINARY ASSESSMENT OF DIVERSITY AMONG SELECTED TAXA OF DYTISCIDAE (COLEOPTERA) USING MANDIBULAR MORPHOLOGY AND GEOMETRY, *Christy C. Cecil\**, *W. P. Wall*, and *E. H. Barman*, *Georgia College & State University, Milledgeville GA 31061*. A recent phylogenetic hypothesis has *Coptotominae*, *Laccophilinae*, *Copelatinae*, and *Hydroporinae* in a single lineage. Mandibles of representative species of each of these subfamilies were examined to determine angle of attack, arc, and, basal angle, using *Matus* as an out-group. Representatives of the clade that were examined had more acute angles of attack than did *Matus* with *Laccornis* having the most acute. Arcs of *Laccophilus* and *Copelatus* are similar to those of *Matus* with smaller arcs computed for *Coptotomus* and *Laccornis*. Basal angles of *Coptotomus* and *Laccornis* were comparable to the basal angle of *Matus* with more acute basal angles observed on *Laccophilus* and *Copelatus*. The role that the mandible plays in food acquisition and manipulation is also examined. Systematic conclusions about the relationships between these taxa are made in light of the biomechanical constraints placed on the mandible for a given feeding niche. The possibility of convergent evolution in these characters is discussed. This project was supported in part by a Faculty Research Grant, Office of Research services, Georgia College & State University. Aquatic Coleoptera Laboratory Project No. 57.

8:00 A COMPARATIVE ANALYSIS OF THE LARVA OF RHANTUS CALIDUS (FABRICIUS) (COLEOPTERA: DYTISCIDAE), *B.R. Lemieux\**<sup>1</sup>, *E. H. Barman*<sup>1</sup>, and *B. P. White*<sup>2</sup>, <sup>1</sup>*Georgia College & State University, Milledgeville, GA 31061* and <sup>2</sup>*Georgia Military College, Warner Robins, GA 31093*. *Rhantus calidus* is the only species of record in Georgia for this cosmopolitan genus. The primary chaetotaxy of legs, last abdominal segment, and cerci is generally consistent with that reported for *Rhantus* and a related genus, *Colymbetes*. However, significant differences were noted when the morphology of the mature larva of *R. calidus* was compared to that of mature larvae of previously identified and/or described larvae of other *Rhantus* and *Colymbetes* species. Differences in the larval morphology of *R. calidus* include: i) absence of secondary cercal sensilla, ii) spine-like rather than lamellate frontoclypeal sensilla, and iii) differences in the distribution and size of the stemmata. These differences in larval morphology indicate that the present generic placement of *R. calidus* is doubtful. This project was supported in part by a Faculty Research

Grant, Office of Research Services, Georgia College & State University. Aquatic Coleoptera Laboratory Contribution No. 55.

8:15 A PRELIMINARY REPORT ON THE MANDIBULAR MUSCULATURE OF THE MATURE LARVA OF *THERMONECTUS BASILLARIS* (HARRIS) (COLEOPTERA: DYTISCIDAE: ACILIINI) AS A CONSEQUENCE OF STEMMATAL ENLARGEMENT, *Angeline Mouton\**, *W. P. Wall*, and *E. H. Barman*, *Georgia College & State University, Milledgeville GA 31061*. Dytiscid larval mandibles are acted upon by the mandibular abductor and adductor muscles. In larvae of *Agabus punctatus*, the stemmata are relatively small and the abductor muscle has its insertion laterally on the base of the mandible and its origin along the lateral cranial wall. The two dorsal stemmata of *Thermonectus basillaris* are columnar in shape, penetrate deeply into the cranial interior, and occupy a significant proportion of the lateral cranial interior. As a result of the increase in size and location of the dorsal stemmata, the mandibular abductor of *T. basillaris* has a ventromedial rather than a lateral origin. The change in the orientation of the mandibular abductor muscle alters mandibular biomechanics and indicates the dominance of sensory requirements over mandibular biomechanical requirements in this taxon. *Thermonectus* has a hyperprognathic cranial morphology that is most likely an adaptation for feeding on prey above it in the water column. This active mode of predation may explain the increased importance of visual acuity in this taxon. This project was supported in part by a Faculty Research Grant, Office of Research Services, Georgia College & State University. Aquatic Coleoptera Laboratory Project No. 58.

8:30 AN ANALYSIS OF VARIATION IN LATERAL CRANIAL ARCHITECTURE OF RELATED TAXA OF DYTISCIDAE (COLEOPTERA) USING DISTORTION COORDINATES (CARTESIAN TRANSFORMATIONS), *Shannon N. Shepley\**<sup>1</sup>, *W. P. Wall*<sup>2</sup>, and *E. H. Barman*<sup>2</sup>, <sup>1</sup>*Georgia Military College, Milledgeville, GA 31061* and <sup>2</sup>*Georgia College & State University, Milledgeville, GA 31061*. Distortion coordinates were employed to compare and contrast the lateral cranial morphology of representative species of a dytiscid clade that includes the genera *Laccophilus*, *Coptotomus*, *Copelatus*, and *Neoporus*. The analysis includes comparisons of representatives of this clade with *Matus bicarinatus* as the out-group. The analysis revealed five distinct cranial architectures. Each representative taxon examined exhibited significant differences, including differences in cranial orientation that ranges from hypoprognathic to hyperprognathic. Differences in internal landmarks include the presence or absence of occipital sutures and posterolateral notches, and differences in the relative positions of posterior frontoclypeal boundaries and antennal origins. Life habits of these taxa can be inferred by careful analysis of these cranial characters. This project was supported in part by a Faculty Research Grant, Office of Research Services, Georgia College & State University. Aquatic Coleoptera Laboratory Project No. 56.

8:45 BEAVER (*CASTOR CANADENSIS*) IMPACTS ON PLANT COMMUNITIES IN SOUTHERN GEORGIA\*\*, Jessica R. Brzyski\*, Georgia Southern University, Statesboro, GA 30460. North American beavers are considered ecosystem engineers and through their activities can create long-term changes in the ecosystem. Modifications of habitat by beaver can increase species richness at the landscape level, yet beaver constructions may permit highly aggressive colonizing plants, notably non-native species, to invade or potentially dominate. The objectives of this study were to (1) measure the abundance and diversity of herbaceous and small woody vegetation, (2) measure degree of canopy opening, and (3) assess the relative abundance of non-native to native vegetation in two areas: beaver modified habitat (N=9) and nearby but relatively non-impacted riparian habitat (N=9) in a matched pairs design. Vegetation surveys and canopy cover measures were performed at each site for two seasons. In a 100 m X 20 m sampling area, herbaceous and woody vegetation were counted and identified along nine transects at intervals of 5 m, 10 m, 15 m, and 20 m perpendicular to the waterline. Species richness, exotic species abundance, and canopy cover will be compared between beaver-modified and non-modified sites. Species richness will also be analyzed across a gradient perpendicular to the waterline within each site. Beaver activities can influence the course of succession by altering the composition and structure of plant communities. This study will attempt to answer specifically how ecosystem engineers such as the beaver alter the plant community. Funding was received from Sigma Xi Grants-in-Aid of Research Program and Georgia Southern University Graduate Student Research Grant.

9:00 DETERMINING THE PREVALENCE OF *TRYPANOSOMA CRUZI* IN THE BALDWIN COUNTY, GEORGIA, POPULATION OF OPOSSUMS (*DIDELPHIS VIRGINIANA*) USING POLYMERASE CHAIN REACTION\*\*, Emily Parrish\*, H. Reed, D. Bachoon, and A. Mead, Georgia College and State University, Milledgeville, Georgia, 31061. Urbanization of Georgia's rural areas brings residents into closer contact with known reservoirs of the protozoal parasite *Trypanosoma cruzi* and the insects that act as vectors. Previous studies of reservoir hosts relied on microscopic examination of blood or serologic tests for antibodies. These methods are not entirely reliable, as trypanosomes invade tissues and are rarely found in the bloodstream after the initial stages of infection. Serologic tests are more reliable, but cross-reactive antigens may result in false-positives. This study tested heart muscle tissue, where the parasite prefers to encyst. Thirty-one road-killed opossums were collected; their hearts were extracted and fresh frozen. From a cell culture provided by R. Tarleton of the University of Georgia, a positive control was established by injecting parasites into heart tissue samples. A pork heart was used as a negative control. DNA was extracted from heart tissue using a Proteinase K protocol. Polymerase chain reaction of this DNA with *T. cruzi*-specific primers indicated whether parasite DNA was present. Previous studies using visual examination of blood or serologic tests have shown the presence of *T. cruzi* in ~16% of raccoon and opos-

sum populations. This more sensitive PCR method may show a higher prevalence of the parasite. Funding for this study came through a Georgia College and State University Faculty Research Grant.

9:15 REINTRODUCTION OF FIRE IN A LONG-UNBURNED MOUNTAIN LONGLEAF PINE FOREST – IMPACTS ON FINE ROOT AND MYCORRHIZAL DYNAMICS\*\*, Brianna E. Bennett\*, and J.J. Hendricks, State University of West Georgia, Carrollton, GA 30118. Longleaf pine (*Pinus palustris*), once the dominant forest type in the southeastern United States, is a fire-dependent forest that has decreased significantly in range (> 97 %) since the advent of fire suppression laws in the 1920s. Recent efforts to reintroduce fire into these long-unburned ecosystems has resulted in significant tree kill, emphasizing the need to gain an improved understanding of the impacts of burning on the structure and function of these forests. The objective of this study was to assess the effects of a growing season prescribed burn on fine root and mycorrhizal fungi dynamics. The fire reached peak temperatures of 34 and 685°C in the humus and ground surface strata, respectively, and consumed 35% of the organic horizon. There was not a significant direct reduction in root standing biomass due to burning. However, post-burn root and mycorrhizal production was approximately 50% lower in the burn plots relative to control plots ( $2.9 \pm 2.3$  versus  $5.6 \pm 1.3$  g m<sup>-2</sup> mo<sup>-1</sup>). Thus, while burning did not have an apparent direct impact on fine root and mycorrhizal production, there was a potential indirect effect of burning resulting in a trend of reduced production belowground. These preliminary results highlight the need to explore the belowground impacts of burning in longleaf pine forests to develop ecologically sound conservation, silvicultural, and management regimes for these endangered ecosystems.

9:30 CARBON SOURCE AND SINK CONTROLS ON MYCORRHIZAL FUNGI PRODUCTION IN A LONGLEAF PINE FOREST, Stephanie E. Sims\*, and J.J. Hendricks, State University of West Georgia, Carrollton, GA 30118. The objective of this study was to evaluate how a reduction of carbon source strength (i.e. decreasing current photosynthate production to roots via foliar scorching) and an increase in the carbon sink strength (i.e., increasing fine root and hyphal N concentrations, and hence respiration rates, via fertilization) influence the production of mycorrhizal fungi in a longleaf pine (*Pinus palustris*) ecosystem. Study sites were established in a 20 year-old monospecific plantation using a complete, randomized factorial design consisting of two fertilization (control and 50 kg N ha<sup>-1</sup> yr<sup>-1</sup>) and two foliar reduction (control and 85 % canopy scorch) treatments with eight replication plots (each 20 m ´ 20 m) of each treatment combination. In each treatment plot, mycorrhizal production was assessed by measuring sporocarp, root tip colonization, and extramatrical hyphal production. Repeated measure analyses of total fungal biomass for main and interaction effects of fertilization, scorching, and time revealed a significant fertilization ´ time interaction (P < 0.0387). Peak differences in fungal biomass between the control (mean = 0.02 mg fungal biomass/g soil dry mass, SD = 0.007) and fertilization treatments (mean = 0.003, SD = 0.004) occurred in late summer.

These results indicate that carbon allocation to mycorrhizal fungi is inversely related to soil fertility, thereby supporting the “differential allocation” hypothesis regarding soil resource controls on carbon allocation and net primary production in forests.

9:45 THE OCCURRENCE AND DISTRIBUTION OF *HETERANDRIA FORMOSA* (TELEOSTEI, POECILIIDAE) IN LOWNDES COUNTY, GEORGIA, Jason C. Chaney and David L. Bechler, Department of Biology, Valdosta State University, Valdosta, GA 31698-0015. Heretofore, *Heterandria formosa* has not been reported from Lowndes County, Georgia, in the literature. We report on a county-wide survey in which eight localities from the southeastern portion of the county produced more than 30 specimens of *H. formosa*. The southeastern portion of the county is primarily flatwoods with numerous wetlands and low gradient streams compared to the remainder of the county which is typified by a more upland habitat with greater relief and greater stream gradients. It is postulated that the greater stream gradients have inhibited the migration of *H. formosa* into the southwestern and northern portions of the county. The sex ratio of the 30 specimens collected was 1:5, males to females, and may be controlled by genetics, predation, or a combination of the two.

10:00 **Business meeting**

10:30-12:00 Poster session

### POSTERS IC - Second floor lobby

DIEL PATTERNS OF INVERTEBRATE DRIFT IN A MIDDLE GEORGIA STREAM\*\*, Andrew Bigham, Melanie A. Hall\* and Diana Turner, Departments of Biology and Environmental Science, Mercer University, Macon, Georgia, 31207. The phenomenon of invertebrate drift refers to the downstream dispersal of benthic organisms that inhabit the substratum of streams and rivers. Presumably, the adaptive significance of the behavior is related to predator avoidance, reductions in intra- and interspecific competition, and exploitation of more favorable patches. We hypothesized that if fish predation were an important factor in the population dynamics of stream macroinvertebrates, then the pattern of invertebrate drift might exhibit a diel periodicity. As a preliminary test of this hypothesis, in mid-November, six Surber samplers were placed in sections of Walnut Creek (Bibb Co., GA) that were similar in both flow rate and depth. Drift organisms were collected over two-hour intervals at sunrise and at midday over a period of several days. The abundance of organisms dispersing downstream over any two-hour interval was fairly low ( $n = 4$  to 23 per sampler), suggesting that the time spent adrift was kept to a minimum. However, a diel pattern was clearly evident with a statistically significant preference for the dawn hours ( $p = 0.002$ ). These two observations suggest that the time and duration of invertebrate drift may be important in the avoidance of visual predators. This

research was sponsored by the Biology and Environmental Science Departments of Mercer University under the advisement of Alan Smith.

A PRELIMINARY ANALYSIS OF THE RELATIONSHIP BETWEEN NUTRIENT LEVELS AND RELATIVE ALGAL ABUNDANCE IN MIDDLE GEORGIA LAKES AND PONDS\*\*, Jenniffer Corriea, Gypsy Long, Emily Salman\*, and Emily Woodard, Department of Biology, Mercer University, Macon, GA 31207. Nutrient concentrations in limnetic systems are highly variable and are affected by both naturally occurring as well as anthropogenic factors. The purpose of the present study was to determine if there exists a relationship between nutrient levels and the relative abundance of suspended algal growth in middle Georgia ponds and lakes. Water and algal samples from the surfaces of 30 different lake and pond sites were collected over a period of several weeks during the fall of 2004. Distinguishing characteristics (e.g., vegetation types, waterfowl activity, run-off sources) of each study site were recorded. The aquatic habitats were grouped into three usage categories: residential, industrial and recreational. A customized grid system provided a quantitative assessment of algal abundance in each water sample. Nitrate and phosphate concentrations for each sample were obtained by colorimetric analysis using commercially available test kits (LaMotte, CHEMets, respectively). Potential correlations between factors (e.g., nutrients loads, algal abundance) were tested statistically. Alan Smith served as the faculty consultant for this project and funding was provided by the Department of Biology, Mercer University.

GENETIC VARIATION IN FOUNDER POPULATIONS OF THE MEDITERRANEAN GECKO, *HEMIDACTYLUS TURCICUS*, ACROSS THE SOUTHERN UNITED STATES\*\*, Ashleigh DeVries\* and Terry D. Schwaner, North Georgia College & State University, Dahlonega, GA 30597. Populations initially founded by a small number of individuals risk chance increases in some genetic variants (founder effect) and experience periods during which only a few individuals survive to continue the existence of the population (bottlenecks). Random changes in allele frequencies result from sampling of gametes from generation to generation (genetic drift), increasing the likelihood of fixation and homozygosity in these populations. The Mediterranean gecko, *Hemidactylus turcicus*, was introduced to port cities along the Gulf Coast (and elsewhere) in the early 20th century. Gecko populations occupying buildings separated by only a few city blocks exhibited differences in allele frequencies likely due to founder effect, and possibly bottlenecks and genetic drift. This study compared expected probabilities of polymorphism and heterozygosity, computed from allelic frequencies in representative source populations in port cities of the southeast (Mobile, Alabama, and Gulfport, Mississippi), with actual levels of polymorphism and heterozygosity among founder populations sampled from Florida, Louisiana, Texas, and Arizona.



ISLAND BIOGEOGRAPHY ON THE SCALE OF A POND ECOSYSTEM\*\*, Kelly Floyd, Annie Harris, Kyle Hunt\*, and Sara Noone, Department of Biology, Mercer University, Macon, GA 31207. The MacArthur-Wilson equilibrium theory of island biogeography contends that, based on immigration and extinction rates, larger islands closer to the mainland should exhibit higher equilibrium species diversities than smaller, more distant islands. The purpose of this study, conducted during the fall of 2004, was to test the immigration component of the theory on a small scale by using a 68-m wide, 2-hectare, Monroe County (GA) pond as the model system. Hester-Dendy samplers (n=15) served as "islands" and were suspended 5 cm below the surface from buoyed PVC pipes tethered to a polyester-nylon rope transect. Five islands each were placed in one of three treatment groups based on a prescribed distance from the shore: near shore (1.4 m), quarter way (17.4 m), and midway (32 m). The samplers remained in place for 6 weeks and were then removed without dislodging the resident organisms by enclosing each in a polystyrene jar for later ethanol preservation. Macroscopic invertebrates were identified to the family and/or morphospecies level. We had predicted that species richness, species diversity, and population density would be inversely related to immigration distance; however, any such correlation, if present, might have been obscured by several possible factors for which we had not accounted: (1) two mainlands with different migration distances, the shallow-vegetated littoral zone and the benthic zone, may have confounded the relationship; (2) equilibrium communities must be established before any significant relationship can be discerned; and (3) predation rates on the macroinvertebrates (e.g., *Chironomidae*) may have been disproportionately higher in the near shore, vegetated region. Alan Smith served as the faculty consultant for this project and funding was provided by the Department of Biology, Mercer University.

INGESTION RATES OF FIVE SPECIES OF PACIFIC ECHINODERM LARVAE FED NATURAL AND ARTIFICIAL DIETS, Colleen A. Fox\* and Sophie B. George, Georgia Southern University, Statesboro, GA 30458. Ingestion rates for the sea urchin *Strongylocentrotus purpuratus*, the sand dollar *Dendraster excentricus*, and the sea stars *Dermasterias imbricata*, *Pisaster ochraceus*, and *Evasterias troschelii* were investigated by assigning larvae to three natural (*Dunaliella tertiolecta*, *Isochrysis galbana* and *Rhodomonas sp.*) and one artificial diet (Ziegler E-Z Larval diet) in the laboratory. For *Dendraster excentricus* larvae, no significant differences were observed in the volume of natural and artificial particles ingested while for *S. purpuratus* larvae, significant differences were observed. For *S. purpuratus* larvae, ingestion rates were highest for the artificial diet followed by *Rhodomonas sp.*, *Dunaliella tertiolecta* and *I. galbana*. For all three species of sea stars, significant differences were observed in ingestion rates on natural and artificial particles. All three species ingested significantly higher volumes of the natural alga *Rhodomonas sp.* than the other diets. The volume of artificial particles ingested varied among seastars. *Dermasterias imbricata* larvae ingested significantly higher volumes of the artificial diet while *P. ochraceus* and *E. troschelii* larvae ingested significantly lower volumes of this diet. Both *P. ochraceus* and *Dermasterias imbricata* larvae ingested *Dunaliella*

*tertiolecta* and *I. galbana* at similar rates. The differences in ingestion rates for these five echinoderm species might be due to differences in larval size and form. This is the first study documenting echinoderm larvae ingesting artificial and natural particles. The use of an artificial diet instead of natural diets has great implications for sea urchin aquaculture and embryological studies in the medical field.

NUCLEOTIDES AFFECT REPRODUCTIVE OUTPUT AND LARVAL DEVELOPMENT OF THE SEA URCHIN *LYTECHINUS VARIEGATUS*, Sophie B. George<sup>1</sup>, J.M. Lawrence<sup>2</sup>, and Addison Lawrence<sup>3</sup>, <sup>1</sup>Georgia Southern University, Statesboro, GA 30460, <sup>2</sup>University of South Florida, and <sup>3</sup>Texas A&M University, College Station, TX, 77843. The present study examined the effects of nucleotides on the reproductive output, larval growth, development, and juvenile production of the sea urchin *Lytechinus variegatus*. Thirty sea urchins were collected from Florida, randomly distributed into tanks, and fed one of three diets: artificial feed with 0, 5, or 10 mg nucleotides/g feed for two months. Adults fed nucleotide-enhanced diets produced significantly larger eggs than those in the control. Adults fed diets enhanced with 5 mg nucleotide/g produced large numbers of small eggs while those fed diets enhanced with 10 mg nucleotide/g produced fewer larger eggs. Larvae from adults fed nucleotide-enhanced diets were significantly larger with higher developmental rates than larvae in the controls. Adults fed diets enhanced with 5 mg nucleotides/g produced larvae with lower survival rates and a few large juveniles. Larvae from adults fed diets enhanced with 10 mg nucleotides/g produced larvae with higher survival rates and many small juveniles. This study is the first to clearly indicate the nutritional role of nucleotide-enhanced diets on the reproductive output, larval development, and juvenile production of the edible sea urchin *Lytechinus variegatus*. It demonstrates the potential of using sea urchins as a model to study the effect of food additives and anti-nutritional factors on reproduction and development.

DIATOM DIVERSITY IN ENRICHED AND NON-ENRICHED MICROCOSMS FROM A MIDDLE GEORGIA POND\*\*, Marisa Hadley\*, Christina Schmidt, Kassie York, and Cavina Anderson, Mercer University, Macon, GA 31207. The purpose of this project was to observe and record the effect of nutrient enrichment on freshwater diatom communities maintained as greenhouse microcosms. Water and sediment samples were taken from a 25-m length of littoral zone of a southern Monroe County pond in late September 2004. Eight four-gallon containers were used to create the microcosms, four of which were enriched with ecologically relevant phosphate and nitrate levels from a commercial plant fertilizer and four of which remained untreated to serve as controls. Initial phosphate and nitrate concentrations were measured prior to enrichment to establish baseline values using standard water test kits (CHEMetrics, Inc.). Thereafter, levels were determined biweekly in both the enriched and controlled microcosms. A periphyton sampler (Wildco) was floated in each microcosm for an initial three-week period to permit the establishment of a periphyton community. Next, one slide was randomly selected from each sampler for analysis on a weekly basis for the next three weeks. Slides were processed by removing the obscuring

filamentous algae with a hydrogen peroxide-potassium dichromate cleansing protocol. Dried slides were examined microscopically and diatom diversity was calculated using the Sequential Comparison Index based upon a 200-diatom count. Differences between the enriched and control groups included relative biomass, percent filamentous algal composition, diatom species richness, and diatom diversity. Alan Smith served as the faculty consultant for this project and funding was provided by the Department of Biology, Mercer University.

**NEUROGENESIS IN RESPONSE TO PHOTO-STIMULATION IN CRAYFISH (*Procambarus clarkii*) DEUTOROCEREBRUM\*\***, *Ihunanya C. Mbata\**, *Barry K. Rhoades*, and *Wanda T. Schroeder*, *Wesleyan College, Macon, GA 31210*. Neurogenesis is one mechanism underlying neuronal plasticity, which enables organisms to adapt to environmental changes and learn throughout life. Vertebrates and invertebrates share many of the physiological mechanisms that control neurogenesis; however, invertebrates have simpler organization, and larger, more identifiable neurons that make them easier to study. Enriched environments have been shown to increase neurogenesis in olfactory regions of the crayfish, the deutocerebrum. In the present experiment, neurogenesis in the deutocerebrum was studied in crayfish (*Procambarus clarkii*) in response to varying light patterns. Juvenile and adult crayfish were evenly distributed into a control group, exposed to 12 hours of light and 12 hours of darkness, and a treatment group continuously exposed to stroboscopic light flashes. Following this light exposure period, the crayfish were treated with 5-Bromo-2-Deoxyuridine (BrdU), which is integrated into replicating DNA and serves as a mitotic marker. After dissection and cryosectioning of the brains, immunocytochemistry was used to visualize and quantify the extent of neurogenesis in the deutocerebrum. BrdU was localized using primary and secondary antibodies; specifically, mouse anti-BrdU and goat anti-mouse IgG conjugated to a fluorescent marker. As a positive control, serotonin was similarly localized with rabbit anti-serotonin and goat anti-rabbit IgM conjugated to a different fluorescent marker. The experiment is in progress, and our operating hypothesis is that the crayfish in the treatment group that are exposed to a complex environment should show a greater extent of neurogenesis than the crayfish in the control group. Partial funding for the research was provided by the Munroe family of Georgia.

**A POPULATION OF *CYPRIPEDIUM ACAULE* (PINK LADYSLIPPER) AT KENNESAW STATE UNIVERSITY**, *A. Rachel Prakash\** and *H.D. Sutton*, *Kennesaw State University, Kennesaw, GA 30144*. *Cypripedium acaule* (Pink Ladyslipper) is an orchid species native to eastern North America that is vulnerable due to ongoing habitat loss and over-collection. The Kennesaw State University campus has a mixed pine-deciduous forest patch that in the spring of 2004 contained a population of 273 *C. acaule*. As a baseline for a long-term study on this population, mapping of the current population was completed using standard surveying techniques. Each individual in the population was flagged with a number. In addition to the baseline survey, two short-term studies were performed. The objective of the first study was to determine if leaf size influenced

flowering. After measuring leaf size for each plant, and noting whether or not it produced a flower, it was shown using a logistic regression that *C. acaule*'s flowering was dependent on leaf size. The second study sought to determine which, if any, abiotic factors influenced the location of growth of *C. acaule* individuals within the forest patch. Data collected regarding the individual clusters of orchids within the population demonstrated, by way of logistic regression, that the location of the orchids was affected by leaf litter depth, but not light, soil temperature, or soil compaction. This study represents the first year of a long-term study that is being conducted with the aim of helping to preserve this important native plant species.

**LARVAL DENSITY AFFECTS GROWTH AND DEVELOPMENT OF THE SEA URCHIN *LYTECHINUS VARIEGATUS*. (ECHINODERMATA: ECHINOIDEA)**, *Carla A. Terry\** and *Sophie B. George*, *Biology Department, Georgia Southern University, Statesboro, GA 30460*. Due to the high demand of sea urchin "roe," fishing industries worldwide are searching for ways to cultivate sea urchins at optimal densities in the laboratory. The present study investigated the effect of sea urchin larval density on growth and development. Eggs from two females were fertilized with sperm from a single male. A day after fertilization, two treatments with three replicates per treatment were set up; a low-density treatment with 550 larvae per jar and a high-density treatment with 1550 larvae per jar. All larvae were fed the alga *Dunaliella tertiolecta*, at a concentration ranging from a minimum of 4000 cells/mL to a maximum of 8000 cells/mL per day for two months. A nested analysis of variance revealed significant differences in total larval length, rudiment length, and juvenile diameter. *L. variegatus* larvae reared at low-density had a higher survival rate, grew bigger, developed bigger rudiments, and metamorphosed into bigger juveniles. This is an important find in sea urchin aquaculture. Commercial hatcheries could increase the yield and the size of juveniles by simply keeping the number of larvae/mL at 0.025 and feeding them a maximum of 8000 cells/mL.

**GENETIC VARIATION IN MAINLAND AND ISLAND POPULATIONS OF THE GREEN TREE FROG, *HYLA CINEREA*, IN THE SOUTH CAROLINA LOW COUNTRY**, *Adam White\**, *Brandon Pinson\**, and *T. D. Schwaner*, *North Georgia College & State University, Dahlonega, GA 30597*. Island models predict that finite population size and reduced migration causes reduction and eventual loss of genetic variation in natural populations. We estimated heterozygosity and allelic frequencies for four polymorphic loci, using allozyme electrophoresis, in tissue samples of the green tree frog, *Hyla cinerea*, representing two islands (one small and one large) and one mainland population. Results did not support expectations. Overall genetic variation was lower in the mainland population and higher on the islands. In addition to the limited coverage of island and mainland populations in this survey, and our lack of estimates of spatial and temporal effective population sizes, migration may be more limited than assumed for the mainland site.

EFFECTS OF SUBSTRATE AND TEMPERATURE ON AFLATOXIN PRODUCTION OF *ASPERGILLUS FLAVUS* AND *ASPERGILLUS PARASITICUS* IN PEANUTS, *Premila Achar and Andres Sanchez, Kennesaw State University, Kennesaw, GA 30144*. We investigated the effects of different substrates (potato dextrose agar [PDA], nutrient agar [NA], and corn meal agar [CMA]) and temperatures on aflatoxin production and growth in *Aspergillus flavus* and *A. parasiticus*. Contaminated peanuts from retailers at different locations in Georgia were used throughout the experiment. Two hundred seeds were selected from each sample. PDA, NA, and CMA served as the substrate to express the mold from the contaminated seeds. Seeds were plated equidistantly on each of the media and incubated at 10° C, 27° C, 30° C, and 37° C. Seeds incubated on moils filter paper served as control. Neither mold growth nor detectable levels of aflatoxin B<sub>1</sub> was observed at temperatures of 10° C and 37° C on amny media used. However, maximum growth of both molds, along with detectable levels of aflatoxin B<sub>1</sub>, was attained at the temperatures of 27° C and 30° C. Of the three media tested, PDA supported vigorous growth of both *Aspergillus* species at temperatures of 27° C and 30° C.

THE INFLUENCE OF ELEVATION ON STOMATA DENSITY, *Kamal Aderibigbe, Kimberly Bollinger\*, Lesli Duvall\*, Gayla, Prince\*, and Mark Davis, North Georgia College & State University, Dahlonega, GA 30597*. We investigated the potential relationship between stomata density in tuliptree (*Liriodendron tulipifera*) and elevation above sea level. We collected 265 leaves from different elevations (457 m - 1219 m) in four locations within a 65 km radius in northern Georgia. Impressions of stomata on the underside of each leaf were made using clear nail polish and cellophane tape. Linear regression analysis followed by ANOVA showed that mean stomata density decreased with an increase in elevation ( $y = -0.09x + 211.82$ ;  $R^2 = 0.11$ ;  $F_1, 263 = 31.64$ ,  $P < 0.0001$ ). The inverse relationship between elevation and stomata density could reflect enhanced carbon dioxide availability (Henry's Law) and perhaps increased partial pressure of carbon dioxide (Dalton's Law) at higher altitudes. In addition, fewer stomata may reflect a greater need to conserve water in the cooler, drier air found at higher elevations.

PREDATION ON APOSEMATIC AND NON-APOSEMATIC SNAKE REPLICAS IN NORTHERN GEORGIA, *Brandi Barrett, Brandi Owen\*, Angela Pastore, Kyle Wilbanks\*, and Mark Davis, Department of Biology, North Georgia College & State University, Dahlonega, GA 30597*. Batesian mimicry theory states that harmless, edible species resemble harmful species to reduce predation risk. By extension, mimics should not experience reduced predation in areas of allopatry where harmful models are absent. We investigated predation on replicas of non-venomous scarlet kingsnakes (*Lampropeltis triangulum elapsoides*), which resemble aposematic venomous eastern coral snakes (*Micrurus fulvius*), in northern Georgia where potential predators had no previous experience with coral snakes. Plasticine models of coral snakes, scarlet kingsnakes, and non-aposematic, non-venomous eastern kingsnakes (*Lampropeltis getula*) were placed

in the wild at four locations. Models were checked for evidence of predation, usually bite marks or peck marks, each 72 h for 4 weeks. Models that were damaged by predators were reshaped and returned to their original position. Predation data were analyzed using a one-way ANOVA. We found no significant difference in the number of attacks among snake replicas ( $F_{2,6} = 1.77$ ,  $P = 0.25$ ). Our results parallel those of Pfennig et al. (2001) and demonstrate that protection afforded to mimics breaks down in areas where dangerous models are absent.

**Section II: Chemistry  
IC - 417  
Kenneth Martin, Presiding**

9:00-12:00 **Poster session**

10:00 **Business meeting**

10:45 STEPPING OFF THE STAGE: STUDENT CENTERED LEARNING IN THE CHEMISTRY CLASSROOM, *Andrew R. Bressette, Department of Chemistry, Berry College, Mt. Berry, GA 30149-5016*. We recently implemented Process Oriented Guided Inquiry Learning (POGIL) in several of our General Chemistry and Organic Chemistry Classrooms. POGIL, a NSF sponsored curricular reform effort in chemistry education, seeks to have students build their own knowledge of chemistry by working through guided activities in small groups. In addition to developing content knowledge, students also acquire and hone process skills (such as data interpretation/extrapolation, oral and written communication, time management, etc) through their group roles. This new learning method replaces the 'sage on the stage' with a series of activities that forces students to become actively engaged in learning the material. As part of our implementation of POGIL, we used the Student Assessment of Learning Gains (SALG) survey to assess the impact that student centered learning had on our students. Unlike traditional course evaluations, which ask students to focus on the faculty, this comprehensive, validated assessment asks students to report where they have made gains in their own learning and skill development. A brief overview of a typical POGIL classroom will be presented followed by SALG assessment data of student performance in traditional lecture and student centered learning classrooms. Results indicate that students in the guided inquiry classrooms made significantly greater gains in most categories of the assessment than their peers in the traditional classrooms.

11:00 THE EVOLUTION OF THE RESEARCH EXPERIENCE FOR UNDERGRADUATES IN THE CHEMISTRY DEPARTMENT OF BERRY COLLEGE FROM 1974 TO 2004, *Larry G. McRae, Berry College, Mount Berry, GA 30149*. The number of chemistry students from Berry College presenting papers at national, regional, and state meetings, as well as being listed as co-authors

on journal articles, has increased dramatically during the last decade. This increase in scholarly production must be due to an increasing richness of the research experiences available to the students. Factors—such as increasing numbers of faculty engaged in personal research, stipends for students, and improved facilities—which have led to an increasingly meaningful experience will be discussed.

11:15 USING SPARTAN TO EXPLAIN SPLITTING OF *D* ORBITALS IN VARIOUS CRYSTAL FIELDS, *Kenneth L. Martin, Berry College, Mt. Berry, GA 30149*. Textbooks of General Chemistry fairly often include (1) a figure of a central metal coordinated to a number of ligands (e.g., six ligands to form an octahedral field of ligands) and (2) an energy level diagram showing the splitting of the *d* orbitals. The figure requires a fair amount of imagination on the part of the novice learner of Crystal Field Theory. Therefore the static, two-dimensional figure of the complex ion is not satisfactory to convey to the student why a particular *d* orbital would have a certain energy relative to the other *d* orbitals. However, through the use of SPARTAN, “three-dimensional” representations of linear ( $\text{GeH}_2^{2+}$ ), square planar ( $\text{GeH}_4$ ), tetrahedral ( $\text{GeH}_4$ ), trigonal bipyramidal ( $\text{GeH}_5$ ), and octahedral ( $\text{GeH}_6^{2+}$ ) complex ions can be generated. Hydrogen was chosen to represent the ligands because hydrogen contributes minimally to the surfaces representing molecular orbitals. It was found that the use of germanium as the “transition metal” allowed each of the five “complexes” to have (1) their geometries minimized and (2) the surfaces representing the five *d* orbitals able to be displayed such that the orientations of the *d* orbitals are consistent with respect to each other and the ligands. Through inspection of the relative interaction of the various *d* orbitals with the ligands and answering a number of questions that guide their inquiry, students of General Chemistry were able to correctly deduce the relative energies of the *d* orbitals in each of the commonly-encountered ligand fields.

11:30 INTERACTIVE VISUAL LEAST SQUARES METHOD WITH EXCEL PROGRAM, *Myung-Hoon Kim<sup>1</sup> and Michelle Song Kim<sup>2</sup>, <sup>1</sup>Georgia Perimeter College - Dunwoody Campus, Dunwoody, GA 30338 and <sup>2</sup>Stanford University, Palo Alto, CA 94309*. The Least Squares Method is one of the most commonly used tools for an analysis of data in science and engineering. In this work, we developed a novel graphic method of least squares, which is based on vision, by utilizing an interactive feature of a spreadsheet program (Excel). This is accomplished by minimizing the heights of a bar graph that represent either the sum of squares of the deviation or the sum of absolute values of the deviations. This approach was extended to a Least Absolute Method as well. Results from both methods (Least Squares vs. Least Absolutes) were compared, and found to be the same as those obtained from the Gauss Formulae (namely, for the slope and intercept for a case of linear relationship) when the correlation is high. However, the results were somewhat different, but still comparable, when the correlation is relatively low.

## POSTERS

### IC - Second floor lobby

EVALUATION OF THE VISCOSITY OF OKRA GUM WITH THE ADDITION OF FRUCTOSE OR SUCROSE, *Jasmine M. Cook\*<sup>1</sup>, Sarah N. Bryl<sup>1</sup>, Paul F. Cerpovicz<sup>2</sup>, and Joelle E. Romanchik-Cerpovicz<sup>1</sup>, <sup>1</sup>Georgia Southern University, Statesboro, GA 30460 and <sup>2</sup>East Georgia College, Swainsboro, GA 30401*. This laboratory is studying methods to maximize the viscosity of okra gum for use as a fat ingredient substitute in sweetened food products. The current study determined the effects of various concentrations of fructose or sucrose on the thickness of okra gum. Gum was obtained from fresh cut okra by boiling water extraction. A stock solution of each sugar was blended gently into okra gum to achieve final sugar concentrations of 0-400 mg/ml (0-2.2 *M* fructose or 0-1.2 *M* sucrose). Viscosities (*V*) of okra gum/sugar solutions were determined using a rotational viscosimeter. The effects of each concentration of sugar were reported as relative viscosity (*RV*) of okra gum, where

$$RV = [(V_{okra+sugar}) - (V_{sugar+water})] / V_{okra+water}$$

The addition of increasing concentrations of fructose or sucrose resulted in a continuous increase in the relative viscosity of okra gum. While relative viscosities reached  $2.32 \pm 0.22$  and  $2.66 \pm 0.05$  at 400 mg/ml of fructose and sucrose respectively (*N* = 3 for each), the relative viscosities of okra gum containing either sugar were not significantly different at any concentration of sugar tested. On a molar basis, sucrose showed a much greater effect than fructose, suggesting that the molecular size difference between sucrose (342 g/mol) and fructose (180 g/mol) influences the positive effect that each sugar has on the viscosity of okra gum.

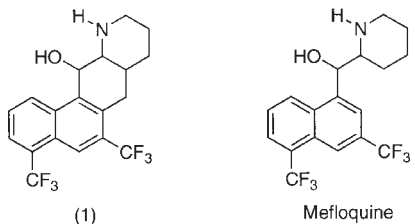
THE SYNTHESIS OF LACTONES VIA BAEYER-VILLIGER OXIDATION BY MICROWAVE AND SOLID-STATE SYNTHESIS\*\*, *Mayisha Ealey\* and Nripendra Bose, Spelman College, Atlanta, GA 30314*. The production of lactones, critical components in disease prevention and medicine, is described by Baeyer-Villiger Oxidation under solvent-free and microwave conditions. The advantageous conditions surrounding microwave and solid-state synthesis of lactones will be discussed. Research funding is provided by the NASA-WISE (Women in Science and Engineering) program at Spelman College.

A SPETROSCOPIC STUDY OF ELECTROLYTE EFFECTS ON ALPHA-CRYSTALLIN CONFIGURATION\*\*, *Kamika Felder\*, Candis Mayweather\*, and Lisa Hibbard, Spelman College, Atlanta, GA 30314*. The primary protein component in the ocular lens, alpha-crystallin, is known to play a major role in maintaining lens transparency. Recent studies have shown that alpha-crystallin prevents the aggregation of other lens proteins by acting as a molecular chaperone. Although the mechanism of the chaperone-like behavior is unknown, there is evidence that alpha-crystallin acts by exposing its hydrophobic regions to interact with damaged proteins. It is therefore, of interest to study the configuration of alpha-crystallin samples in the presence of varying NaCl and  $\text{CaCl}_2$

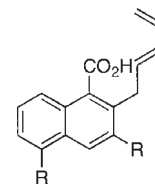
concentrations (0.5 M - 1.0 M) at temperatures ranging from 35° to 65° C. Tryptophan residue fluorescence was monitored to determine the extent of photolysis. ANS-binding studies and acrylamide fluorescence quenching studies yielded information regarding changes in protein configuration. Circular dichroism monitored changes in protein secondary structure.

**SYNTHESIS, CHARACTERIZATION AND LUMINESCENCE STUDIES OF LANTHANIDE(III) COMPLEXES\*\***, *Zewdu Gebeyehu*<sup>1</sup>, *Hirofumi Motegi*<sup>\*1</sup>, and *David E. Zelmon*<sup>2</sup>, <sup>1</sup>*Columbus State University, Columbus, GA 31907* and <sup>2</sup>*Wright-Patterson Air Force Base, Dayton, OH 45433*. Lanthanide(III) complexes are of much interest because of their photoluminescence properties that make them important in a variety of applications such as light-emitting diodes, in biomedical imaging and optical amplification. In this study three lanthanide metal complexes were synthesized, to produce materials that have luminescence and waveguide properties. The synthesis was achieved by the reaction of lanthanide metal salts,  $MCl_3 \cdot 6H_2O$  (M = Sm, Eu, Gd) with a chelating ligand, potassium dithioimidodiphosphine ( $K[N(PPh_2S)_2]$ ) in methanol. The reactions resulted in the formation of white powder in high yields for all the three metals. The products were characterized by elemental analysis, spectroscopic methods and melting points. All these results suggested the formation of the expected complexes,  $M([N(PPh_2S)_2])_3$ . The fluorescence property study of the europium complex in THF gave an excitation band at  $\lambda_{max} = 312$  nm and emission band at  $\lambda_{max} = 364$  nm.

**MOLECULAR MODELING STUDIES OF CONFORMATIONALLY CONSTRAINED ANALOGS OF MEFLOQUINE**, *Al M. Panu and Shylah Kirch*\*, *Kennesaw State University, Kennesaw, GA 30144*. Geometry optimization of each of the lowest energy conformations for the eight stereoisomers of the proposed antimalarial (**1**) using the semiempirical AM1 methods as implemented in the SPARTAN molecular modeling package have been calculated. The geometries were also used to calculate such properties as molecular electrostatic potential, dipole moment, proton affinity and frontier molecular orbital energies. Comparison of these properties to those of the active enantiomer of mefloquine and predictions of relative antimalarial activity of the stereoisomers of **1** are discussed.



**SYNTHESIS OF 2,7-DISUBSTITUTED-3-((E/Z)-PENTA-2,4-DIENYL)-QUINOLINE-4-CARBOXYLIC ACID**, *Al M. Panu, Bhavin Patel*\*, and *Madeleine Ndomo*\*, *Kennesaw State University, Kennesaw, GA 30144*. The title compound is needed as a precursor in the synthesis of conformationally constrained analogues of the antimalarial compound mefloquine. The strategy for the synthesis of this quinoline derivative involves the use of the Pfitzinger reaction starting with suitably substituted isatin and (E/Z)-hepta-4,6-dienal which was in turn synthesized starting from divinylcarbinol. The overall synthesis strategy and the characterization of the intermediate compounds by IR, NMR and MS will be discussed.



**COMPARISON OF FATTY ACID LIGANDS IN HUMAN HNF4- ACTIVITY AND ITS ROLE IN DIABETES\*\***, *Allen Stokes*\* and *Karen Duda*, *Kennesaw State University, Kennesaw, GA 30144*. The Hepatocyte Nuclear Factor 4- $\alpha$  (HNF4- $\alpha$ ) is a member of the nuclear receptor superfamily whose ligand is in current debate. Mature-Onset Diabetes Mellitus in Youth (MODY) and other forms of Diabetes have been genetically linked to the HNF4 gene. Previous x-ray structures have revealed the presence of a fatty acid in the HNF4 ligand binding domain (HNF4 LBD). The HNF4- $\alpha$  x-ray structure contains both the open and closed forms HNF4- $\alpha$ . In the open form, the helix  $\alpha 12$  is linear with helix  $\alpha 10$ , allowing access to the fatty acid ligand and preventing the binding of coactivators. The closed form restricts access to the ligand but allows the formation of a coactivator binding site. Since HNF4 has not been isolated without a fatty acid, we need to obtain the HNF4 ligand binding domain without a fatty acid in order to study the effects of various ligands and drugs. Using protein folding methods, HNF4 will be folded and its functionality will be tested through the comparison of HNF4 without a ligand to HNF4 with a fatty acid ligand. We have cloned, expressed, and purified the ligand binding domain of HNF4. HNF4- $\alpha$  LBD will be denatured and the ligands removed by extensive dialysis. We will then refold HNF4 in the absence of ligand and perform functionality studies.

**Section III: Earth and Atmospheric Sciences**  
**IC - 421**  
**Mark Groszos, Presiding**

8:30 A WATER QUALITY TREND STUDY OF THE YAHOOOLA CREEK RESERVOIR AND ITS TRIBUTARIES, *Jason Ryncarz and Robert Fuller, North Georgia College & State University, Dahlonega GA 30597*. Yahooola Creek reservoir was constructed during the period 1999-2001 to serve as a major source of drinking water for most of Lumpkin County Georgia. This study was conducted to assess the water quality of the reservoir and its tributaries. Samples were collected and the following tests were conducted: alkalinity, ammonium nitrogen, biochemical oxygen demand, dissolved oxygen, fecal coliform bacteria, hardness, nitrate, pH, total solids, and turbidity. These tests were modeled after R. Fullers research of Lake Lanier and the Vernier Water quality testing series. The data was taken once a week from January to April 2004. The results of this study showed that the impact of the reservoir construction might have a lasting effect on the water supply and local aquatic life and that Ward Creek, one of the two major tributaries to the reservoir, contributes more bacteria and sediment to the reservoir than the other tributary Yahooola Creek.

8:45 THE AFFECT OF STORMS ON WATER QUALITY OF STREAMS OF WEST GEORGIA,\*\* *Eric G. Phillips and Curtis L. Hollabaugh, Department of Geosciences, State University of West Georgia, Carrollton, GA 30118*. Water quality monitoring of the Little Tallapoosa River and Central Campus Branch, a tributary creek that drains the central campus of UWG was conducted up to five times a week. Samplings began in August 2004. The Little Tallapoosa watershed is a mix of farmland, forest, small towns, and light industry. The watershed serves as the major source of drinking water for the city of Carrollton. The watershed is undergoing rapid residual development. Central Campus Branch drains an area consisting of buildings, roads, parking lots, sidewalks, recreational fields and lawns. Near its confluence with the river is a weir where samples are collected and flow is measured. The passage of major storms including the remnants of two hurricanes provided some significant rain events. Parameters measured include specific conductivity, turbidity, dissolved oxygen, pH, total phosphorus, and nitrate-nitrite-N. The first tropical storm produced 3.5 inches of rain in three days and river and creek turbidities of 75 and 240 NTU, respectively. This storm lowered the creek's specific conductivity from ~80 to 35 mS/cm. Recovery to background turbidity and specific conductivity after a major rain event takes about five days for Campus Creek. The Little Tallapoosa River requires over seven days returning to pre-storm turbidity levels. When rainfall events follow at close intervals the Little Tallapoosa River may not return to baseflow turbidity conditions for several weeks. The pH levels are lowered for 1-3 days after a major storm.

9:00 SEDIMENTATION IN VESICLES; INTERPRETATION OF GEOPETAL FABRICS IN AMYGDALOIDAL AGATES\*\*, *Jake L. Holloway and Timothy M. Chowns, State University of West Georgia, Carrollton, GA 30118*. Agates derived from lava vesicles consist of silica in several habits; opal, chalcedony and quartz. We investigate these various fabrics under light and electron microscope using etched thin sections. It is inferred that silica diffuses into the vesicles from the surrounding lava via capillary water. Microcrystalline chalcedony (length fast) occurs as thinly laminated isopachous, radial fringes throughout vesicles, suggesting multiple seeding in vadose, capillary water films (meniscus cement). Drusy quartz (length slow) occurs as late fillings on cavity walls. Crystals are larger, unlaminated, with fewer nucleation points and appear to have grown in less concentrated solutions, below the water table. Most interesting are deposits of geopetal agate occupying the bottoms of cavities. These are derived from both colloidal precipitates (opal) and fibrous crystals (chalcedony) in vesicles only partly filled by water. Horizontal laminae are mantled by botryoidal chalcedony, sometimes growing both up and down from the surface. Small-scale druses commonly occur between laminae. Botryoidal chalcedony is continuous with radial fringes on vesicle walls but seeded intermittently. The fabric suggests that crystals were growing at the interface between liquid and gas either supported by surface tension or possibly seeded on rafts of bubbles. This interpretation is reinforced by the occurrence of unusual palisade structures associated with fluctuating water levels.

9:15 **Break**

9:30 THE MINERAL HERITAGE PROJECT – A CALL TO ACTION TO PRESERVE MINERAL OCCURANCES IN THE STATE OF GEORGIA, *David Babulski, Georgia Mineral Society, Atlanta, GA 30333-5011*. Daily each of us witnesses the destruction of our precious mineral heritage. With each new strip mall, each new housing development, our environment is changed. As the hills are bulldozed away and as the ground is built upon and paved over, a page of Georgia mineral history is lost. The purpose of the Mineral Heritage Project is to accurately document in detail mineral occurrences within the state of Georgia. A site research and documentation protocol is used to ensure complete and consistent documentation of: (1) Geography, (2) Geology, (3) Minerals, and (4) Detailed photographs of the mineral occurrence and of representative mineral samples. Guidelines are supplied on how to assemble a Mineral Heritage documentation package that will be cataloged and stored at a controlled site for use by future generations of students and workers in the earth sciences. This paper is "Call to Action" on the part of the professional and academic earth science communities to participate and assist with the Mineral Heritage Project. At present, the Georgia Mineral Society and the South-East Chapter Friends of Mineralogy sponsor the Mineral heritage Project. An example documentation package on the "Minerals of the Wolf Creek Formation – Norcross Quadrangle, Duluth, Georgia" is included in the presentation.



9:45 A UNIQUE OPEN FRAME GIMBAL VARIATION OF THE MICROSCOPE UNIVERSAL STAGE FOR USE WITH MINERAL PHOTOMICROGRAPHY AND MINERAL ANALYSIS, *David Babulski, Georgia Mineral Society, Atlanta, Georgia, 30333-5011*. A five degree of freedom open frame gimballed mechanical stage loosely based on the Universal Stage used in optical mineralogy has been built using readily available and low cost materials. Similar in form to commercially available stacked 3 axis goniometers, the open frame gimbal stage provides 360° rotation in azimuth and rotation through 90° in rotational x and rotational y directions at a fraction of the cost of commercial stacked goniometers. The microscope is attached to a device that affords linear motion in the x and y directions. All axes are calibrated in five-degree intervals to afford repeatability in positioning a specimen in three dimensions under the microscope. This gimbal stage is currently used for mineral photomicrography and optical mineral analysis. A discussion of the innovative use of light emitting diodes as microscope light sources at various wavelengths is included with the report. A set of detailed engineering drawings of the open frame gimbal stage is also included.

#### 10:00 **Business meeting**

10:30 TEMPORAL VARIATION OF LEACHABLE METALS IN COASTAL SOILS OF GEORGIA, *Gian S. Ghuman, S. Paramasivam, and Kenneth S. Sajwan, Savannah State University, Savannah, GA 31404*. Dissolved metals in the surface runoff water and in the water extracts of two coastal soils (sandy and loamy textures) were analyzed twice with an interval of 16 years. The objective of this study was to assess the impact of released major and trace metals on the quality of coastal waters and achieve better management of soil fertility. These two soils were grasslands and their adjacent forest areas near Chatham-Effingham County line in Coastal Georgia. Water-soluble major and trace metals were analyzed through ICP-OES. The results of this study showed a decrease in soil pH, Ca, Mg, K and Zn concentrations and increase in Na concentrations in the present samples compared to soils from the same location analyzed sixteen years ago.

10:45 CLIMATIC IMPLICATIONS OF 52 YEARS OF ICE-MARGIN LOSS IN SELECTED GLACIERS OF THE BEARTOOTH PLATEAU IN SOUTH-CENTRAL MONTANA, *Edward E. Chatelain, Valdosta State University, Valdosta, GA 31698*. A recent aerial survey taken in August 2004 revealed further significant ice-margin loss in many of the largest glaciers of the Beartooth Plateau. Proximal SNOTEL sites provided the needed snow-water equivalent data and maximum and minimum temperature data to document annual snow coverage days and temperatures present after snow melt-out. 38 years of water equivalent data from Fisher Creek SNOTEL (elev. 9100, 4.8 mi. from Grasshopper Glacier) indicates a trend of decreasing number of total snow coverage days and an equally dramatic increase in the number of days with no snow coverage. 23 years of temperature data from the Fisher Creek and 20 years of data from the Beartooth Lake (elev. 9280, 9 mi. from Castle Rock Glacier) SNOTEL stations indicate



declining summer average maximum temperatures but strongly increasing summer minimum temperatures responsible for the continual ice-margin decline initiated by the low precipitation/high temperature 1987, 1991, and 1994 El Niño events.

11:00 LINKING ENVIRONMENTAL SCIENCE AND GLOBAL ISSUES EMPLOYING READING, WRITING, REEFS, ROCK IGUANAS AND RUM, *Beth Rushing, Dwight Call and Melanie DeVore Georgia College & State University, Milledgeville, GA 31061*. Environmental issues cover an immense range of topics within both the natural and social sciences. Unfortunately, introductory courses with content focused on environmental issues are often taught as environmental science. Many of the issues addressed in Introduction to Environmental Science at GC&SU, such as human population growth, urbanization and human impact on the environment at a global level, directly interface with one of our required core courses, Global Issues. In May of 2004 both Environmental Science and Global issues were cluster taught as part of the GC&SU People and Ecosystems of San Salvador Island study abroad program at the Gerace Research Center. Unlike New Providence, San Salvador is a small, outer family island. Because of its size, San Salvador provides students and faculty with an unparalleled opportunity to both interact with the residents and critically assess specific environmental issues impacting the island. The program is structured so that students complete some required readings and assignments before the program begins. This enables the faculty to utilize the locality during the day and lecture at night. Evaluation is largely based on keeping a journal containing observations, assignments and reflections. The journal also serves as a means for maintaining a personal dialogue between the instructors and students. The combination of both Environmental Science and Global Issues taught in an international setting result in students grasping the complexity of human interactions with the environmental.

11:15 PHOTO-MOSAICS AND PHOTO CLUSTERS-WIDENING THE HISTORICAL GEOLOGIST'S WINDOW INTO THE PAST, *Edward E. Chatelain and Cecilia S. Barnbaum, Valdosta State University, Valdosta, GA 31698*. Valdosta State University's website [http://www.valdosta.edu/phy/hist\\_geo\\_lab](http://www.valdosta.edu/phy/hist_geo_lab) has been recently supplemented by extensive photographic documentation in the West Temple, Utah, Palisades, Utah, and Boysen Peak, Wyoming geological study areas. As a result, a new section entitled "Gallery" was added. Each "Gallery" window begins with a small-scale aerial photograph obtained from <http://terraserter.microsoft.com>, which serves as an index map for the photo-clusters taken within the study area. Several larger-scale aerial photos then serve as location maps for each photo cluster. Photo mosaics from both aerial and ground-based color slide photography have replaced individual slide frames where possible, because wide-field composites greatly enhance the visualization of regional stratigraphic and structural relationships. Formational contacts, unconformities, faults, and folds have then been drawn upon these mosaics, and are revealed by clicking successive icons. Where close-up detail is required, single frames





continue to provide the ultimate zoom-lens effect. The impact of this section is that it connects the world of aerial photographs (maps) and ground/aerial color slide photography accessible to the student with the abstract world of delineated

11:30 A NEW WINDOW INTO VALDOSTA STATE UNIVERSITY'S VIRTUAL FOSSIL MUSEUM, *Edward E. Chatelain and Cecilia S. Barnbaum, Valdosta State University, Valdosta, GA 31698*. Valdosta State University's Virtual Fossil Museum website <http://fossils.valdosta.edu> recently opened a second window entitled: "Find an Animal". This portal displays the taxonomic assignments and relative distributions for the more than 400 fossil specimens pictured at the site in the context of their geologic ranges. The first level designates the basic subdivisions of fossil procaryotes, Single-Celled eucaryotes, invertebrates, vertebrates, and plants. Secondary taxonomic assignments for each subdivision are then displayed, with some further representations made down to the familial level. By clicking the geologic range configurations at this level, the individual generic names will appear superimposed upon the total geologic range of their taxonomic group. Clicking a single genus name will then locate the specimen photographs as in the "Choose a Time" window. The "Find an Animal" portal provides the geologic range configuration for the taxonomic group containing each fossil specimen represented in the Virtual Museum. This display provides important information regarding both the taxonomic and evolutionary affinities each fossil featured at the site.

## POSTERS

### IC - Second floor lobby

DESIGN OF A THERMOCOUPLE-BASED SOIL THERMOMETER, *Richard P. Faucett and Eric C. Brevik, Valdosta State University, Valdosta, GA 21698-0055*. The design of a simple, inexpensive soil thermometer will be presented. Components of the thermometer include Type-T thermocouple wires and connectors, 2" and 3" diameter PVC pipe and glue, #10Ω one-hole rubber stoppers, dry sand, and all-weather caulking. A main PVC pipe is cut to the desired length using the 2" diameter pipe. Holes are drilled and routed to allow the thermocouple wires to be set at the required depths relative to a reference point marked on the main pipe. When the thermometer is installed, it is pushed into the soil until the reference point is at ground level, meaning that each hole represents the soil depth at which temperature is taken. The thermocouple wires are set into the routed holes and held in place with all-weather caulk. After the caulk sets the pipe is backfilled with dry sand, which acts as insulation and prevents the pipe from floating if set below the water table. A #10Ω stopper is placed over the top opening with the wires running through the hole. Caulk is placed around the wires and the edges of the stopper, and a 2" to 3" adapting collar glued over the stopper. A short piece of 3" diameter PVC is glued onto the collar to act as a storage area for the Type-T connectors. Placing a 3" PVC cap over the storage area to protect the thermocouple connectors from the elements finishes off the thermometer.



GEOMORPHIC CHANGES TO BARRIER ISLANDS NEAR PENSACOLA DUE TO HURRICANE IVAN, *Katrina M. Pate, Eric C. Brevik, and Paul C. Vincent, Valdosta State University, Valdosta, GA 31698-0055*. Hurricanes have been shown to create significant geomorphic change on barrier islands. Hurricane Ivan came ashore between Pensacola, FL and Mobile, AL as a strong Category 3 hurricane. Georeferenced pre-hurricane aerial photographs of the barrier islands off the Escambia and Santa Rosa County coast of Florida were used to georeference post-hurricane aerial photographs from NOAA. Pre and post-hurricane photos were then compared using ArcGIS 8.x to determine how the islands were altered by the storm. Geomorphic processes involved were then interpreted. Results of this study will be presented.

GEOMORPHIC CHANGES TO BARRIER ISLANDS NEAR PENSACOLA DUE TO HURRICANE IVAN, *Katrina M. Pate, Eric C. Brevik, and Paul C. Vincent, Valdosta State University, Valdosta, GA 31698-0055*. Hurricanes have been shown to create significant geomorphic change on barrier islands. Hurricane Ivan came ashore between Pensacola, FL and Mobile, AL as a strong Category 3 hurricane. Georeferenced pre-hurricane aerial photographs of the barrier islands off the Escambia and Santa Rosa County coast of Florida were used to georeference post-hurricane aerial photographs from NOAA. Pre and post-hurricane photos were then compared using ArcGIS 8.x to determine how the islands were altered by the storm. Geomorphic processes involved were then interpreted. Results of this study will be presented.

CARBON SEQUESTRATION IN LAKE LOUISE, SOUTHERN GEORGIA, *Angela Wall<sup>1</sup>, Amie Leandro<sup>2</sup>, Eric C. Brevik<sup>1</sup>, James A. Hyatt<sup>2</sup>, and Gary L. Wood<sup>1</sup>*, <sup>1</sup>Valdosta State University, Valdosta, GA 21698 and <sup>2</sup>Eastern Connecticut State University, Willimantic, CT 06226. Sequestration of carbon in various environments has been proposed as one potential way to address rising levels of CO<sub>2</sub> in the atmosphere. Several studies have shown that lake sediments can be efficient places to sequester carbon, and small lakes are particularly effective. This study looks at the sequestration of carbon in the sediments of Lake Louise, a small (~13 acre) lake located in Lowndes County, Georgia. Sediments were cored during the summer of 2004 using a piston corer at 3 locations along a lake-wide transect. Cores were sampled for bulk density using samples of known volume and carbon was determined using a Perkins-Elmer CHN analyzer and compared with loss on ignition (LOI) carbon concentrations from previously collected sediment cores. Ongoing analyses indicate that organic carbon concentrations are significantly depleted (<20% by dry weight LOI) and dry bulk densities are increased (by up to a factor of 10) in the uppermost 15 cm of the sediment column as compared to deeper sediments (to 3.3 m below the lake bed). These changes can be confidently attributed to influx of inorganic sediments to the lake following nearby highway construction. Carbon concentrations increase on average by nearly a factor of 3 below these sediments. All findings suggest relatively high amounts of carbon sequestration per unit volume of sediment relative to terrestrial environments.





**Section IV: Physics, Mathematics,  
Computer Science and Technology  
IC - 321**

**Andreas Lazari, Presiding**

8:00 STUDENT STATISTICAL ANALYSIS OF STUDENT EDUCATIONAL RESOURCE FACILITY (SERF) AT REINHARDT COLLEGE, *Richard Summers, Reinhardt College, Waleska, GA 30183*. Several years ago a successful writing laboratory was established at Reinhardt College. In 2002, the college faculty decided to extend the services of the lab to include all academic subjects offered at the college. I decided to have my introductory statistics class analyze two questions related to the lab. (1) Has overall usage of the lab increased in the time period since its use was extended to include subjects other than writing? (2) Have significant numbers of students begun to use the lab for assistance in subjects other than writing? Students are expected to produce a written report and give an in-class presentation. In this way my statistics students learn to perform statistical analysis on a real-world problem and present their results in an organized and convincing manner. I present the results of several student analyses and compare them to my own assessment of the lab. From my experience over several semesters, the project has proven to be a valuable teaching tool.

8:15 THE RIEMANN HYPOTHESIS, *Gary Lewellen, Gordon College, Barnesville, GA 30204*. An introductory exposition of the mathematical and historical features of one of the most famous unsolved problems in all of mathematics; history, number theory, and complex analysis frame Riemann's conjecture; the result is an indication of why this problem is still important today. A true *Riemann hypothesis* would shed much light on the distribution of the primes and would hence be of great importance in the number theory that has been employed in cryptology. *Riemann's hypothesis* has inspired parallel conjectures in algebra and even has a counterpart in the mathematics of particle physics. This exposition gives a sketch of both the background of Riemann's historic paper and the mathematics it contains.

8:30 DO STUDENTS IN COLLEGE ALGEBRA PERFORM BETTER IN A THREE DAY LECTURE VERSUS A TWO DAY LECTURE, *Andreas Lazari, Valdosta State University, Valdosta, GA 31698*. One course that draws attention at the university level is college algebra. It is perceived by the students to be one of the most difficult courses in college. Students take the class three and four time before they succeed. Universities are introducing new ways of teaching college algebra hoping to improve the student's success in this course. At our university we are facing the same problem. We decided to compare a three-day lecture class against a two-day class. We believed that because of the nature of the material, shorter lectures more frequently, like three-day classes, would be more successful than two-day classes with longer lectures less frequently. We also believed that students in three-day classes would have higher retention rates

than those in two day classes. Data was collected over a period of four years and analyzed. Findings indicate that students have higher success and retention rates in the three day lecture classes.

8:45 INSTITUTIONAL RESEARCH CONCERNING THE SUCCESS OF STUDENTS IN MATH 1113, PRE-CALCULUS, *DeWitt More and Teresa Betkowski, Gordon College, Barnesville, GA 30204*. Statistics were collected and analyzed from Summer 2003 through Spring 2004 to examine the performance of students who completed MATH 1113, Pre-Calculus. The study focused on a comparison of former MATH 1101, Introduction to Mathematical Modeling, students to MATH 1111, College Algebra, students who completed MATH 1113, Pre-Calculus. The researchers also collected data on students who completed MATH 1113 taking neither MATH 1101 nor MATH 1111. The study showed that former MATH 1101 and MATH 1111 students performed about the same in MATH 1113 with a mean grade point average of 2.0. Students who did not take either MATH 1101 or MATH 1111 had a mean grade point average of 1.7. The researchers concluded that taking MATH 1101 or MATH 1111 is the best first-step for most of their students.

9:00 PHOTOELECTRIC MAGNITUDE MEASUREMENTS OF THE LUNAR ECLIPSES ON MAY 16, 2003 AND OCT. 28, 2004, *Richard W. Schmude, Jr., Gordon College, Barnesville, GA 30204*. The Moon's brightness dropped by 10.73 and 10.61 magnitudes during the total lunar eclipses on May 16, 2003 and Oct. 28, 2004 respectively. These magnitude drops are close to the corresponding value for the January, 2000 total lunar eclipse. It is concluded that the atmosphere was moderately transparent during 2003 and 2004.

9:15 BRIGHTNESS MEASUREMENTS OF SATURN IN LATE 2004, *Richard W. Schmude, Jr., Gordon College, 419 College Dr., Barnesville, GA 30204*. The writer measured the brightness of Saturn during November of 2004. The B, V, R and I magnitudes of Saturn plus rings on Nov. 15 were: 1.02, 0.00, -0.70 and -0.90 respectively. It is concluded that the color of Saturn has not changed during the past year; however Saturn has become a little dimmer due to the rings beginning to close up.

9:30 SURPRISES ON URANUS, *Richard W. Schmude, Jr. Gordon College, Barnesville, GA 30204*. Members of the Association of Lunar and Planetary Observers have observed two surprising developments on Uranus, which are a bright South Polar Region and a drop in the brightness of Uranus. It is concluded that the drop in brightness is due to the bright South Polar Region shifting away from the Earth

9:45 AN ALTERNATIVE APPROACH TO SOLVE THE "15-PUZZLE?" *K. C. Chan, Albany State University, Albany, GA 31705*. The 15-puzzle is a 4 x 4 frame that contains 15 sequentially numbered tiles and one hole. The

objective of the game is to order the numbered tiles either by rows or by columns, moving only one tile at a time within the frame. Conventionally, to solve the puzzle, one moves 15 tiles by trial and error until a solution is found. It is quite a challenge to generalize a pattern of 15 shifting tiles that can lead to a solution. In contrast, by borrowing the “hole” concept from solid-state physics, a more efficient means of solving the 15-puzzle may be found by moving the missing tile (the “hole”) among 15 seemingly stationary tiles. Let  $T_{ij}$  be the current position of a tile in an  $n \times m$  grid and  $T_{ab}$  be its targeted position to traverse from  $ij$  to  $ab$ , where  $ij$  and  $ab$  are the  $i$ -th row and  $j$ -th column and  $a$ -th row and  $b$ -th column of the grid respectively. The role of the hole, amazingly, is to render the move of the tile from  $T_{ij}$  to  $T_{ab}$  possible through a number of possible square-lattice pathways. Hence, the 15-puzzle is actually a square-lattice walker problem. The real challenge in solving the 15-puzzle is to determine the minimum number of steps necessary to achieve a sequenced ordering of the 15 tiles. The strategies to find a shortest path, the minimum number of shortest paths, and the distribution of the pathways will be discussed. It can be concluded that the “hole” concept from physics may lead to a new means of solving the 15-puzzle.

#### 10:00 Business meeting

10:30 A BINARY REPRESENTATION OF THE GEOMETRY OF SPACE-TIME, *Dennis W. Marks, Valdosta State University, Valdosta, GA 31698*. Geometric (Clifford) algebra provides a description of various geometrical elements (points, lines, planes, volumes, etc.) generated by  $n$  basis vectors. Depending on the signatures (+1 for space-like, -1 for time-like) of the basis vectors, the geometric algebra is isomorphic to matrices of reals  $\mathbf{R}$ , complex numbers  $\mathbf{C}$ , or quaternions  $\mathbf{H}$ . In two dimensions, the geometric algebra is isomorphic to  $\mathbf{H}$  if both basis vectors are time-like (forming a time-like plane); it is isomorphic to  $2 \times 2$  matrices of reals  $\mathbf{R}(2)$  either if both basis vectors are space-like (forming the time-like Euclidean plane) or if one basis vector is space-like and one basis vector is time-like (forming the space-like Minkowskian plane). The Euclidean case can be expressed with trigonometric functions and the Minkowskian case with hyperbolic functions. Because the real range of the hyperbolic cosine used to describe vectors in the Minkowskian plane has only one point in common with the real range of the cosine used to describe vectors in the Euclidean plane, the matrix representation of the geometric algebra that can describe both the Euclidean plane and the Minkowskian plane is unique. The four geometric elements (1 point, 2 lines, and 1 plane) in each case can be expressed with four  $2 \times 2$  matrices whose non-zero elements are either the same (+1) or different (-1) on either the major axis or the minor axis. The direct product of the matrices of the two 2-dimensional geometries (the Euclidean plane and the Minkowskian plane) generates a matrix representation of four-dimensional Minkowskian space-time.

10:45 A CONVENIENT GENERAL ANGLE FORMULA FOR THE PERIOD OF A PENDULUM, *J. E. Hasbun, State University of West Georgia, Carrollton, GA 30118*. It is generally accepted that the period of a pendulum for small initial angles,  $\theta_0$ , of less than about 0.26 radians ( $\pm 15^\circ$ ) is reasonably described by  $\tau_0 = 2\pi\sqrt{l/g}$  (1). However, for larger angles the period deviates well

above this and the general result  $\tau = 2(\tau_0/\pi) \int_0^{\pi/2} d\phi/[1 - k^2 \sin^2 \phi]$  (2), where  $k = \sin(\theta_0/2)$ , has to be used. One can use this integral's Taylor series to make approximations to the actual period with an accuracy that depends on the value of  $\theta_0$  and the number of terms used in the Taylor series expansion. The different approach of using successive approximations to the solution of the pendulum's differential equation for which  $\sin(\theta) \approx \theta - \theta^3/3!$  obtains a simple formula for the period that goes beyond the usual  $\tau_0$  but less accurate than the fourth order term in  $k$  in the Taylor expansion of (2). This presentation makes use of this successive approximations result to motivate the simple approximation to the pendulum's period in the form  $\tau = \tau_0/\sqrt{1 - \theta_0^2/a}$  (3), with  $a = 8.563$ . It is demonstrated that this result is more accurate than including terms in the Taylor expansion of (2) up to 6th order in  $k$ . This renders (3) a useful empirical formula for the period of a pendulum for initial angles between 0 and  $\pi/2$ .

11:00 NUMERICAL ANALYSIS OF A LINEAR OSCILLATOR HAVING “VOLLEYBALL AERODYNAMICS DRAG” DAMPING, *Kale Oyediji<sup>1</sup>, S.A. Rucker<sup>2</sup> and R.E. Mickens<sup>3</sup>, <sup>1</sup>Morehouse College, Atlanta, GA 30314-3773, <sup>2,3</sup>Clark Atlanta University, Atlanta, GA 30314*. The standard simple harmonic oscillator (SHO) provides a good first approximation to many phenomena in the natural and engineering sciences. The inclusion of linear damping extends even further its applicability to a broader class of dynamical systems. We present preliminary work on a SHO with damping term expressed as a velocity dependent suitable for modeling “volleyball aerodynamic drag.” This type of damping force increases at low speeds, but suddenly becomes small when the speed exceeds a certain critical value; see SCIENCE, vol. 306, 1 October 2004, pp.42. Our numerical simulations indicate that the behavior of this oscillator has major features that differ in comparison with the damped SHO. This work was supported by funds from DOE and the MBR-S-CORE Program at Clark Atlanta University.

#### POSTERS IC - Second floor lobby

STRENGTH EVALUATION OF POROUS AND BRITTLE MATERIALS USING ULTRASONIC AND FINITE ELEMENT METHODS\*\*, *Barry Hojjatie, Kathryn Hall, and Steven McDonald, Valdosta State University, Valdosta, GA 31698*. This study investigates on application of ultrasonic techniques in measurements of mechanical properties of two different types of materials. First, the stiffness properties of paper materials will be investigated, and then ceramic materials

used in fabrication of dental restorations will be analyzed. Paper industry that employs more than ten percent of our state's manufacturing workforce, ranks one of the Georgia's top manufacturing industries. This industry often relies on labor-intensive methods of mechanical testing for screening of their products. This study reports on successful measurement of paper stiffness properties using ultrasonic method. In the second part, we will report on application ultrasonic techniques in determination of elastic modulus and Poisson's ratios of dental ceramic materials. An ultrasonic sensor available at Georgia Tech was employed for measurements. Interestingly, this ultrasonic sensor has been originally designed for measurements of paper properties; however, this study shows that the sensor is also capable in accurately measuring the stiffness properties of the dental ceramics. Mean value of Young's Modulus corresponding to ten measurements on each of three porcelain samples were 83.2, 81.7, and 83.2 GPa, respectively. The corresponding coefficient of variability values were 1.80%, 1.93% and 0.96% respectively. The results were consistent with the reported values in published literature.

**Section V: Biomedical Sciences**  
**IC - 319**  
**Pamela Moolenaar-Wirsiy, Presiding**

7:30 NOVEL APPROACHES FOR VACCINE DELIVERY AGAINST STDs, F. O. EKO<sup>1</sup>, Q. He<sup>1</sup>, G. Ifere<sup>1</sup>, G. Ananaba, <sup>2</sup>D. Lyn, <sup>1</sup>C. Black, <sup>3</sup>J. U. Igiatseme<sup>3</sup>; <sup>1</sup>Morehouse School of Medicine, Atlanta, 30310, <sup>2</sup>Clark Atlanta University, Atlanta 30314; and <sup>3</sup>Centers for Disease Control and Prevention (CDC), Atlanta, GA 30333. Genital infections caused by *Chlamydia trachomatis* and Herpes simplex virus type 2 (HSV-2) rank among the highest sexually transmitted diseases (STDs) in the world. The availability of a combination vaccine that can be administered as a single regimen to protect against multiple infections would be highly desirable. Designing efficacious vaccines against Chlamydia and genital herpes would require the development of effective delivery vehicles capable of eliciting the immune effectors relevant for long-term protection. The recombinant *Vibrio cholerae* ghost (rVCG) is a novel bacterial ghost delivery system with inherent adjuvant properties and capable of simultaneously delivering multiple antigens from the same or different pathogens to the immune system. rVCGs expressing the chlamydial outer membrane protein (MOMP) and the HSV-2 envelope protein, gD2 were produced by the expression of protein-encoding genes and subsequent lysis of cells by cloned \*174 gene E. The expression of both proteins was detected by immunoblotting analyses. In addition, immunologic analysis indicated that intramuscular immunization of naive mice with recombinant ghosts induced a strong T helper type1 (Th1) response against target antigens. The degree of protection conferred by the combination vaccine against both pathogens is a function of the level of specific Th1 response elicited against each organism. Thus, a combination vaccine regimen can simultaneously

protect against multiple organisms if adequate immune effectors are elicited against the individual pathogens.

8:00 EXPRESSION OF KERATINOCYTE TRANSGLUTAMINASE (TGASE1) IN VAGINAL EPITHELIUM OF MICE DURING DIFFERENT STAGES OF ESTROUS\*\*, Yo-Leigh A. Gardner, A. B. Redwood and W. T. Schroeder, Wesleyan College, Macon, GA 31210. Keratinocyte transglutaminase, TGase1, is essential to the formation of the cornified layer of the epidermis and is usually expressed during the latter stages of keratinocyte differentiation. While extensive research has been performed to assess the role that this protein plays in normal skin development, studies have not yet been preformed to investigate TGase1 expression in hormone-responsive epithelia such as vaginal tissue. The purpose of this study is to determine the expression pattern of keratinocyte transglutaminase in the mouse vagina at each stage of the estrous cycle. After determining the stage of estrous cycle of sexually mature virgin female mice, tissue sections were obtained for the various stages and processed via immuno-histochemistry. The vaginal tissue sections were mounted on glass slides, air-dried and fixed with acetone-methanol (1:1, v/v) for 1 minute. Subsequently sections were rinsed and blocked with PBS/1%BSA for 15 minutes, followed by incubation for 1 hour with a rat monoclonal TGase1 antibody in PBS/0.15% Triton X-100/1%BSA. Sections were then incubated for 1 hour with goat anti-rat IgG in PBS/0.15% Triton X-100/1%BSA and mounted in 90% glycerol/PBS. Afterwards, TGase1 expression was determined utilizing fluorescence microscopy.

8:15 THE EFFECT OF ALL-TRANS RETINOIC ACID ON GENE EXPRESSION PATTERNS IN *ORYZIAS LATIPES* EMBRYOS\*\*, Uschi Auguste and Holly Boettger-Tong, Wesleyan College, Macon GA 31210. Retinoic acid is a potent derivative of Vitamin A that affects vertebrate physiological processes such as cell growth and differentiation, morphogenesis, and development. Retinoic-acid mediated gene activation is important for normal vertebrate development; however, when embryonic exposure to retinoids is higher than normal, developmental anomalies occur. The retinoic acid isomer being used in this study is all-trans retinoic acid (ATRA). ATRA binds to retinoic acid receptors (RARs) that are transcription factors, thereby affecting gene expression. Previous studies have indicated that treatment of embryos with retinoic acid caused defects in cardiac morphology. In the current study, messenger RNA (mRNA) will be obtained from cardiac tissue of embryos that have been treated with 100nm of ATRA in the neurula stage of development. Using reverse transcriptase-polymerase chain reaction (RT-PCR), gene expression from the tissue of the treated embryos will be compared with that of control embryos in an attempt to begin to uncover the mechanism by which retinoid treatment interferes with heart formation in Medaka. As the basic pattern of heart formation in Medaka is similar to that in other vertebrates, this information may be useful for understanding cardiac abnormalities in other species, including man.

8:30 ESTROGEN INDUCED EXPRESSION OF KERATINOCYTE TRANSGLUTAMINASE IN RAT VAGINAL EPITHELIUM\*\* *Abena B. Redwood, Y. Gardner and W.T. Schroeder, Wesleyan College, Macon GA 31210.* Expression of keratinocyte transglutaminase, TGase-1, occurs in differentiated layers of epidermal tissue and influences the cornification of the outermost layers of keratinocytes. While TGase1 expression has been investigated in epidermis, little is known of its expression pattern in hormone-responsive epithelia including uterine and vaginal tissues. This study was designed to determine the expression pattern of TGase-1 protein in rat vaginal epithelium at different time points post estrogen administration. Ovariectomized rats received an initial dose of estrogen followed by the collection of vaginal tissue at 0, 1, 3, 6, 12, and 18 hours post injection. Frozen sections from each time point were prepared, mounted on glass slides, and air dried followed by fixation in acetone-methanol (1:1). Sections were then blocked in PBS containing 1% BSA and incubated with anti-mouse TGase-1 monoclonal antibody diluted in PBS/0.15% Triton X-100/1% BSA. Subsequent rinses in PBS/0.15% Triton X-100/1% BSA were followed by incubation with FITC-conjugated goat anti-rat IgG secondary antibody. Sections were then mounted in 90% glycerol/PBS and TGase1 expression was determined using fluorescence microscopy.

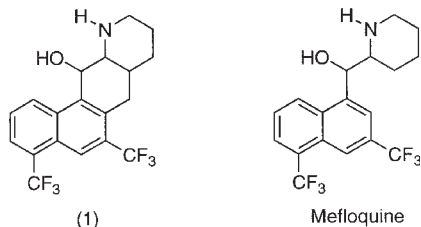
8:45 METHEMOGLOBIN AND SKELETAL MEMBRANE PROTEIN ALTERATIONS IN RAT ERYTHROCYTES EXPOSED TO PARA-iodo-PHENYLHYDROXYLAMINE, *Harriett King, Harpal Singh, Elissa T. Purnell and Melva Coles Bostick, Savannah State University, Savannah, GA 31404.* Exposure to aniline and its analogs lead to an increase in methemoglobin concentrations in red blood cells. The formation of MetHb is the first hemotoxic response in the induction of hemolytic anemia, which is defined as the premature removal of mature erythrocytes from the circulation following chemical exposure. Whole blood was collected from healthy male Sprague-Dawley rats, weighing 125-150 grams. Cells were washed (x3) with 50 ml of phosphate buffered saline supplemented with glucose (PBSG, pH 7.4). Methemoglobin induction was determined by treating 1.5 ml aliquots of packed red blood cells with 100, 200, or 300  $\mu$ M of *para*-iodo-phenylhydroxylamine (*p*-iodo-PHA) at 37°C. Control red blood cells were dosed with 10  $\mu$ l of acetone. Aliquots (75  $\mu$ l) were removed from each treatment at specific time points (0-180 minutes) and mixed with 5 ml of cold hemolysis buffer. The percentage of MetHb was determined spectrophotometrically at 635 nm. The remaining cell suspensions from each treatment were washed (x1) with PBSG then lysed in 20 ml of phosphate buffer (5mM, pH 8.0) and centrifuged for 10 minutes to produce red blood cell ghosts. Analysis of membrane proteins was performed by SDS-PAGE. The results suggest a correlation between methemoglobin induction and changes in the banding patterns of red blood cell skeletal membrane proteins.

9:00 **Break**

9:15 THE EFFECTS OF A SEALED CULTURE VESSEL ON THE DEVELOPMENT AND SURVIVAL OF SHELL-LESS CHICK EMBRYOS, *Mariyam Durojaiye\*, Daina Ngugi, Folasade Ademosu, Tosin Olaleye, and Army Lester, Kennesaw State University, 1000 Chastain Rd., Kennesaw, GA 30144.* The goal of creating an effective culture vessel for maintaining shell-less chick embryos has been limited by high mortality and poor development. In this study, unincubated chick embryos were removed from their shells and cultured in sealed egg-shaped culture vessels made of plastic wrap. The environment was maintained at 37-38 °C, 60% relative humidity and varying partial pressures of oxygen. The sealed vessel was effective in supporting 90% survival for shell-less embryos during the first three days of incubation, when the partial pressure of oxygen was maintained at 450 mmHg. Approximately 70% of the embryos survived until day 13 under similar conditions. Shell-less embryos cultured with no supplementary oxygen experienced high mortality during the first three days of culture, with less than 10% survival at day 13. Development of shell-less embryos maintained under high oxygen was similar to that of in ovo controls during the first ten days of incubation. However, by the 13<sup>th</sup> day of incubation, shell-less embryos were significantly smaller than controls. These results indicate that a sealed culture vessel may be effective in helping to maintain the survival and development of shell-less embryos by regulating gas exchange and water loss. Funded by the Kennesaw State University Mentor Prot g Program and a grant from the Georgia Space Grant Consortium.

9:30 DETERMINING THE CONCENTRATION AND PERIOD FOR WHICH THE ANTIBIOTICS VANCOMYCIN, PENICILLIN, AND OXACILLIN HAVE A BACTERICIDAL EFFECT ON BOTH RESISTANT AND SENSITIVE STRAINS OF *STAPHYLOCOCCUS AUREUS* AND SELECTED ENTEROCOCCAL STRAINS\*\*, *Cecile M. Ewane, Don Davis, Kennesaw State University, Kennesaw, GA 30144.* Previous research (unpublished) has indicated that inhibitory concentrations of vancomycin did not have a bactericidal effect on selected *Staphylococcus aureus* isolates within 48 hours. To determine bactericidal periods and concentrations, four resistant Enterococcal strains, a control strain with no van genes plus seven *Staphylococcus aureus*, five resistant and three sensitive to vancomycin strains were tested. All *Staphylococcus aureus* strains were isolated from throat cultures derived from healthy adults, and were selected based on zone diameter disk diffusion tests performed using NCCLS standards. Agar minimum inhibitory concentration tests (MICs) per NCCLS standards were used to determine the bactericidal concentrations of the antibiotics. MICs were performed for all strains at concentrations of 4ug/ml, 8ug/ml, 16ug/ml, 32mg/ml, and 64ug/ml of vancomycin. The period for a bactericidal effect was determined by transferring the cells from Mueller-Hinton agar plates containing the various vancomycin concentrations to blood agar plates at 24 hour intervals for eight days. Vancomycin bactericidal effects were as follows: control Enterococcal strain at 4ug/ml after 96 hours (4 days), resistant Enterococcal strains; two isolates at 32ug/ml after 120 hours (5 days), one at 64ug/ml after

144 hours (6 days), no bactericidal effect on one isolate after 8 days, both sensitive *Staphylococcus aureus* strains at 8ug/ml after 96 hours (4days). Agar vancomycin MICs for the resistant *Staphylococcus aureus* strains and penicillin MICs for all strains are still in progress.



#### 9:45 Business meeting

10:30 EARLY EXPRESSION OF CHEMOKINES AND RELATED GENES IN HELA CELLS DURING *CHLAMYDIA TRACHOMATIS* INFECTION, *Tesfaye Belay*<sup>\*1</sup>, *E. L. Barr*<sup>1</sup>, *K. S. Kimbro*<sup>2</sup>, *F. Eko*<sup>3</sup>, *J. U. Igietseme*<sup>4</sup>, *G. A. Ananaba*<sup>1</sup>, <sup>1</sup>*Clark Atlanta University, Atlanta, GA*, <sup>2</sup>*Emory University, Atlanta, GA 30322*, <sup>3</sup>*Morehouse School of Medicine, 30310*, and <sup>4</sup>*Centers for Disease Control, Atlanta, GA, 30333*. Chemokines are important mediators of leukocyte trafficking and recruitment of specific immune cells in host defense against all infections including chlamydial infection. Identification of the patterns of the chemokine response to chlamydial infection is essential to an understanding of the host immune response. Previous studies have demonstrated that certain chemokines and their receptors are crucial in the induction of protective immunity against *C.trachomatis* and the clearance of infection. However, the initial events associated with *Chlamydia*-host interaction, especially early expression of chemokine genes and other genes important for immunological events are not well defined. In this study we examined the expression of chemokine genes and other genes induced early during chlamydial infection. Total RNA was isolated from 2, 4, 8, 12, 24, 48 h from chlamydial infected and non-infected HeLA cells. The levels of mRNA chemokines (RANTES, MCP-1, MIP-1, and IP-10) and related genes were determined using the RT-PCR method. Our preliminary data showed increased expression of genes 2 h after infection but indicated a decline 24 h postinfection. Microarray analysis also showed increased level of induction of several gene expressions including RANTES as early as 2 h after infection with *C.trachomatis*. The early expression of chemokines by infected epithelial cells may contribute to the recruitment of inflammatory cells to the site of infection.

11:00 DIFFERENTIAL TRANSCRIPTION OF HOST GENES DURING GENITAL *CHLAMYDIA* INFECTION, *G. Ananaba*<sup>2</sup>, *E. Barr*<sup>2</sup>, *K. Kimbro*<sup>1</sup>, *T. Belay*<sup>2</sup>, *T. Okou*<sup>2</sup>, *G. Nwankwo*<sup>3</sup>, *G. Ifere*<sup>3</sup>, *F. Eko*<sup>3</sup>, *Q. He*<sup>3</sup>, *J. Igietseme*<sup>1,3,4</sup>, <sup>1</sup>*Emory University Winship Cancer Institute, Atlanta, GA, 30322*, <sup>2</sup>*Clark Atlanta University, Atlanta GA*, <sup>3</sup>*Morehouse School of Medicine, Atlanta, GA 30310* and <sup>4</sup>*Centers for Disease Control and Prevention, Atlanta, GA 30333*. *Chlamydia trachomatis* bacterium is an intracellular human pathogen that primarily infects the columnar epithelial cells of the ocular and genital mucosae. It is the most common bacterial sexually transmitted disease in both industrialized and developing countries and often leads to significant sequelae in women, including pelvic inflammatory disease, ectopic pregnancy, and infertility. We hypothesized that protection against chlamydial diseases is influenced by the host genes expressed at the early stages of *Chlamydia* infection. To identify these cellular genes, differential microarray was used to examine cDNA made from total RNA after two hours of *Chlamydia trachomatis* infection. Affymetrix U133A Human Gene chip which consists of approximately 33,000 genes and Expressed Sequence Tags (ETS), was used to compare the transcribed genes in the infected and noninfected host cells. Microarray suite 5.0 (MAS 5.0) was used to identify over 60 genes that were significantly different in the infected and noninfected groups ( $P < 0.05$ ). Six genes were upregulated more than 3-fold, 10 genes more than 4-fold (4.0 – 9.6). Two genes were down-regulated more than 5-fold. Two of the upregulated genes and one of the down-regulated genes are novel mRNA, with no assigned biological function(s). These cellular and molecular entities are important in the overall host response against *Chlamydia*. They are relevant in our understanding of the host factors that govern acquisition and maintenance of anti-chlamydia immunity, or the development of disease complications. Supported by NIH grants # A141231, RR03062, and GM08247.

11:30 IDENTIFICATION OF IMMUNO-REGULATORY FACTORS THAT PROMOTE T-CELL ACTIVATION BY PROTEOME ANALYSIS. *Qing He*<sup>1,2</sup>, *Francis O. Eko*<sup>1</sup>, *Amy Martin*<sup>2</sup>, *Deborah Lyn*<sup>1</sup>, *Godwin A. Ananaba*<sup>1</sup>, *Carolyn M. Black*<sup>2</sup> and *Joseph U. Igietseme*<sup>1,2</sup>, <sup>1</sup>*Morehouse School of Medicine, Atlanta, GA 30310* and <sup>2</sup>*National Center for Infectious Diseases, Centers for Disease Control and Prevention(CDC), Atlanta GA 30333*. Immunity to genital infection by the obligate intra-cellular bacterium, *Chlamydia trachomatis*, requires the induction of TH-1 response. Antigen presenting cells (APCs) such as dendritic cells (DCs) are potent activators of Th1 cells. Our previous studies shown that Chlamydial-pulsed IL-10 knockout DCs (IL-10KO) induced high frequency of protective Th1 cells against chlamydial infection. Therefore, analysis of the IL-10 knockout DC system could reveal the novel molecules and their role in potentiating an enhance T cell activation. In this study proteome analyses was used to identify specific molecules in chlamydial pulsed IL10 KO DC system. The results indicated that chlamydial-pulsed IL-10KO DC matured earlier and acquired antigen acquisition and processing ability faster than wild-type (WT) DC, as revealed by the expression of CD11 and MSP receptor within

2 hours of exposure to antigen. In addition, IL-10KO DCs expressed greater levels of critical co-stimulatory and signaling molecules including B7.1, CCL27, CD161 and Calmodulin-dependent protein kinase when compared to WT DC. The enhancing Th1-activating capacity of IL-10KO APCs could be associated with an early maturation, rapid antigen acquisition and processing capacity as well as up-regulated co-stimulation and signaling molecules. The modulation of these molecules may boost T-cell response to vaccines against *Chlamydia* and several intracellular pathogens.

### POSTERS IC - Second floor lobby

WOUND HEALING OF GINGIVAL FIBROBLASTS (GF) AND PERIODONTAL LIGAMENT FIBROBLASTS (PDL) UNDER CYCLICAL MECHANICAL STRAIN (CMS)\*\*, *Douglas Lancaster, Michael E. Dinos, James C. McPherson, III, Gary Swiec, Mark Peacock and Augustine H. Chuang, Eisenhower Army Medical Center and US Army DENTAC, Ft. Gordon, GA 30905*. Both gingival fibroblasts and periodontal ligament fibroblasts play critical roles in oral wound healing after surgery. In this study, we investigated wound healing of GF and PDL under the influence of CMS in an in vitro model. Using a rubber-tip policeman, a 3 mm wound was created on confluent, synchronized GF or PDL cells on flexible-bottomed plates in DMEM medium containing 5% fetal bovine serum (FBS) for GF and 10% FBS for PDL. The plates were placed in an incubator connected to a Flexercell Unit programmed to perform CMS. GF cells were stained with Hematoxylin and Eosin stains on day 1, 2, 4 and 6 and PDL on day 7, 14, 21 and 28 due to their intrinsic nature of slower growth than that of GF. By day 6, GF filled the wound to 75% under CMS condition and 54% under non-CMS condition. GF cells filled the wound faster under CMS condition than non-CMS condition. However, the wound fill of PDL was not only minimum by day 14 under both CMS and non-CMS conditions, but also the un-wounded PDL cells started to be detached from the Flex plates under CMS condition. It appears that CMS does significantly hamper and delay the growth of PDL cells and their wound healing.

THE EFFECT OF PLURONIC F68 ON WOUND HEALING OF PERIODONTAL LIGAMENT FIBROBLASTS IN LOW ALCOHOL CONDITION, *Augustine H. Chuang, Royce Runner, Carol Lapp, Bharati Bhatt and James C. McPherson, III, Eisenhower Army Medical, Ft. Gordon, GA 30905 and Medical College of Georgia, Augusta, GA 30912*. We have shown that alcohol delays wound healing, while Pluronic F68 enhances early wound healing in laboratory animals. Periodontal ligament fibroblasts (PDL) play an important role in oral wounds. In this study we observed the effect of F68 on in vitro wound healing of PDL in low alcohol condition. A 3 mm wound was created on a synchronized, confluent layer of PDL in 12-well plate. The PDL cells in DMEM medium with 5% FBS were treated with 0%, 0.025%, 0.05% or 0.1% F68 containing 0%, 0.1%, 0.2% or 0.4% ethanol. On day 3 and 6, the cells were stained with 1% crystal violet. The wound healing of PDL was evaluated microscopically using

NIH Scion Image Analysis Software. On day 3, the wound healing without F68 was 37, 33, 30 and 17% in 0, 0.1, 0.2 or 0.4% ethanol, respectively; with 0.025% F68 was 40, 28, 23 and 12%; with 0.05% F68 was 35, 33, 25 and 23%; with 0.1% F68 was 28, 27, 25 and 18%; on day 6, without F68 was 90, 47, 32 and 21%; with 0.025% F68 was 72, 55, 42 and 37%; with 0.05% F68 was 68, 52, 38 and 31%; with 0.1% F68 was 62, 55, 33 and 27%. Our data suggest that F68 at 0.025%, 0.05% and 0.1% protects PDL cells and also increased wound repopulation in media containing 0.1 to 0.4% ethanol.

THE EFFECT OF SODIUM LAURYL SULFATE (SLS) ON IN VITRO GINGIVAL FIBROBLASTS (GF) WOUND HEALING\*\*, *Justin Bordlemy, James C. McPherson, III, Gary Swiec and Augustine H. Chuang, Eisenhower Army Medical Center and US Army DENTAC, Fort Gordon, GA 30905*. Sodium lauryl sulfate, a strong anionic, denaturing surfactant, has been used as a foaming agent in toothpastes at concentrations of 0.5-2.0%. We investigated its potential side effect on oral soft tissues during wound healing. A 3 mm wound was created on confluent, synchronized human gingival fibroblasts grown in 12-well plates maintained in DMEM medium containing 5% fetal bovine serum. The cells were treated with 0, 0.01, 0.02, 0.03, 0.04 or 0.05% SLS once daily for 2 min. The cells were stained on day 0, 2, 4, 6 and 8 with Hematoxylin and Eosin. The percent of wound fill was measured using NIH Scion Image Analysis Software. On day 2, 4, 6 and 8, the wound fill of the control (0% SLS) was 15, 35, 67, and 96%, respectively; at 0.01% SLS, it was 10, 20, 65 and 84%; at 0.02% SLS, it was 7, 10, 15 and 25%; and at 0.03% SLS, the wound fill was 5 and 8% on day 2 and 4. The un-wounded GF cells started to detach from the wells at 25, 45 and 55% on day 4, 6 and 8, respectively. At 0.04 and 0.05% SLS, most of the un-wounded cells started to detached in significant amounts by day 4 and little wound fill took place in these wells. We conclude that after major oral surgery, any dentrifices containing SLS should be avoided while the dental products containing nonionic surfactants, such as Poloxamer 407 should be considered.

ESTABLISHMENT OF A CRITICAL SIZE CRANIAL DEFECT IN THE MOUSE, *J. J. Dalle Lucca, Royce R. Runner and James C. McPherson, III, Eisenhower Army Medical Center, Ft. Gordon, GA 30905*. A critical size defect (CSD), used to evaluate bone wound healing, is defined as the smallest defect which will not heal spontaneously in twelve weeks. There are several well established animal models using a circular cranial defect. The CSD in a rat is 8mm, and 12mm in a rabbit. A CSD has not been established in the mouse. Establishment of a mouse CSD model would allow evaluation of bone grafts and bone substitutes in a variety of genetic modified mouse models. A cranial defect, 4mm in diameter, was created in the cranium of anesthetized mice. A PTFE membrane was placed on each side of the cranium to isolate the defect and the skin sutured closed. At twelve weeks (n=8) and one year (n=7) the mice were sacrificed, the cranium removed and a digital x-ray taken. The percent of closure of the defect was determined by radiographic density with intact bone being 100%. At twelve weeks, the mean percent closure of the cranial defects was 55.237% and at one year the

percent closure was 64.23%.  $p=NS$ . Since a significant area of the critical size defects remained open (bone wound healing was not complete) at twelve weeks, a 4mm diameter defect may be the CSD in a mouse. This observation is supported by the lack of significant additional closure of the 4mm defect at one year. This is the lowest phylogenetic species in which the CSD has been established and furnished bone wound healing research with a powerful new tool of multi-disciplinary application.

A THREE MILLIMETER CRANIAL BONE DEFECT AND ITS ROLE IN ESTABLISHING A CRITICAL SIZE DEFECT IN THE MOUSE, *Royce R. Runner, J. J. Dalle Lucca and James C. McPherson, III, Eisenhower Army Medical Center, Fort Gordon, GA 30905*. A critical size defect (CSD) is defined as the smallest bone defect which will not heal spontaneously in twelve weeks. While CSD animal models have been established using the mandible and the long bones, the cranium has been the most preferred site. The cranial CSD has been established in the rat, rabbit, dog and monkey, but not lower phylogenetic species. We have attempted to establish the CSD in the cranium of the mouse. A cranial defect, 3 mm in diameter, was created in the cranium of anesthetized mice using a water-cooled trephine. A PTFE membrane was placed on each side of the cranium to isolate the defect and the skin was sutured closed. At twelve weeks ( $n=5$ ) and one year ( $n=10$ ) the mice were sacrificed, the cranium removed, and a digital x-ray taken. The percent closure of the defect was determined by radiographic density with intact bone being 100%. At twelve weeks, the mean percent closure was 41.07%. If you were to consider only this data, it would be easy to conclude from the data and the definition of the CSD, that 3 mm would be the CSD size in a mouse. However, when we evaluated the percent bone fill at one year, bone wound healing had continued, reaching 80.91% closure. While this does not represent complete closure of the defect, a significant ( $p<0.001$ ) amount of new bone formation had occurred. This data indicates a 3 mm cranial defect may not be a CSD in the mouse.

STRENGTH OF NORIAN CRS BONE CEMENT IN A CRANIAL DEFECT\*\*, *Richard L. Williams<sup>1</sup>, Royce R. Runner<sup>2</sup>, Gary D. Swiec<sup>1</sup> and James C. McPherson, III<sup>2</sup>, <sup>2</sup>Eisenhower Army Medical Center and <sup>1</sup>US Army DENTAC, Ft. Gordon, GA 30905*. Norian CRS Bone Cement, an injectable synthetic bone alloplast, was developed to repair wrist fractures, and latter expanded to vertebral fractures. While determining the suitability of using CRS cement to repair a critical size cranial defect in the rat, the strength of the repair came into question. This experiment was designed to determine the strength of CRS repair in a critical size defect. Harlan Sprague-Dawley laboratory rats were divided into three groups, Intact Control ( $n=10$ ); CRS Cement ( $n=7$ ) or Demineralized Freeze Dried Bone Allograft (DFDBA, the standard in dental care,  $n=10$ ). Under appropriate anesthesia, a 8mm cranial defect was created; a PTFE membrane placed cranially, the defect filled with the test material and a PTFE membrane placed over the material. The skin was sutured closed. At twenty weeks, the rats were sacrificed, the cranium removed and cleaned of excess tissue and the strength of

the repair determined by measuring the force required to push a 7mm punch through the defect site using an Instron 4502 instrument. There were no significant differences among the three groups. The DFDBA repair had the greatest strength (384 Newtons), the Intact Controls (373 Newtons) and the CRS Cement (289 Newtons). These results indicate that the strength of the repair of a 8mm critical size cranial defect in the rat with Norian CRS Bone Cement is not significantly different than intact bone or a DFDBA repair.

**Section VI: Philosophy and History of Science**  
**Section VIII: Anthropology**  
**IC - 322**  
**Tom McMullen, Presiding**

8:30 A HISTORICAL SKETCH OF "FACTORS WALK RETAINING WALL" AND AN INVESTIGATION INTO THE CAUSE OF THE WALLS EROSION, *Elliott O. Edwards, Jr., U.S. Army Corps of Engineers, Savannah, GA. 31402*. Factors Walk Retaining Wall is a stone ballast retaining wall built during 1856 – 1869. The wall was built of stone (mostly limestone) brought over on cargo ships to prevent the eroding, thirty-foot high sandy bluff from further erosion and to make use of the many tons of stone stacked along river street. There was not an assigned storage area for the stone and, as a result, it hindered to some extent shipping activities. Erosion of the stone and mortar has been occurring for many years and the cause was investigated. It was concluded that salt intrusion is the main source of erosion and acid rain is the secondary source of erosion. The author recommends a course of action to rehabilitate the wall and the need to educate the public about the increasing negative effects of acid rain in the southeast.

9:00 THOMAS SHAW (C. 1694-1751), AN EARLY EIGHTEENTH CENTURY NATURALIST IN THE BARBARY AREAS AND THE HOLY LAND, *Vivian Rogers-Price, George A. Rogers and Marvin Goss, LeConte-Woodmanston Foundation, Midway, GA, 31320 and Georgia Southern University, Statesboro, GA 30460*. Thomas Shaw (c. 1694-1751) was educated at Queen's College, Oxford. Soon after receiving his M.A. degree, he was appointed chaplain for the English factory at Algiers. From there he traveled widely in Morocco, Algeria, Tunis, Egypt, Syria and the Holy Land. His notes recorded people, antiquities, plants, animals, insects, fish and fossils. After his return to England, he received his D.D. (Queen's College) in 1734. In that same year, he was elected F.R.S. and began to establish himself as a scholar, preacher and administrator. He published his 'Travels and Observations' in 1738. It is replete with detailed descriptions, careful renditions of ancient architectural remains, precise maps and natural history observations. Plant names, such as *Persea*, and other genera, are probably based on Tournefort instead of Linnaeus. In his Preface, he claimed near 140 species, acknowledged the great assistance of Professor Dillenius and listed additional plants omitted from his 'Catalogue'. He

noted his frequent use of footnotes and his citation of the specific passage in these, since few readers would have access to a great library as he did at Oxford. The work made a major contribution to the geography of the Barbary and Levant. His dried plant specimens are preserved at Oxford. The plant genus *Shawia* commemorates his name.

9:30 VERTEBRATE FAUNAL REMAINS FROM THE MINNIS-WARD SITE (SS-3), SAN SALVADOR, BAHAMAS: PRE-COLUMBIAN DIET AND FISHING TECHNIQUES OF THE PEOPLE WHO ENCOUNTERED COLUMBUS, *J.P. Blick and D.C. Brinson\**, *Georgia College & State University, Milledgeville, GA 31061*. Archaeological investigations on San Salvador, Bahamas in May 2003 and 2004 included archaeological testing and excavations at the Minnis-Ward site. Ca. 10 cubic meters of earth were excavated and passed through fine mesh (2 mm) window screen yielding a total of 31,000+ artifacts, including some 10,000 vertebrate faunal remains. Analysis of the vertebrate faunal remains at the comparative ichthyological collection at the University of Georgia's Museum of Natural History indicates the presence of some 17 different taxa including sea turtle (*Cheloniidae*), three or four varieties of parrotfish (*Sparisoma*, *Scarus*), porgy (*Calamus*), triggerfish (*Balistes*), surgeonfish (*Acanthurus*), various labrids (*Labridae*), possible hogfish (*Lachnolaimus*), possible puffer fish (*Sphoeroides*), jack (*Caranx*), grouper (*Epinephelus*, *Myctoperca*), snapper (*Lutjanus*), grunt (*Haemulon*) and needlefish (*Tylosurus*). The types of fish, their sizes, and habitats reveal a great deal about pre-Columbian diet, fishing techniques, and location of capture. Modern fish behavioral ecology indicates that the inhabitants of the Minnis-Ward site fished in near-shore waters primarily with traps and in offshore deep reef settings with hook-and-line. Funding for this investigation was provided by Georgia College & State University and the Council on Undergraduate Research.

#### 10:00 **Business meeting**

10:30 C.D. LEAKE'S WORLD VIEW DRIVEN TRANSLATION OF HARVEY'S *DE MOTU CORDIS*, *Tom McMullen*, *Georgia Southern University, Statesboro, GA 30460-8054*. Chauncey Depew Leake (1896-1978) was a scientist and past president of both the History of Science Society and the American Association for the Advancement of Science. He was also a member of the American Humanist Association, which believes there is no Deity. William Harvey (1578-1657) is famous for his discovery of the circulation of the blood, which he reported in *Exercitatio Anatomica De Motu Cordis et Sanguinis in Animalibus* (1628). His world view is that God designed each feature of the human body with a purpose. Careful analysis of the Latin text shows that Leake's humanist world view influenced his translation of *De Motu Cordis*. For example, everywhere that Harvey used the Latin word for purpose, Leake translated it in some other way, such as using the word "function" instead. Harvey's use of purpose and his creationist world view were important in the discovery of the

blood's circulation. However, the impression given by Leake's translation is that they were not.

11:00 MATHEMATICS AND SCIENCE, *Ronald E. Mickens*, *Clark Atlanta University, Atlanta GA 30314*. The spectacular successes of the sciences are due in large measure to the use of mathematics in the creation and analysis of models for the phenomena of interest. Clearly, mathematics is a very effective tool for the formulation of scientific theories. So, if mathematics is the "language of science", how is this possible? Also, is this mathematics the same mathematics often referred to as "pure mathematics?" In recent times, the essay of Eugene P. Wigner sparked renewed interest in the problem. We go beyond the discussion of "the unreasonable effectiveness of mathematics," by examining the relationships between mathematical concepts and their corresponding physical manifestations. Our general conclusion is that a distinction must be made between the pure mathematics utilized in the formulation of physical theories and the "physical mathematics" required to connect the predictions of these theories to the phenomena.

11:30 DISPERSION OF INDIAN SCIENTIFIC KNOWLEDGE FROM ANTIQUITY TO MODERNITY, *Bhagyavati*, *Columbus State University, Columbus, GA 31907*. This paper explores possible routes by which scientific knowledge of the Indian subcontinent was transmitted to other parts of the world in ancient and medieval times. Beginning with prehistoric times, the paper is an account of how Indian science was transmitted to other cultures until the arrival of the Europeans in the 15<sup>th</sup> century A.D. Scientific development in India was trivial in the years that followed. Today, India is catching up to Western scientific advances that started during the Renaissance. The organization of the paper is as follows: First, a sampling of early Indian knowledge and significant contributions to science are described. Different dispersion routes of Indian scientific knowledge to Europe and the West are then discussed. Finally, a narrative of the difficulties in obtaining evidence of the work of early Indian scientists is presented. This section is followed by concluding remarks and a list of references used in the paper. Indian science evolved rapidly during its heyday, stagnated in the middle "dark" ages, and is now enjoying a resurgence of interest.

### **Section VII: Science Education IC - 422 Rebecca Penwell, presiding**

8:30 COMPARATIVE ANALYSIS OF HIGH SCHOOL GEOMETRY TEXTBOOKS, *Ronald E. Mickens*, *Clark Atlanta University, Atlanta, GA 300314*. High school geometry textbooks have changed during the last half century from being elementary introductions to plane geometry to now including the elements of analytical geometry, networks, and other topics. Also modern





textbooks and the associated courses have a large diverse set of support materials available to both instructors and students: dedicated websites, software for constructions, sample test problems, history of the subject, etc. We have carried out a comparative analysis of three geometry textbooks published over a span of sixty years. The items for comparison include book lengths; number of figures, illustrations, and pictures; number and type of worked examples and problems; and in and out of classroom resource needs. Our major conclusions are: (1) The geometry course has evolved from their presentation of pure geometry to a heterogeneous course on a variety of mathematics topics. (2) Manual skills have been replaced by computer manipulations

8:45 STUDENT'S RETENTION OF SCIENCE CONTENT THROUGH VARIOUS ASSESSMENT MEASURES \*\*, *Nabulungi Bolton\* and Benita Flournoy, Clark Atlanta University, Atlanta, GA 30318*. This qualitative study examines the effectiveness of teacher and student centered instructional methods on high school students' retention of science content using various assessment measures. The focus group for this study was a mixed gender sample of biology students from an urban high school setting, an Engineering Magnet school. The objective of this study was to compare the retention of knowledge in science for a variety of instructional strategies. Retention of science knowledge was measured utilizing traditional and authentic assessments. The student's performance on an array of assessments such as quizzes, laboratory reports, traditional tests and product based assessments were analyzed after various instructional methods such as lecture-discussions, direct instruction, guided discovery, cooperative learning and problem-based learning and inquiry were implemented. Data was analyzed by triangulation and induction. The survey indicated that students prefer teacher-centered learning over problem-based learning, which is one of the student-centered methods of instructions. Future research will include additional data collection and analysis with continued intervention.

9:00 THE DEVELOPMENT OF NEWTONIAN CONCEPTS IN MIDDLE SCHOOL CHILDREN \*\*, *Paul Camp, Akilah Bonner\*, Evelyn Conley\*, Lauren Thomas\*, Tenicka Turnquest, 350 Spelman Lane, Atlanta, GA 30314-4399*. Periodic content quizzes were given in order to better understand the development of Newtonian conceptualization in middle school students. The distracters were chosen to indicate the prior states of understanding that the students were using to assess each question. A snapshot of the students' understanding of each of Newton's Laws is determined by analyzing the answers given to several questions about each law. The goal of this research initiative is not only to improve physics education, but to foster children's interest in physics by making it more accessible.



9:15 USING A SKILL MATRIX AS A PREDICTOR OF STUDENT SUCCESS ON A PHYSICAL SCIENCE END OF THE COURSE (EOCT) EXAMINATION\*\*, *Ernest Kelly\*, Bonita E. Flournoy, Clark Atlanta University, Atlanta, GA 30314*. A practice Physical Science EOCT consisting of fifty objective multiple-choice questions was administered to students and item-analyzed using scantron answer forms coupled with an item analysis feature, which identified test questions most students answered incorrectly. Materials, such as labs, activities and worksheets, were developed to target areas of weakness indicated by the analysis. A skill matrix consisting of three core comprehension components for each skill was used to monitor and chart the progress of students in preparation of the EOCT. The first component provides a description of the skill, the second component requires that the skill be demonstrated, and the third component provides an opportunity to apply the skill. The matrix will serve as both a diagnostic and a prognostic instrument of EOCT preparation.

9:30 A CASE STUDY OF K-12 STUDENTS AND PRE-SERVICE SCIENCE AND MATHEMATICS TEACHERS' PERCEPTIONS OF A SERVICE LEARNING PROJECT IN SCIENCE EDUCATION, *Ollie I. Manley, Clark Atlanta University, Atlanta, GA. 30314*. Teacher education programs across the country are including service learning in their curriculums. It is believed that service-learning activities can strengthen teaching candidates' practice of critical reflection, causing them to examine their assumptions about the ways in which teachers and schools interact with students. The purpose of this service-learning project was to enhance the teacher candidates' experience in the use of technology in the teaching of science and mathematics by requiring them to provide a needed service in a faith-based school located in an urban community. The project provided K-12 students with content-driven learning outside the traditional academic setting and encouraged the application of technology in a way that gave the students a connection to the real world. K-12 students completed special projects, made presentations and improved their classroom performance. The site official, the K-12 students, and the teacher candidates completed questionnaires. This data was analyzed to determine if the teacher candidates had an impact on the infusion of technology in the teaching of science and mathematics. Data analysis showed that there was a strong positive relationship between pre-service teachers' perception of service learning and student performance.

9:45 **Break**

10:00 **Business meeting**

10:30 USING GROUP EXAMS AS A LEARNING TOOL IN GEOLOGY COURSES, *Polly A. Bouker, Georgia Perimeter College, 1000 University Center Lane, Lawrenceville, GA 30043*. At the time of an exam, students are better prepared for a discussion of course material than at any other time preceding the exam. However, this is typically a point in when discussion is discouraged.



An innovative approach to learning through assessment utilizes a group discussion of exam questions. First, students complete the exam on an individual basis and then students are placed in randomly generated groups to discuss the answers to each test question with other members of their group. For many, the material becomes clearer at this time, and they are able to see their errors in logic. Groups are rewarded with bonus points if they improve their score over the mean of individual scores for each group member. This encourages students to participate in the discussion because they are motivated to succeed as a group. The discussion of exam questions by groups generates rich discussion and clarification of geological concepts. As indicated by the results of an anonymous survey, students prefer this method to simply going over the correct answers even if they do not receive any bonus points.

10:45 MATHEMATICAL PROOFS AND CONCEPTUALIZATIONS, *Sandra Rucker, Clark Atlanta University, Atlanta, GA 30314*. Mathematical proof is considered the benchmark of mathematics for many mathematicians. The purpose of this work is to explore student conceptions regarding mathematical proofs. Data was collected from students enrolled in mathematics courses for pre-service elementary teachers and other mathematics courses. Student responses on surveys, writing assignments, and work completed on tests were analyzed. We concluded that a better understanding of mathematical proof techniques leads to enhanced student performance.

11:00 REALTIME ELVIS IN THE CLASSROOM: USING *LabVIEW* IN THE INTRODUCTORY PHYSICS LABORATORY, *Julie Talbot, James Espinosa, State University of West Georgia, Carrollton, GA 30118*. *LabVIEW* is a data acquisition system commonly used in industry, as well as academic research and it is increasingly being used in classroom settings as well. National Instruments is now selling a unit called ELVIS (Electronics Laboratory Virtual Instrumentation Suite) that contains, in one package, a DMM, protoboard, function generator, power supply, oscilloscope, and many other basic electronics instruments. While this has obvious applications for the electronics laboratory curriculum, it may also be used in the introductory classroom, since there are adapters available that allow analog and digital sensors, such as Vernier's temperature sensor and motion sensor, to plug directly into the protoboard, so that the output can be read, displayed and analyzed by *LabVIEW*. This allows students to gain familiarity with *LabVIEW* in the introductory classes, so that they are more able to use it to its fullest capability in the advanced laboratory classes. The authors have submitted a NSF grant to use the ELVIS in all levels of the experimental curriculum, and in preliminary findings, have discovered that the sensors give experimental results within 7% of the accepted values.

11:15 COMPARING STUDENT SATISFACTION WITH GROUP AND INDIVIDUAL CASE STUDIES IN HUMAN ANATOMY AND PHYSIOLOGY. *John V. Aliff, Georgia Perimeter College, Lawrenceville, GA 30043*. Case studies help students understand the multiple issues involved in the explanation of natural phenomena. Students can experience open-ended problem solving where the student scientists, working individually and in teams, consider competing hypotheses and use deduction and induction over a long series of experimental observations, and may arrive at multiple solutions. The case study method is similar to that used in Nursing curricula. Step-wise, case studies should be designed to allow the students to recognize multiple solutions, to research what we know about the problems, brainstorm for connections, pose specific questions, and investigate the questions using the scientific method. Students preferred individual case studies to group studies.

11:30 AUTHENTIC POPULATION STUDY FOR BIOLOGY STUDENTS USING BOX TURTLES, *David L. Bechler and Leslie S. Jones, Department of Biology, Valdosta State University, Valdosta, GA 31698*. The science education community is actively looking for ways to provide inquiry-oriented activities that allow students to experience something closer to genuine scientific investigations than traditional "cookbook" labs. We have developed a versatile laboratory exercise that literally allows students to carry out an authentic population study and learn the importance of statistical analysis of the data set they have generated. The lesson uses a captive population of active-breeding three-toed box turtles, *Terrapene c. carolina*; an organism that students are willing and able to handle without aversion or risk. The class of students rotates through a variety of different tasks that include: identifying and recording sex, eye color, ability to close shell, weight, carapace length, plastron length, and dome height. With minimal preparation, science students generate data sets comparable to trained biologists. They subsequently manage their own data and demonstrate how regression analyses showed that size parameters of weight and shell dimensions are highly correlated. From this study it can be concluded that students felt they learned more about scientific processes by actually conducting an authentic population study, as opposed to going through the motions of the traditional "cookbook" lab exercise. Specifically, students indicated an appreciation for the practical difficulties of working with live animals, and a sense of pride and ownership of the real data they collected.

11:45 ENRICHING PRE-COLLEGE SCIENCE AND MATHEMATICS' TEACHERS' RESEARCH SKILLS USING RESEARCH SCIENTISTS AS MENTORS, *Bonita E. Flournoy, Clark Atlanta University, Atlanta, GA. 30314*. The Clark Atlanta University and Partners Summer Fellows Institute, over a two-year period, provided 40 middle and secondary science and mathematics teachers research summer experiences in the labs of ten on-site research scientists. Four teachers were assigned to each scientist, representing earth science, botany, theoretical physics, theoretical geometry, and organic chemistry. Each set of four

teachers implemented research projects over a two-week period. This descriptive study identified teachers' prior research experiences, educational preparation, and infusion of the scientific research process in their classroom teaching, by administering a survey questionnaire. The objectives of the research experiences were to actively engage classroom teachers in cutting-edge research, implement the scientific method; expose teachers to current instrumentation and equipment for analyzing data, and infuse the knowledge gained in their everyday pedagogical practices. Findings of this study found that 78% of teachers did not have previous formal research experiences, 60% of teachers had degrees in either science or mathematics, and 50% had knowledge or experience with the instrumentation and or materials used in their respective research labs. Teacher participants indicated that they would infuse their research work as part of ongoing science projects for their students and continue the collaboration with the research scientist mentors.

## THE GEORGIA ACADEMY OF SCIENCE

*Affiliated with the American Association for the Advancement of Science*

The Georgia Academy of Science is composed of "Residents and non-residents of Georgia who are engaged in scientific work, or who are interested in the development of science." The purpose of the Academy of "the promotion of interests of science, particularly in Georgia."

The Georgia Academy of Science was organized in 1922 and incorporated as a non-profit organization in 1953. Originally, eligibility for membership in the Academy was "definite achievement in some branch of scientific activity," and the number of members was set at fifty. This number gradually increased to ninety-five by 1934, and in 1937 the numerical limitation was removed. For several years the Academy affairs were administered by Fellows, but today this class of membership is honorary only, and all members who are residents of Georgia are equally eligible for Academy offices. Currently the membership of the Georgia Academy of Science is approximately 450, composed of men and women from all scientific disciplines and interest, located throughout the state of Georgia. In addition to direct membership in the Academy, affiliation of scientific societies with the Academy is also possible. At present the Georgia Junior Academy of Science and the Georgia Genetics Society are affiliated with the Academy, and have representatives on the Council, which is the governing body of the Academy.

The primary activities of the Academy are centered around the Journal, the Annual Meeting and the Georgia Junior Academy of Science. The Georgia Journal of Science is a recognized scientific publication, and is to be found in libraries throughout the United States and in many foreign countries. The Journal is published four times each year, the April issue being devoted to the abstracts of papers presented at the Annual Meeting.

The Annual Meeting of the Academy presents an opportunity for scientists and others interested in the development of science to meet, visit, and deliver scientific papers. Members of the Academy belong to Sections representing various fields of scientific endeavor the Annual Meeting is primarily oriented towards the programs of these Sections. In order to fulfill the growing requirement for interdisciplinary conferences one session of the Annual Meeting is devoted to a joint program in which the entire Academy participates.

The Georgia Junior Academy is composed of high school and middle school students organized into science clubs under the guidance of a Director and his (or her) staff, appointed by the President of the Georgia Academy of Science. The Georgia Junior Academy of Science supports a number of activities designed to promote scientific inquiry on the part of students. These activities include: (1) a state-wide Scientific Problem-Solving Bowl, (2) regional and state Science Bowl competitions, (3) regional and state Science Olympiad competitions, and (4) original research projects presented at the American Junior Academy annual meeting. In addition, the Georgia Junior Academy of Science sponsors a Fall Leadership Conference and a Spring Conference to give all members opportunities to explore areas of scientific inquiry in regional settings, and is heavily involved with regional and state science fairs. Active participation by businesses, industrial organizations, and colleges and universities in Georgia contribute significantly to the work of the Junior Academy.

Membership in the Georgia Academy of Science supports the activities described above: the publication of the Journal, the Annual Meeting and the Junior Academy with its State District Science Fairs. Members of the Academy benefit from the opportunities to associate with their colleagues, to present scientific papers and introduce their students at the Annual Meeting, the receipt of and opportunity to publish in the Journal, and participation in the one state-wide interdisciplinary organization in Georgia devoted solely to the promotion of the interests of science.



**GEORGIA ACADEMY OF SCIENCE MEMBERSHIP RECORD**

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