

**TENNESSEE
ACADEMY OF
SCIENCE**

TAS

Program

of the

120th Meeting

Tennessee Technological University
Cookeville, Tennessee

November 18 - 19, 2010

INSTITUTIONAL SUSTAINING MEMBERS OF THE TENNESSEE ACADEMY OF SCIENCE

Austin Peay State University

Middle Tennessee State University

Motlow State Community College

Rhodes College

Lincoln Memorial University

Tennessee Technological University

The University of Tennessee, Knoxville

The University of Tennessee at Martin

The University of Tennessee Space Institute

Volunteer State Community College

AFFILIATED SOCIETIES OF THE TENNESSEE ACADEMY OF SCIENCE

American Association for the Advancement of Science

Barnard Astronomical Society

Clarence T. Jones Memorial Observatory

National Association of Academies of Science

Tennessee Association of Science Department Chairs
Tennessee Entomological Society

Tennessee Psychological Association

Tennessee Junior Science and Humanities Symposium

Tennessee Science Teachers Association

TAS HOME PAGE INFORMATION

For information about TAS, including information for the annual and collegiate division meetings, the Tennessee Visiting Scientist Program, the membership list, and more, visit the TAS website at: <http://www.mtsu.edu/~tnacadsc/>

TAS FUTURE MEETING SITES

2011 Union University

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ANNOUNCEMENTS

Registration: Meeting attendees may register by mail (see previous mailing) or onsite in the Millard Oakley STEM Center.

Luncheon Tickets. Extra tickets may be available at the registration table.

Membership: Application forms for membership in the Tennessee Academy of Science will be available at the Registration Desk. A completed application accompanied by first year dues may be left for the TAS Treasurer at the registration table or mailed to: Dr. Steven Murphree, Department of Biology, Belmont University, 1900 Belmont Blvd., Nashville, TN 37212-3758. Current annual dues by category are: Regular \$40; Sustaining, \$50; Supporting, \$100; Life, single payment \$400; Student or Emeritus, \$10. Membership includes a subscription to the TAS Journal.

MEETING SCHEDULE

Thursday, November 18

6:00 – 10:00 **TAS Executive Committee Meeting**
Millard-Oakley STEM Center, Ray
Morris Hall, TTU

Friday, November 19

7:30 - Noon **Registration** – Millard Oakley STEM
Center, Tennessee Technological
University, Cookeville, TN.

7:30 – 9:00 **Poster Set Up**

8:00 – 9:00 **Science & Engineering Chairs Meeting** –
STEM Center Conference Room

8:00 – 9:00 **Virtual Theater Shows**

9:00 -10:00 **Plenary Lecture – STEM Center
Auditorium**
“Next Generation Climate and Biomass
Research: From Molecular Biology to
Earth System Models and Back”
Dr. Martin Keller, Oak Ridge National
Laboratory

10:00 – 11:00 **Poster Session Judging** (Poster Session
open 9:00-12:00)

11:00 – 12:00 **2010 TAS Business Meeting – STEM
Center Auditorium**
Dr. Michael Gibson, 2010 TAS President,
Presiding

11:00 – 12:00 **Virtual Theater Shows**

12:00-1:00 **TAS Luncheon** – Nursing Building
Room 260
(Pre-paid or purchased on site for \$7.00)

1:00 - closing **Section Business and Technical Sessions:**
Nursing Building
(2 blocks east on 7th street from the
STEM Center – all sessions)

PLENARY PRESENTATION

9:00 STEM Center Auditorium

“Next Generation Climate and Biomass Research: From Molecular Biology to Earth System Models and Back”

Presented by

Dr. Martin Keller

Associate Laboratory Director, Biological and
Environmental Sciences Directorate
Oak Ridge National Laboratory

Martin Keller was appointed to his current position as Associate Laboratory Director of Biological and Environmental Sciences at Oak Ridge National Laboratory (ORNL), on July 1, 2009. As Associate Laboratory Director, he is responsible for the biological and environmental research programs at ORNL supported by the U.S. Department of Energy’s Office of Science, as well as research programs supported by the U.S. Environmental Protection Agency and the National Institutes of Health. The scientific thrust of the directorate is to understand biological and environmental systems across multiple scales so that sustainable solutions to pressing societal challenges in energy, environment, and health can be developed. The directorate includes two research divisions (Biosciences and Environmental Sciences) and several research centers (BioEnergy Science Center, Center for Bioenergy Sustainability, Center for Molecular Biophysics, and the Center for Structural Molecular Biology).

VIRTUAL THEATER

8:00 – 9:00 and 11:00 – 12:00

“To the Edge and Back: A Tour of the Universe”

Fly through the solar system, go to the edge of an active volcano, and experience more exciting learning adventures offered in this state-of-the-art theater. Shows begin approximately every 20 min.

BOTANY

Friday 1:00 p.m.

Room 230, Nursing Building

Dwayne Estes, Austin Peay State University, *presiding*

- 1:00 SECTION BUSINESS MEETING: ELECTION OF OFFICERS FOR 2011
- 1:15 RELOCATION SUCCESS OF FEDERALLY THREATENED *SCUTELLARIA MONTANA* (LAMIACEAE, LARGE-FLOWERED SKULLCAP) FROM A PROPOSED HIGHWAY CORRIDOR. **Jennifer Boyd and Joey Shaw**, *The University of Tennessee at Chattanooga, Chattanooga, Tennessee.*
- 1:30 THE EFFECTS OF CANOPY THINNING AND BURNING ON TRANSPLANTATION OF FEDERALLY THREATENED *SCUTELLARIA MONTANA* (LAMIACEAE, LARGE-FLOWERED SKULLCAP) IN A SOUTHEASTERN DECIDUOUS FOREST. **H. Mae Kile*, Joey Shaw, and Jennifer Boyd**, *The University of Tennessee at Chattanooga, Chattanooga, Tennessee.*
- 1:45 PLANT CONSERVATION AND THE ENDANGERED SPECIES ACT. **Geoff Call**, *United States Fish and Wildlife Service, Cookeville, Tennessee.*
- 2:00 THE VASCULAR FLORA OF THE TENNESSEE RIVER GORGE. HAMILTON AND MARION COUNTIES, TENNESSEE. **Emily R. Blyveis* and Joey Shaw**, *The University of Tennessee at Chattanooga, Chattanooga, Tennessee.*
- 2:15 THE BAA-TANY GOAT PROJECT AND ROAN MOUNTAIN'S UNIQUE ALDER BALD. **James T. Donaldson, Todd V. Eastin, Frosty Levy, Roger A. McCoy, and Joseph Powell***, *East Tennessee State University, Johnson City, Tennessee (JD, FL, JP), Shady Valley, Tennessee (TE), and Tennessee Natural Heritage Program, Nashville, Tennessee (RM).*
- 2:30 IMPACTS OF GOAT BROWSING AND DISEASE ON *LILIUM GRAYI*, GRAY'S LILY, ON ROAN MOUNTAIN. **Joe Powell*, Frosty Levy, and Jamey Donaldson**, *East Tennessee State University, Johnson City, Tennessee.*
- 2:45 AN OVERVIEW OF FLORISTIC STUDIES IN TENNESSEE'S NATIONAL WILDLIFE REFUGES. **Edward W. Chester and Stephanie Gunn-Zumo**, *Austin Peay State University, Clarksville, Tennessee, and Louisiana Office of Coastal Protection and Restoration, Baton Rouge, Louisiana.*

- 3:00 THE VASCULAR FLORA OF THE CLARKS RIVER NATIONAL WILDLIFE REFUGE. MARSHALL, McCRACKEN, AND GRAVES COUNTIES, KENTUCKY. **Matt S. Bruton* and Dwayne Estes**, *Austin Peay State University, Clarksville, Tennessee.*
- 3:15 TAXONOMY OF *LANTANA* SECT. *LANTANA*: STATUS AND CHALLENGES. **Roger W. Sanders**, *Bryan College, Dayton, Tennessee.*
- 3:30 *MACROTHELPTERIS TORRESIANA* (THELYPTERIDACEAE) NEW TO KENTUCKY. WITH AN UPDATE OF ITS CONTINUED EXPANSION IN THE UNITED STATES. **Courtney E. Gorman*, Matt S. Bruton*, and Dwayne Estes**, *Austin Peay State University, Clarksville, Tennessee.*
- 3:45 THE DISTRIBUTION, ABUNDANCE, AND HABITAT COLONIZATION OF THE INVASIVE SUBMERSED MACROPHYTE, *HYDRILLA VERTICILLATA* (HYDROCHARITACEAE), IN THE OBED WILD AND SCENIC RIVER, MORGAN COUNTY, TENNESSEE. **Dwayne Estes, Chris Fleming, Angelina D. Fowler*#, and Nathan Parker***, *Austin Peay State University, Clarksville, Tennessee.*
- 4:00 FLORISTIC SURVEY OF THE OCOEE RIVER GORGE. **Sunny Hart*, Emily Blyveis*, Matt S. Bruton*, Clea Klagstad*, Nathan Parker*, Dwayne Estes, and Joey Shaw**, *Austin Peay State University, Clarksville, Tennessee (MB, CK, NP, DE) and The University of Tennessee at Chattanooga, Tennessee, Chattanooga, Tennessee (SH, EB, JS).*
- 4:15 RECENT ADDITIONS AND NOTEWORTHY VASCULAR PLANT COLLECTIONS FROM TENNESSEE. **Dwayne Estes, Todd Crabtree, Joey Shaw, and Edward W. Chester**, *Austin Peay State University, Clarksville, Tennessee (DE, EC), Tennessee Natural Heritage Program, Nashville, Tennessee (TC), and The University of Tennessee at Chattanooga, Chattanooga, Tennessee (JS).*
- 4:30 FLORISTIC QUALITY ASSESSMENT: A MEASURE OF CONSERVATION SUCCESS FOR ARNOLD AIR FORCE BASE, AND TENNESSEE. **Kevin Willis**, *Arnold Engineering and Development Center Arnold Air Force Base, Tennessee.*
- 4:45 A FLORAL SURVEY AND *CASTANEA DENTATA* (FAGACEAE, AMERICAN CHESTNUT) CENSUS AT BENDABOUT FARM, BRADLEY COUNTY, TENNESSEE. **Amelia Harris*, J. Hill Craddock and Joey Shaw**, *The University of Tennessee at Chattanooga, Chattanooga, Tennessee.*

* student author # presenting author, if not first author

**CELL and MOLECULAR BIOLOGY (C&M)
HEALTH AND MEDICAL SCIENCES (H&M)**

Friday 1:00 p.m.

Room 264, Nursing Building

Michael W. Thompson, Middle Tennessee State
University, *presiding* (C&M)

J. Michael Redding, Tennessee Technological
University, *presiding* (H&M)

1:00 SECTION BUSINESS MEETING: ELECTION OF
OFFICERS FOR 2011

1:15 PROSTATE SPECIFIC MEMBRANE ANTIGEN
PROCESSES LAMININ DOWNSTREAM
OF MATRIX METALLOPROTEASES IN
ENDOTHELIAL CELL ACTIVATION AND
ANGIOGENESIS. *Alex Patterson**, *Bobby Rampp**,
Amanda D. Williams, *Beth Conway*. *Lipscomb
University. Nashville, Tennessee. (C&M)*

1:30 RELATIVE CONNEXIN-26 MRNA LEVELS IN
GT1-7 CELLS FOLLOWING PASSAGING. *Megan
J. Walker** and *Gilbert R. Pitts*, *Austin Peay State
University, Clarksville, Tennessee. (C&M)*

1:45 ESTROGEN REGULATES RIGHT
VENTRICULAR LOAD STRESS RESPONSES
IN THE PULMONARY ARTERY BANDING
MODEL. *Karen Maynard*, *James West*, *John H.
Newman*, and *Anna R. Hemnes*. *Division of Allergy,
Pulmonary, and Critical Care Medicine, Vanderbilt
University Medical Center. Nashville, Tennessee.
(C&M)*

2:00 ASPARAGINE³⁶² INCREASES ZINC AFFINITY
OF LEUKOTRIENE A4 HYDROLASE
THROUGH INTERACTIONS WITH ZINC-
BINDING RESIDUES. *Michael W. Thompson*,
*Alexis Schaible**, *Frank C. Bailey*, *Rebecca L. Seipelt*,
*Middle Tennessee State University. Murfreesboro,
Tennessee. (C&M)*

2:15 ONE UNIVERSITY'S RESPONSE TO THE H1N1
PANDEMIC OF 2009. *Elisa Lund** and *Chad Brooks*,
*Austin Peay State University. Clarksville, Tennessee
(H&M)*

CHEMISTRY

Friday 1:00 p.m.

Room 218, Nursing Building

Daniel J. Swartling, Tennessee Technological
University, *presiding*

1:00 SECTION BUSINESS MEETING: ELECTION OF
OFFICERS FOR 2011

1:15 HARTREE-FOCK AND DENSITY
FUNCTIONAL MODELING OF THE RAMAN
SPECTRA OF MELAMINE DERIVATIVES AND
B-LACTAM ANTIBIOTICS. *William H. Ilsley* and
Ngee-Sing Chong, *Middle Tennessee State University.
Murfreesboro, Tennessee.*

1:30 BEYOND THE COOKBOOK: LEARNING
ABOUT KINETICS IN GENERAL CHEMISTRY
LABORATORY. *Stephanie E. Meadows** and *Scott
H. Northrup*, *Tennessee Tech University.*

1:45 EXTRACTIVE CHROMATOGRAPHY FOR THE
TREATMENT OF USED NUCLEAR FUEL,
*Matthew D. Gott** and *Dale D. Ensor*, *Tennessee Tech
University*

2:00 USING LIQUID FLOW IN PLASTIC MODELS
TO DEMONSTRATE GRAVITY CURRENTS IN
THE CLASSROOM. *Harvey F. Blanck*, *Austin Peay
State University. Clarksville, Tennessee*

2:15 REFINE OF THE SPECTROPHOTOMETRIC
ANALYSIS OF Hg (II) USING DITHIZONE,
*Stephen Kojo Okine** and *Hong Zhang*, *Tennessee
Tech. University, Cookeville, Tennessee.*

2:30 MASS SPECTROMETRIC IDENTIFICATION OF
DIFFERENTIALLY EXPRESSED PROTEINS IN
Chlamydomonas reinhardtii DUE TO TRICLOSAN
TOXICITY. *Upul Deepthike** and *Jeffrey O. Boles*,
*Department of Chemistry, Tennessee Technological
University, Cookeville, Tennessee.*

2:45 PROTEOMIC PROFILING OF UNNATURAL
AMINO ACID TOXICITY THROUGH
DIFFERENTIAL EXPRESSION OF WILD TYPE
VS. TELLUROPROTEINS IN ESCHERICHIA
COLI DL41(DE3) pCOCK. *Sarah C. Brinkley** and
Jeffrey O. Boles, *Department of Chemistry, Tennessee
Technological University, Cookeville, Tennessee.*

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ENGINEERING AND ENGINEERING TECHNOLOGY

Friday 1:00 p.m.
Room 252, Nursing Building

Ismail Fidan, Tennessee Technological University, presiding

- 1:00 SECTION BUSINESS MEETING: ELECTION OF OFFICERS FOR 2011
- 1:15 MULTIPLE CURVE PRESENTATION AND ZOOMING PROCESSOR USING FPGA. **Dhushyanth Venkatesan***, **Omar Elkeelany**, Tennessee Technological University, Cookeville, Tennessee.
- 1:30 INCREASING THE STUDENT QEP SKILLS IN ADDITIVE MANUFACTURING PROJECTS. **Kenan Hatipoglu***, **Ismail Fidan**, Tennessee Technological University, Cookeville, Tennessee.
- 1:45 "AUTOMATIC PARKING SYSTEM USING MICROCONTROLLERS AS A CAPSTONE PROJECT." **Hugo J. Chavez***, **Stephen McKinley***, **Adel Salama**, Austin Peay State University, Clarksville, Tennessee.
- 2:00 INTRODUCING ADDITIVE MANUFACTURING INTO THE APSU ENGINEERING TECHNOLOGY CURRICULUM. **Chin-Zue Chen and Adel Salama**, Austin Peay State University, Clarksville, Tennessee.
- 2:15 POLYACRYLAMIDE-MMT NANOCOMPOSITE HYDROGELS: EFFECT OF NANOPARTICLE LOADING ON PROTEIN ELECTROPHORETIC MOBILITY. **Jeffery W. Thompson***, **Holly Stretz**, **Pedro Arce**, **Harry Ploehn**, and **Hongsheng Gao**, Tennessee Technological University, Cookeville TN and University of South Carolina, Columbia South Carolina.
- 2:30 ANALYSIS AND VALIDITY OF THE METHOD OF AVERAGING IN ELECTROCHEMICAL SYSTEMS. **Rajavardhan Reddy Nagolu***, **Vinten D. Diwakar**, and **Pedro E. Arce**, Department of Chemical Engineering, Tennessee Technological University, Cookeville, Tennessee.
- 2:45 PREDICTION OF SURFACE TENSION FOR DILUTE BINARY AQUEOUS SYSTEMS USING A MOLECULAR THERMODYNAMIC-BASED MODEL. **Naresh Tadisina***, **Natalia Shlonimskaya***, **Donald P. Visco**, **Joseph J. Biernacki**, **Hamed Kayello***, Tennessee Technological University, Cookeville, Tennessee.
- 3:00 COMPARATIVE PYROLYSIS KINETICS FOR ONE LEGUME AND TWO GRASS HAYS. **Jessica D. Murillo***, **Preejith Ambuken***, **Tiffany Hughes***, **Joseph J. Biernacki**, and **C. Pat Bagley**, Tennessee Technological University, Cookeville, Tennessee.

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HISTORY OF SCIENCE

Friday 2:00 p.m.

Room 260, Nursing Building

George E. Webb, Tennessee Tech University, presiding

- 2:00 SECTION BUSINESS MEETING: ELECTION OF OFFICERS FOR 2011
- 2:15 KEPLER'S DETERMINATION OF THE INCLINATION OF THE ORBIT OF MARS. **Brother Kevin Ryan, FSC**, Christian Brothers University.
- 2:30 POPULAR VISIONS OF OAK RIDGE: THE FIRST DECADE. **George E. Webb**, Tennessee Tech University.
- 2:45 CENTENNIAL STUDIES: THE HISTORY OF TENNESSEE ACADEMY OF SCIENCE HISTORIES, 1914-PRESENT. **James X. Corgan**, Austin Peay State University, Clarksville, Tennessee.
- 3:00 CENTENNIAL STUDIES: JESSE SHAVER, SELF-MADE SCIENTIST AND SERVANT SCHOLAR. **Nora Beck**, Tennessee Parks and Greenways Foundation, Nashville, Tennessee.
- 3:15 CENTENNIAL STUDIES: TAS AND THE 1927 AAAS MEETING IN NASHVILLE. **George E. Webb**, Tennessee Tech University.
- 3:45 ROUNDTABLE DISCUSSION: THE CENTENNIAL OF THE TENNESSEE ACADEMY OF SCIENCE. **Participants TBA.**

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**MATH and COMPUTER SCIENCE (M&C)
SCIENCE and MATH TEACHING (S&MT)**

Friday 1:00 p.m.

Room 254, Nursing Building

Ramanjit Sahi, Austin Peay State University, *presiding* (M&C)
Jennifer Thomas, Belmont University, *presiding* (S&MT)

- 1:00 SECTION BUSINESS MEETING: ELECTION OF OFFICERS FOR 2011
- 1:15 A PARALLEL FINITE ELEMENT METHOD FOR THE CONVECTION-DIFFUSION-REACTION EQUATION. *Robert D. French**, *Casey L. McKnight**, *Amber N. O'Connell**, *Ben Ntatin*, Austin Peay State University, Clarksville, Tennessee. (M&C)
- 1:30 SOLVING ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS BY THE NUMEROV'S METHOD. *Andrew D. Kerr**, *Samuel N. Jator*, Austin Peay State University, Clarksville, Tennessee. (M&C)
- 1:45 ANALYZING VARIATION IN COMMITMENT RATES OF CHILDREN AND YOUTH TO STATE'S CUSTODY IN TENNESSEE. *Robert Cox**, Cumberland University, Nashville, Tennessee. (M&C)
- 2:00 OMNIMOSAICS AND UNIVERSAL GRAPHS. *Anant P. Godbole*, East Tennessee State University, Johnson City, Tennessee. (M&C)
- 2:15 A NOTE ON THE STEEPEST DESCENT METHOD. (HIKING IN THE MOUNTAINS). *B. Ntatin*, Austin Peay State University, Clarksville, Tennessee. (M&C)
- 2:30 A SIMPLE AND EFFECTIVE METHOD TO PREDICT SEEDED TOURNAMENT OUTCOMES. *Stephen J. Robinson*, Belmont University, Nashville, Tennessee. (M&C)
- 2:45 INITIAL VALUE METHOD VERSUS BOUNDARY VALUE METHOD. *Ramanjit K. Sahi*, Austin Peay State University, Clarksville, Tennessee. (M&C)
- 3:00 TRENDS IN ASSIGNMENTS AND EXAMS IN BIOLOGY COURSES. *Darlene Panvini*, Belmont University, Nashville, Tennessee. (S&MT)
- 3:15 THE MORE THINGS CHANGE, THE MORE THEY STAY THE SAME: A COLLABORATIVE INVASIVE PEST PLANT EDUCATION PROJECT. *Kim Cleary Sadler*, Middle Tennessee State University, Murfreesboro, Tennessee. (S&MT)

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**PHYSICS and ASTRONOMY (P&A)
GEOLOGY AND GEOGRAPHY (G&G)**

Friday 1:00 p.m.

Room 216, Nursing Building

Eugene de Silva, Lincoln Memorial University, *presiding* (P&A)
Peter Li, Tennessee Technological University, *presiding* (G&G)

- 1:00 SECTION BUSINESS MEETING: ELECTION OF OFFICERS FOR 2011
- 1:15 THE JERK VECTOR IN PLANETARY MOTION. *Arjun Tan*, *Gene Mize*, and *Matthew Edwards*, Alabama Agricultural and Mechanical University, Normal, Alabama. (P&A)
- 1:30 EXACT VALUES OF DYNAMICAL QUANTITIES IN PLANETARY MOTION. *Arjun Tan*, *Gene Mize*, and *Matthew Edwards*, Alabama Agricultural and Mechanical University, Normal, Alabama. (P&A)
- 1:45 DISCOVERING THE ANGULAR JERK IN PLANETARY MOTION. *Arjun Tan* and *Matthew E. Edwards*, Alabama Agricultural and Mechanical University, Normal, Alabama. (P&A)
- 2:00 KICK DRUM TUNNELS: A PHYSICAL ANALYSIS OF A RECORDING TECHNIQUE. *Phil Feurtado**, Belmont University Nashville Tennessee. (P&A)
- 2:15 SPIN-SPIN EFFECTS IN MODELS OF BINARY BLACK HOLE SYSTEMS. *Scott H. Hawley*, Belmont University, Nashville (P&A)
- 2:30 ANALYZING TORNADO TRACK DENSITIES IN KENTUCKY AND TENNESSEE USING GEOSPATIAL TECHNIQUES. *Robert Mark Simpson*, University of Tennessee at Martin, Martin, Tennessee. (G&G)
- 2:45 GANSU, CHINA'S MUDSLIDE TRAGEDY- NATURAL OR MANMADE DISASTER? *Shannon M. White** and *Dr. Hsiang te Kung*, The University of Memphis, Memphis, Tennessee. (G&G)
- 3:00 THE GEOGRAPHIC DISTRIBUTION OF CAVE FISH IN TENNESSEE. *Charles J. Sutherland**, Earth Sciences, Tennessee Technological University. (G&G)

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ZOOLOGY

Friday 1:00 p.m.

Room 232, Nursing Building

Timothy J. Gaudin, University of Tennessee at
Chattanooga, *presiding*

- 1:00 SECTION BUSINESS MEETING: ELECTION OF OFFICERS FOR 2009
- 1:15 EARLY IRON DEPOSITION IN TEETH OF THE STREAMSIDE SALAMANDER, *AMBYSTOMA BARBOURI*. **Michael A. Anderson*** and **Brian T. Miller**, Middle Tennessee State University, Murfreesboro, Tennessee. (TAS member: Brian T. Miller)
- 1:30 THE EFFECTS OF SHORT-TERM STRESS ON CORTICOSTERONE, LEUKOCYTES, TESTOSTERONE, AND PROSTAGLANDIN E2 IN MALE SOUTHEASTERN FIVE-LINED SKINK (*PLESTIODON INEXPECTATUS*). **Ryan Seddon*** and **Matt Klukowski**, Middle Tennessee State University, Murfreesboro, Tennessee. (TAS member: Ryan Seddon)
- 1:45 EFFECTS OF FOOD DEPRIVATION ON PLASMA CORTICOSTERONE AND TRIGLYCERIDES IN WATER SNAKES. *NERODIA SIPEDON*. **Alison Carey*** and **Matthew Klukowski**, Middle Tennessee State University, Murfreesboro, Tennessee. (TAS member: Matthew Klukowski)
- 2:00 EFFECTS OF MATERNALLY TRANSFERRED METHYLMERCURY CHLORIDE ON STRESS INDUCED CORTICOSTERONE LEVELS IN *NERODIA SIPEDON* NEONATES. **J. Patrick W. Cusaac***, **Raymond C. Wright***, **Cassandra Henry***, and **Frank C. Bailey**, Middle Tennessee State University, Murfreesboro, Tennessee. (TAS member: Frank C. Bailey)
- 2:15 MERCURY CONCENTRATION IN FECAL SAMPLES AS AN INDICATOR OF METHYLMERCURY ABSORPTION IN DOSED NORTHERN WATER SNAKES. *NERODIA SIPEDON*. **Raymond C. Wright***, **J. Patrick W. Cusaac***, **Cassandra Henry***, **Frank C. Bailey**, Middle Tennessee State University, Murfreesboro, Tennessee. (TAS member: Frank C. Bailey)

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- 2:30 NICHE PARTITIONING AND OVERLAP BETWEEN WINTERING WOODPECKERS IN A BOTTOMLAND HARDWOOD FOREST IN NORTHWEST TENNESSEE. **Caitlin M. Gussenhoven** and **H. Dawn Wilkins**, The University of Tennessee at Martin, Martin, Tennessee. (TAS member: H. Dawn Wilkins)
- 2:45 AN ASSESSMENT OF CHROMOSOMAL POLYMORPHISM IN THE SOUTHERN SHORT-TAILED SHREW (*BLARINA CAROLINENSIS*). **A. Christopher Grow***, **Melvin L. Beck**, and **Michael L. Kennedy**, The University of Memphis, Memphis, Tennessee. (TAS member: Michael L. Kennedy)
- 3:00 RELATIONSHIP OF THE OCCURRENCE OF THE VIRGINIA OPOSSUM AND SELECTED HABITAT VARIABLES. **Daniel M. Wolcott*** and **Michael L. Kennedy**, The University of Memphis, Memphis, Tennessee. (TAS member: Michael L. Kennedy)
- 3:15 AN EXAMINATION OF INTERSPECIFIC ASSOCIATION BETWEEN EASTERN WILD TURKEY AND WHITE-TAILED DEER. **Corey T. Young*** and **Michael L. Kennedy**, The University of Memphis, Memphis, Tennessee..
- 3:30 SAMPLING MACROINVERTEBRATES IN POND COMMUNITIES: A COMPARISON OF TWO TECHNIQUES. **Laura A. Farmer*** and **Steven W. Hamilton**, Austin Peay State University, Clarksville, Tennessee.
- 3:45 THERMAL ECOLOGY OF HIBERNATION IN THE MIDLAND WATERSNAKE. **Jerrod D. Shipman***, **Vince A. Cobb**, Middle Tennessee State University, Murfreesboro, Tennessee.

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POSTERS ON DISPLAY

Lobby of the STEM Center Building 4

*student author # presenting author, if not first author

BOTANY

IMPACTS OF NONPOINT-SOURCE POLLUTION ON DIATOM COMMUNITY STRUCTURE AND OXYGEN METABOLISM IN THE RED RIVER WATERSHED OF NORTH-CENTRAL TENNESSEE. *Jefferson G. Lebkuecher, Stacy M. Rainey**, *Chelsea B. Williams**, and *Alex J. Hall**, *Austin Peay State University, Clarksville, Tennessee.*

THE EFFECTS OF *LONICERA MAACKII* ON THE DIVERSITY OF SMALL WOODY PLANTS AT WARNER PARKS IN NASHVILLE, TENNESSEE. *Julianna Bejma** and *A. Darlene Panvini*, *Belmont University, Nashville, Tennessee.*

GENETIC DIVERSITY OF *DALEA FOLIOSA* USING ISSR MARKERS. *Jay Pannell**, *Wes Rogers**, *Amanda D. Williams*, and *Mary K. Sledge*. *Lipscomb University, Nashville, Tennessee.*

ALLELOPATHIC ACTIVITY OF *PASSIFLORA INCARNATA* EXTRACTS AS MEASURED BY *HORDEUM VULGARE* AND *RAPHANUS SATIVUS*. *Adam W. Keasling** and *Frank C. Bailey*, *Middle Tennessee State University, Murfreesboro, Tennessee.*

CELL AND MOLECULAR BIOLOGY

OLFACTORY RESPONSES OF *C. ELEGANS* TO SELECTED BACTERIAL SPECIES. *Gabrielle Facey** and *Robert T. Grammer*, *Belmont University, Nashville, Tennessee.*

SMALL EXTRACELLULAR MATRIX PEPTIDES REGULATE ENDOTHELIAL CELL ACTIVATION. *Bobby Rampp**, *Alex Patterson**, *Amanda D. Williams*, *Beth Conway*. *Lipscomb University, Nashville, Tennessee.*

THE ROLE OF ENDOTHELIN CONVERTING ENZYME-1 IN HUMAN BREAST CANCER CELL INVASION. *Molly Watson**, *Amanda D. Williams*, *Beth Conway*. *Lipscomb University, Nashville, Tennessee.*

POSTERS ON DISPLAY

BRAIN DERIVED NEUROTROPHIC FACTOR EXPRESSION IN PROSTATE CANCER CELLS DURING STRESS. *Kyle Brawner**, *Amanda D. Williams*, *Jon Lowrance*. *Lipscomb University, Nashville, Tennessee.*

BRAIN DERIVED NEUROTROPHIC FACTOR EXPRESSION DURING CELLULAR STRESS IN T-LYMPHOBLASTS. *Porter W. Maerz**, *Amanda D. Williams*, *Jon Lowrance*. *Lipscomb University, Nashville, Tennessee.*

ENDOTHELIN CONVERTING ENZYME-1 EXPRESSION LEVELS IN BREAST CANCER CELLS. *Ben Kellum**, *Amanda D. Williams*, *Beth Conway*. *Lipscomb University, Nashville, Tennessee.*

CHARACTERIZATION OF THE DEAD ELVIS (DEL) MUTATION IN ZEBRAFISH. *Lauren Milleville**, *Michael R. Taylor*, *Charles A. Lessman*, and *Ethan A. Carver*, *University of Tennessee at Chattanooga, Chattanooga, Tennessee (LM, EC)*, *St. Jude's Children's Hospital, Memphis, Tennessee (MT)*, and *University of Memphis, Memphis, Tennessee (CL)*.

CHEMISTRY

CHARACTERIZATION OF MOLDS BY ANALYZING VOLATILE ORGANIC COMPOUNDS RELEASED USING GAS CHROMATOGRAPHY-MASS SPECTROMETRY. *Beng Guat Ooi*, *Department of Chemistry, MTSU.*

CHARACTERIZATION OF MOLDS BY ANALYZING VOLATILE ORGANIC COMPOUNDS RELEASED USING GAS CHROMATOGRAPHY-MASS SPECTROMETRY. *Beng Guat Ooi**, *Middle Tennessee State University, Murfreesboro, Tennessee.*

CALIBRATION OF DIAPHRAGM VACUUM GAUGE MEASUREMENTS OF WATER ASPIRATOR PERFORMANCE. *Alae Rabiei** and *Martin V. Stewart*, *Middle Tennessee State University, Murfreesboro, Tennessee.*

A HISTORY OF THE CHEMISTRY SECTION OF THE TENNESSEE ACADEMY OF SCIENCE: 1940 – 2010. *Stokes R. Swann**, *James X. Corgan*, and *Martin V. Stewart*, *Middle Tennessee State University, Murfreesboro, Tennessee (SRS, MVS)*, and *Austin Peay State University, Clarksville, Tennessee (JXC)*.

POSTERS ON DISPLAY

REGIOSELECTIVE REDUCTIONS OF POLYHALOHETEROAROMATICS. **Rachael Hall*** and **Scott T. Handy**, Middle Tennessee State University, Murfreesboro, Tennessee.

ONE-POT IODINATION/CROSS-COUPPLINGS IN ROOM TEMPERATURE IONIC LIQUIDS. **Lindsey Bailey*** and **Scott T. Handy**, Middle Tennessee State University, Murfreesboro, Tennessee.

ANNULATED CARBAZOLES AS NEW DONORS FOR DYE SENSITIZED SOLAR CELLS. **Jessica Treadway***, **Ian Hunter**, and **Scott T. Handy**, Middle Tennessee State University, Murfreesboro, Tennessee.

ONE-POT SONOGASHIRA/SUZUKI COUPLING TANDEM ON DIHALOHETEROAROMATICS. **Tunde Osinloye** and **Scott T. Handy**, Middle Tennessee State University, Murfreesboro, Tennessee.

A SERIES OF ALLOXAN THIOSEMICARBAZONES AND REACTIONS WITH PLATINUM AND PALLADIUM, **Talon Hill***, **Andrea Wilson**, **Edward C. Lisic**, Tennessee Tech University, Cookeville, Tennessee.

ENZYMATIC AND MASS SPECTRAL ANALYSIS OF MUTANT AND WILD-TYPE SELENOMETHIONYL-DIHYDROFOLATE REDUCTASE. **Kathleen Broderick*** and **Jeffery O. Boles**, Tennessee Tech University, Cookeville, Tennessee.

ADSORPTION OF ATMOSPHERIC MERCURY (Hg(II)) BY TOP SOIL THROUGH LEACHING OF RAIN WATER: A LABORATORY SIMULATION STUDY. **Carrie Thompson*** and **Hong Zhang**, Tennessee Tech University, Cookeville, Tennessee.

UV-VIS ABSORBANCE OF HUMIC ACIDS EXPOSED TO UVB LIGHT: A PRELIMINARY STUDY. **Zachary Andreasen*** and **Hong Zhang**, Tennessee Tech University, Cookeville, Tennessee.

INVESTIGATION OF RAMAN SPECTROSCOPY FOR THE QUANTITATIVE ANALYSIS OF NANOPARTICLE MIXTURES. **Christopher Fowler*** and **Andrew Callender**, Tennessee Tech University, Cookeville, Tennessee.

PHOTOCHEMICAL REDUCTION OF Hg (II) BY HUMIC ACID: A PRELIMINARY STUDY, **Stephen Kojo Okine*** and **Hong Zhang**, Tennessee Tech. University, Cookeville, Tennessee.

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SYNTHESIS AND BIOLOGICAL STUDIES OF PALLADIUM (II) ACETYLPIRAZINE-THIOSEMICARBAZONE COMPLEXES, **Michael Beck***, **Rachel Swindle**, **Sean Reilley**, and **Edward C Lisic**, Tennessee Tech University, Cookeville, Tennessee.

DNA BINDING STUDIES OF THIOSEMICARBAZONE COMPLEXES. **Julia Filer**, **Keyuri Patel**, and **Edward C. Lisic**, Tennessee Tech University, Cookeville, Tennessee.

"SYNTHESIS OF A SERIES OF NAPHTHOQUINONE SULFONIC ACID THIOSEMICARBAZONE LIGANDS AND REACTIONS WITH PALLADIUM (II)". **Megan Monteen** and **Edward C. Lisic**, Tennessee Tech University, Cookeville, Tennessee.

"SYNTHESIS OF A SERIES OF 1, 2-CYCLOHEXANEDIONE THIOSEMICARBAZONE COMPOUNDS". **Max Phillips** and **Edward C. Lisic**, Tennessee Tech University, Cookeville, Tennessee.

KNOEVENAGEL COUPLING OF AROMATIC ALDEHYDES AND MELDRUM'S ACID IN DMF. IONIC LIQUID. AND DEEP EUTECTIC SOLVENT SYSTEMS, **Irene Hwang*** and **Daniel J. Swartling**, Tennessee Tech University, Cookeville, Tennessee.

METHODS IN THE PRODUCTION OF 5-ALKYLIDENEMALONATE DERIVATIVES OF MELDRUM'S ACID. **Casey J. McCormick*** and **Daniel J. Swartling**, Tennessee Tech University, Cookeville, Tennessee.

CHARACTERIZATION OF VOLATILE ORGANIC COMPOUNDS FROM MOLDS USING GAS CHROMATOGRAPHY-MASS SPECTROMETRY, **Chelsey Crowell** and **Beng Guat Ooi**, Middle Tennessee State University, Murfreesboro, Tennessee.

CHARACTERIZATION OF VOLATILE ORGANIC COMPOUNDS FROM MOLDS USING GAS CHROMATOGRAPHY-MASS SPECTROMETRY, **Chelsey Crowell** and **Beng Guat Ooi**, Middle Tennessee State University, Murfreesboro, Tennessee.

PRETREATMENT OF CELLULOSIC FEEDSTOCKS AND CONVERSION TO SIMPLE SUGARS BY ENZYMATIC SYSTEMS: A BIOFUEL INITIATIVE, **Jessika Pinto*** and **Jeffrey O. Boles**, Tennessee Technological University, Cookeville, Tennessee.

POSTERS ON DISPLAY

LC-MS/MS and SPME-GC-MS/MS ANALYSIS OF SEIZED CLANDESTINE DRUGS TO ESTABLISH A CHEMICAL FINGERPRINT DATABASE. **Sri Bharat Madireddy*** and **Jeffrey O. Boles**, *Tennessee Technological University, Cookeville, Tennessee.*

LC-MS/MS and SPME-GC-MS/MS ANALYSIS OF SEIZED CLANDESTINE DRUGS TO ESTABLISH A CHEMICAL FINGERPRINT DATABASE. **Sri Bharat Madireddy*** and **Jeffrey O. Boles**, *Tennessee Technological University, Cookeville, Tennessee.*

POCIS EXTRACTION AND LC-MS/MS ANALYSIS OF STIMULATORY DRUGS OF ABUSE TO EXAMINE ANY SEASONAL VARIATION IN VARIOUS WATER BODIES, **Vanaja Reddy Bodeddula*** and **Jeffrey O. Boles**, *Tennessee Technological University, Cookeville, Tennessee.*

DEVELOPMENT OF AN IMPROVED FILTER PAPER ASSAY FOR THE DETERMINATION OF ENZYMIC ACTIVITIES OF CELLULASE ENZYMES, **Henry Abougor*** and **Jeffrey O. Boles**, *Tennessee Technological University, Cookeville, Tennessee.*

ENGINEERING AND ENGINEERING TECHNOLOGY

SYNTHESIS AND CHARACTERIZATION OF CORE-SHELL NANOPARTICLES OF POLYSTYRENE AND POLYMETHYLMETHACRYLATE. **Verónica Carranza***, **Dennis Chicoma**, and **Reinaldo Giudici**. *São Paulo University, São Paulo, Brazil, and Tennessee Technological University, Tennessee.*

ROLE OF JOULE HEATING IN ELECTROKINETICS SOIL CLEANING: EFFECT OF THE NUSSELT NUMBERS IN CAPILLARY MODELS. **Cynthia Torres***, **Dr Pedro Arce**, **Dr Dale Ensor**. *Tennessee Technological University.*

THE DESIGN OF POTENTIALLY NEW SHRINKAGE REDUCING ADMIXTURES (SRA) USING COMPUTER AIDED MOLECULAR DESIGN WITH THE SIGNATURE MOLECULAR DESCRIPTOR. **Hamed Kayello***, **Donald P. Visco**, and **Joseph J. Biernacki**, *Tennessee Technological University, Cookeville, Tennessee.*

POSTERS ON DISPLAY

WATER MOBILITY IN POLYMER ELECTROLYTE MEMBRANE FUEL CELLS DURING SUB-ZERO ISOTHERMAL COLD-STARTS. **Antonio O. Pistono*** and **Cynthia A. Rice-York**, *Tennessee Technological University, Cookeville, Tennessee.*

EFFECT OF ANODE CATALYST LAYER POROSITY ON PERFORMANCE OF A DIRECT FORMIC ACID FUEL CELL. **Akshay S. Bauskar*** and **Cynthia Rice-York**, *Tennessee Technological University, Cookeville, Tennessee.*

INFLUENCE OF SULFATED ZIRCONIA-DOPED NAFION COMPOSITE MEMBRANES AND CATALYST LAYERS ON DIRECT METHANOL FUEL CELL PERFORMANCE. **Shilpa Beravelli***, **Cynthia Rice-York**, **J. Dalton York**, **Emory Hannah*** and **Akshay S. Bauskar***, *Tennessee Technological University, Cookeville, Tennessee.*

AN EVALUATION OF THE HYDRODYNAMICS PRESENTED FOR FLOW PAST AN ELECTRODE IN THE PRESENCE OF AN APPLIED MAGNETIC FIELD. **Jeffery W. Thompson***, **Seth Wynne** and **Vinten Diwakar**, *Tennessee Technological University, Cookeville, Tennessee.*

ANALYTICAL APPROACH EXAMINING ELECTROSTATIC POTENTIAL IN DIVERGENT AND CONVERGENT CHANNEL TO INVESTIGATE ROLE OF CHANNEL MORPHOLOGY IN MICROFLUIDIC APPLICATIONS. **Parvin Golbayani ***, **Kevin T. Seale**, **Jonathan R. Sanders** and **Pedro E. Arce**, *Tennessee Technological University, Cookeville, Tennessee (PG, JS, PA).* and *Vanderbilt University, Nashville, Tennessee (KS).*

OPTIMIZATION OF PENG-ROBINSON EOS FOR SUPERCRITICAL CO₂. **Franklin Angulo***, **Jeffery Thompson**, **Mario Oyanader** and **Holly Stretz**, *Tennessee Technological University, Cookeville, Tennessee.*

GEOLOGY AND GEOGRAPHY

CRIME RATE ANALYSIS OF THE UNITED STATES. **Jacob K. Peterman***, **Peter Li**, *Earth Sciences, Tennessee Technological University, Cookeville, Tennessee.*

POSTERS ON DISPLAY

POTENTIAL AREAS ACROSS TENNESSEE FOR SOLAR POWER PLANTS. **Blake Smelcer***, **Peter Li**, *Earth Sciences, Tennessee Technological University.*

MICROBIOLOGY

THE INFLUENCE OF ENVIRONMENTAL PH ON GROUP B STREPTOCOCCUS VIRULENCE FACTOR EXPRESSION. **Caitlyn Anderson***, **Caroline Eubanks***, **Stephen Gragg***, **Amanda D. Williams**, **Jon Lowrance**, *Lipscomb University, Nashville, Tennessee.*

ANALYSIS OF INTERFERON REGULATORY FACTOR-3 LEVELS IN CELL LINES EXPRESSING HUMAN PAPILLOMAVIRUS. **Brittney D. Everhart*** and **Jennifer T. Thomas**, *Belmont University, Nashville, Tennessee.*

THE ANTIMICROBIAL EFFECTS OF HERBS AND SPICES ON GRAM-POSITIVE AND GRAM-NEGATIVE BACTERIA. **Ariel Ouellette***, **A. Darlene Panvini**, and **Jennifer Thomas**, *Belmont University, Nashville, Tennessee.*

EFFECT OF HUMAN PAPILLOMAVIRUS ON LEVELS OF TLR-9 IN CERVICAL CARCINOMA CELL LINES. **Jessica E. Rix*** and **Jennifer T. Thomas**, *Belmont University, Nashville, Tennessee.*

ANALYSIS OF INTEGRIN PROTEIN LEVELS IN CERVICAL CELL LINES EXPRESSING HUMAN PAPILLOMAVIRUS. **Emily L. Smothers*** and **Jennifer T. Thomas**, *Belmont University, Nashville, Tennessee.*

EXPRESSION LEVELS OF SELECTIN IN HUMAN PAPILLOMAVIRUS POSITIVE AND NEGATIVE CELL LINES. **Matthew C. Turner*** and **Jennifer T. Thomas**, *Belmont University, Nashville, Tennessee.*

EVALUATING THE ADAPTATION OF STAPHYLOCOCCUS AUREUS TO SEVERAL ANTIBIOTICS TO COMPARE EFFICACY OF MELITTIN, A NOVEL ANTIMICROBIAL THERAPY. **Krystle Irizarry*** and **Chad Brooks**, *Austin Peay State University.*

POSTERS ON DISPLAY

HYDROGEN PRODUCTION VIA GLYCEROL FERMENTATION BY BACTERIUM ENTEROBACTER AEROGENES. **Jared Averitt*** and **Sergei A. Markov**, *Austin Peay State University, Clarksville, Tennessee.*

BIODIESEL, HYDROGEN AND ETHANOL GENERATION FROM CARBON DIOXIDE AND WATER BY SEQUENTIAL USE OF MICROORGANISMS IN BIOREACTORS. **Luke Holliday*** and **Sergei A. Markov**, *Austin Peay State University, Clarksville, Tennessee.*

SCIENCE AND MATH TEACHING

ENGAGING HIGH SCHOOL ECOLOGY STUDENTS IN BIODIVERSITY LAB ACTIVITIES THROUGH THE NSF TRIAD GK-12 PROGRAM. **Alison Carey***, **Mary B. Farone**, **Lewis E. Myles**, **Kim Cleary Sadler**, **Maria Thompson**, and **Anthony L. Farone**, *Middle Tennessee State University, Murfreesboro, Tennessee (AC, MF, KS, AF), and Tennessee State University, Nashville, Tennessee (LM, MT).*

HERE'S THE POOP ABOUT THE PROCESS OF SCIENCE IN A HIGH SCHOOL BIOLOGY CLASSROOM: MAKING SCIENCE REAL IN THE NSF TRIAD GK-12 PROGRAM. **Jerrod Shipman***, **Mary B. Farone**, **Lewis E. Myles**, **Kim Cleary Sadler**, **Maria Thompson**, and **Anthony L. Farone**, *Middle Tennessee State University, Murfreesboro, Tennessee (JS, MF, KS, AF), and Tennessee State University, Nashville, Tennessee (LM, MT).*

ZOOLOGY

THE EFFECT OF OLDER CONSPECIFICS ON GROWTH RATE AND SURVIVAL IN LARVAL TOBACCO HORNWORMS, *MANDUCA SEXTA*. **Davene King*** and **Nancy Buschhaus**, *University of Tennessee at Martin.* (TAS member: Nancy Buschhaus)

A COMPARISON OF INSECT COLLECTIONS USING CDC LIGHT TRAPS EQUIPPED WITH INCANDESCENT AND GREEN LIGHT-EMITTING DIODE LIGHT SOURCES. **Katie L. Rice*** and **C. Steven Murphree**, *Belmont University, Nashville, Tennessee.* (TAS member: C. Steven Murphree)

POSTERS ON DISPLAY

REPELLENT PROPERTIES OF COMMON HERBS OF THE FAMILY LABIATAE AGAINST THE AMERICAN DOG TICK, *DEMACENTOR VARIABILIS*. **Sarah E. Ayers***, **Barbara B. Ward** and **C. Steven Murphree**. Belmont University. Nashville. Tennessee. (TAS member: C. Steven Murphree)

SPECIES DIVERSITY OF WOODPECKERS IN A WATER TUPELO SWAMP AND A BOTTOMLAND HARDWOOD FOREST IN NORTHWEST TENNESSEE. **Leah M. Good** and **H. Dawn Wilkins**, The University of Tennessee at Martin. Martin, Tennessee. (TAS member: H. Dawn Wilkins)

REASSESSMENT OF THE FISHES OF THE LITTLE RIVER SYSTEM, WESTERN KENTUCKY. **Andrew S. Riggs***, **Rebecca E. Blanton**, Center of Excellence for Field Biology, Austin Peay State University. Clarksville. Tennessee.

CONSERVATION GENETICS OF A SPOTTED SALAMANDER (*AMBYSTOMA MACULATUM* (SHAW 1802) LOCAL POPULATION IN SOUTHEAST TENNESSEE. **Daniel S. Armstrong*** and **Thomas P. Wilson**, University of Tennessee at Chattanooga. Chattanooga. Tennessee.

MEACHAM POND REVISITED: AN ASSESSMENT OF ECOLOGICAL FACTORS FIVE YEARS LATER. **Lauren Adan**, **Sandra Bann**, **Brittini Beard**, **Myeshia Coleman**, **Joshua Crowder**, **Brianne Dillahay**, **Joseph Guillet**, **Nathalia Hayashi**, **Ethan Horner**, **Krystle Irizarry***, **Jeffrey Kane**, **Prashant Khatani**, **Michelle Liew**, **LaDetra Major**, **Jonathan Martin**, **Chris Mills**, **Jaret Quitoriani**, **Paige Rasmussen***, **Aaron Ross**, **Christa Ryder**, **Megan Snyder**, **Joshua Taylor**, **Jessica Whitley**, **Chelsea Williams***, **Felicia Williams** and **Willodean Burton**, Austin Peay State University. Clarksville. Tennessee.

EFFECTS OF MULTIPLE PREDATION CUES ON *PHYSID* SNAIL BEHAVIOR. **Amy Fehrmann*** and **John Niedzwiecki**, Belmont University, Nashville, Tennessee

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