

Schedule

4:00 PM THURSDAY REGISTRATION ACADEMIC BUILDING B
7:00 PM THURSDAY EVENING WELCOME RECEPTION LLANO HALL
PAVILLION AND
SOUTH LLANO RIVER

7:45 PM Special Thursday Evening Sessions Administration Building
201 and 205

7:45 PM NS 343 TAS POSITION STATEMENT ON TEACHING OF EVOLUTIONARY
 THEORY IN TEXAS' PUBLIC SCHOOLS

Invited Panel of Board Officers

8:15 PM NS 344 TAS ON THE INTERNET: IMPROVING COMMUNICATION AND
 OUTREACH

Willaim Quinn, St. Edward's University, Austin, TX, Ray Mathews, Texas
 Water Development Board, Austin, TX

7:30 AM FRIDAY REGISTRATION ACADEMIC BUILDING B

SYMPOSIUM ON ENVIRONMENTAL EDUCATION AND OUTREACH PROGRAMS IN TEXAS

7:30 AM Friday, March 6 Packard East

7:30 AM NS 342 INTRODUCTORY REMARKS

T. L. Arsuffi, Llano River Field Station, Texas Tech University, Junction, TX

7:40 AM NS 323 TEXAS PARKS AND WILDLIFE DEPARTMENT'S PROJECT WILD
 SHOWCASE

Nancy Herron and Kiki Corry, Texas Parks and Wildlife Department, Austin,
 TX

8:00 AM NS 324 THE IMPORTANCE OF PLACE-BASED EDUCATION AND
 BIOREGIONAL WEBSITES

Burr Williams, Sibley Nature Center, Midland, TX

8:20 AM NS 325 HOLISTIC, ADAPTIVE, STANDARD-BASED NATURAL RESOURCE,
 SCIENCE K-12 EDUCATION AND CURRICULUM AT TEXAS TECH
 UNIVERSITY'S OUTDOOR SCHOOL AND LLANO RIVER FIELD
 STATION

Dixie Mayer, Bonnie Loeffler, Victoria Faubion, Marcia Clark, Wynn Simon,
 Kaycie Sullivan and T.L. Arsuffi, Llano River Field Station, Texas Tech
 University, Junction, TX

8:40 AM NS 326 FAMILIES IN NATURE: RENEWAL OF A DISCONNECT
 Angela Soldinger, Texas Forest Service, College Station, TX

9:00 AM NS 331 THE NATIONAL PROJECT FOR EXCELLENCE IN ENVIRONMENTAL
 EDUCATION

Christine Moseley, Department of Interdisciplinary Learning and Teaching,
 University of Texas at San Antonio, San Antonio, TX

9:20 AM NS 327 EXPLORING THE NATIVE PLANT WORLD: INFORMAL EDUCATION
 AT THE LADY BIRD JOHNSON WILDFLOWER CENTER

F.M. Oxley and R. Stephen Brueggerhoff, Lady Bird Johnson Wildflower
 Center, Austin, TX

9:40 AM Poster Session 1 and Break Dining Hall & Academic
Building B

- 10:20 AM NS 328 THE CHILDREN AND NATURE MOVEMENT
Nancy Herron. Texas Parks and Wildlife Department, Austin, TX
- 10:40 AM NS 329 THE TEXAS ENVIROTHON: BLENDING SCIENCE AND THE OUTDOORS
Brenda G. Weiser, Environmental Institute of Houston & School of Education-UHCL, Houston, TX
- 11:00 AM NS 330 RENEWABLE ENERGY PROGRAM: COLLABORATION BETWEEN LCRA AND SECO PROVIDES A SOLAR-WIND HYBRID SYSTEM FOR EXHIBITION, ENERGY AND EDUCATION OF NATURE PARK STUDENTS AND VISITORS
Beth W. Banks, McKinney Roughs, Lower Colorado River Authority, West?Cedar Creek, TX
- 11:20 AM NS 332 TEXAS PARKS AND WILDLIFE DEPARTMENT'S APPROACH TO BEST PRACTICES FOR CONSERVATION EDUCATION
Nancy Herron. Texas Parks and Wildlife Department, Austin, TX
- 11:40 AM Lunch**
- 12:20 PM NS 333 THE TEXAS ASSOCIATION FOR ENVIRONMENTAL EDUCATION: ITS MISSION, STRATEGIC INITIATIVES AND PROGRAMS
Haily Summerford, Fort Worth Botanic Garden, Fort Worth TX
- 12:40 PM NS 334 PROGRAMS AND EXHIBITS AT AN URBAN NATURE CENTER: PROVIDING CHILDREN AND FAMILIES WITH OPPORTUNITIES TO EXPLORE THE OUTDOORS
Janice Sturrock, Austin Nature and Science Center, Austin, TX
- 1:00 PM NS 335 AUDUBON TEXAS NATURE CENTERS AND CONSERVATION EDUCATION PROGRAMS
Andrew C. Kasner, Audubon Texas, San Antonio, TX
- 1:20 PM NS 336 THE VISION AND STRATEGIC INITIATIVES IN OUTREACH AND EDUCATION FROM THE TEXAS WATER DEVELOPMENT BOARD
Linda Ruiz McCall, Texas Water Development Board, Austin, TX
- 1:40 PM Break**
- 2:00 PM NS 337 ENVIRONMENTAL EDUCATION IN SAN MARCOS, TX: A NEW LOCAL INITIATIVE TO BROADEN EXPOSURE AMONG SCHOOL-AGED CHILDREN
Jenna Winters, Department of Biology, Texas State University, San Marcos, TX, Melani Howard and Julie King, Parks and Recreation – City of San Marcos, San Marcos, TX
- 2:20 PM NS 338 HEALTHY HABITATS PROGRAM FOR HIGH SCHOOL STUDENTS: A PARTNERSHIP BETWEEN TEXAS PARKS AND WILDLIFE DEPARTMENT AND TEXAS CENTER FOR SERVICE-LEARNING TO PROVIDE HANDS-ON LEARNING IN RESTORATION AND ENVIRONMENTAL LITERACY
Nancy Herron and John Spence, Texas Parks and Wildlife Department, Austin, TX
- 2:40 PM NS 339 ADDING SUSTAINABILITY TO ENVIRONMENTAL EDUCATION PROGRAMS: AWARENESS AND GREEN STEM APPROACHES
Jenny Strovas and T.L. Arsuffi, Llano River Field Station, Texas Tech University, Junction, TX
- 3:00 PM NS 340 USE OF MULTIPLE PARTNERSHIPS AT THE LOWER COLORADO RIVER AUTHORITY'S MATAGORDA BAY NATURE PARK TO DEVELOP, ASSESS AND IMPLEMENT A TEXAS ESSENTIAL KNOWLEDGE BASED CURRICULUM TO IMPROVE STUDENT LEARNING AND NATURAL RESOURCE AWARENESS

Llano Hall Pavillion

Betsy Terrel, McKinney Roughs, Lower Colorado River Authority,
West?Cedar Creek, TX

3:20 PM NS 341 SYMPOSIUM SUMMARY AND SYNTHESIS WITH PANEL/AUDIENCE
DISCUSSION

T.L. Arsuffi, Llano River Field Station, Texas Tech University, Junction, TX

SYMPOSIUM ON BIONANOTECHNOLOGY AND ENVIRONMENTAL RESEARCH

- 8:00 AM Friday, March 6 Admin 205**
- 8:00 AM NS 309 OPENING REMARKS
Sunny Ohia*, Provost and Vice President for Academic Affairs, Texas
Southern University, Houston, TX
- 8:05 AM NS 312 OVERVIEW OF THE CENTER FOR BIONANOTECHNOLOGY AND
ENVIRONMENTAL RESEARCH
Olufisayo Jejelowo*, Texas Southern University, Houston, TX
- 8:25 AM NS 315 MANAGEMENT OF MICROORGANISMS IN CLOSED ENVIRONMENT
Mahmoud Saleh*, Olufisayo Jejelowo, Abdel Rahman, Texas Southern
University, Houston, TX, James Briggs, University of Houston, Houston, TX
- 8:45 AM NS 346 SPACE-LIKE STRESS (SLS) AND SPACE MICROBIOLOGY: IS THIS
THE FINAL FRONTIER?
Jason A. Rosenzweig*, Olufisayo Jejelowo, Texas Southern University,
Houston, TX, C. Mark Ott, Duane L. Pierson, NASA-Johnson Space Center,
Houston, TX
- 9:05 AM NS 348 FUNCTIONALIZED NANOPIPETTE: A VERSATILE BIO/CHEMO
SENSOR
P. Actis, M. Karhanek, University of California Santa Cruz, Santa Cruz, CA,
O. Jejelowo, Texas Southern University, Houston, TX, N. Pourmand,
3Stanford Genome Technology Center, Stanford University, Palo Alto, CA
- 9:25 AM NS 307 CAENORHABDITIS ELEGANS AS MODEL ORGANISM FOR
STUDYING RADIATION AND MICROGRAVITY EFFECTS
Fawzia Abdel-Rahman*, Texas Southern University, Houston, TX.
- 9:40 AM Poster Session 1 and Break Dining Hall & Academic
Building B**
- 10:20 AM NS 349 IN VIVO AND IN VITRO EFFECTS OF SIMULATED MICROGRAVITY
ON BRAIN
Govindarajan Ramesh*, Norfolk State University, Norfolk, VA
- 10:40 AM NS 319 SUPPRESSED EXPRESSION OF NON-DSB REPAIR GENES INHIBITS
GAMMA-RADIATION-INDUCED CYTOGENETIC REPAIR AND CELL
CYCLE ARREST
Honglu Wu, Ye Zhang¹, Kamal Emami¹, Dianne Hammond, Rachael Casey,
Satish K. Mehta, Antony S. Jeevarajan, Duane L. Pierson, NASA Johnson
Space Center, Houston, TX, Larry H. Rohde, University of Houston - Clear
Lake, Houston, TX
- 11:00 AM NS 350 NATURAL PRODUCT COUNTERMEASURES AGAINST THE
ADVERSE EFFECTS OF RADIATION AND MICROGRAVITY
Shishir Shishodia, Mahmoud Saleh, and Olufisayo A. Jejelowo, Texas
Southern University, Houston, TX
- 11:20 AM NS 351 ROLE OF MICROGRAVITY-INDUCED EPIGENETIC CHANGES AND
CHROMATIN REMODELING ON GENE EXPRESSION PATTERN
Kamaleshwar P Singh*, Ragini Kumari, Olufisayo Jejelowo, Department of
Biology/NASA-URC, Texas Southern University, Houston, TX
- 11:40 AM Lunch Llano Hall Pavillion**

12:20 PM		Poster Session 2		Dining Hall & Academic Building B
1:00 PM	NS	295 RADIATION BIOLOGY BASICS	John Ford*, Texas A&M University, College Station. Honglu Wu, NASA Johnson Space Center, Houston, TX Marian Hela, Texas Southern University, Houston, TX	
2:40 PM	NS	318 RADIATION RESEARCH SAFETY & REGULATIONS	Marion Hillar, Texas Southern University, Houston, TX	
3:00 PM	NS	321 ON SCIENCE, TECHNOLOGY AND ENVIRONMENTAL POLICY	Oluponmile Olonilua, Michael Adams, Texas Southern University, Houston, TX	
3:20 PM	NS	352 SYMPOSIUM SUMMARY AND PANEL DISCUSSION	Dan Davis, Olufisayo Jejelowo, Texas Southern University, Houston, TX	

ANTHROPOLOGY

10:20 AM		Friday, March 6		Admin 201
10:20 AM	NS	1 EXPLORING THE IMPACTS OF RAW MATERIAL AVAILABILITY AND SIZE ON PREHISTORIC CHIPPED STONE ASSEMBLAGES IN CENTRAL AND SOUTH TEXAS	Antonia Figueroa*, Cynthia Munoz, Steve Smith, and Raymond Mauldin, The University of Texas at San Antonio	
10:40 AM	G	2 CERAMICS FROM MISSION ESPADA AND RANCHO DE LAS CABRAS: A QUESTION OF ORIGINS	Lori Barkwill Love*, Steve Tomka, Antonia L. Figueroa, The University of Texas at San Antonio, San Antonio, TX, Jeffrey R. Ferguson and Michael D. Glasscock, The University of Missouri, Columbia, Missouri	
11:00 AM	U	174 EXPLORING ECOLOGICAL CONDITIONS USING STABLE CARBON AND OXYGEN ISOTOPIC COMPOSITION OF SOIL AND SNAIL SHELL RECOVERED FROM ARCHAEOLOGICAL SITE 41KM69, JUNCTION, TEXAS	Kristi Salazar*, Department of Geological Sciences, and Jennifer Thompson, Center for Archaeological Research, Department of Anthropology, University of Texas at San Antonio	
11:20 AM	NS	190 PALEOECOLOGICAL RECONSTRUCTION USING SMALL HERBIVORES FROM ARCHAEOLOGICAL SITES.	Cynthia Munoz*, Lynn Wack, Kevin Daiber, Olivia Short, Center for Archaeological Research, Department of Anthropology, University of Texas at San Antonio (UTSA), TX, and Patrick Villanueva, Department of Geological Sciences, UTSA, TX.	
11:40 AM		Lunch		Llano Hall Pavillion
12:20 PM		Poster Session 2		Dining Hall & Academic Building B
1:00 PM		Section Meeting		Admin 201

BIOMEDICAL SCIENCES

8:00 AM		Friday, March 6		Admin 201
8:00 AM	NS	244 CONTINUING STUDIES ON THE POTENTIAL UTILITY OF BORONIC ACIDS AS NOVEL INSECTICIDES	G. Scott Weston*, Feik School of Pharmacy, University of the Incarnate Word	

- 8:20 AM G 233 SYSTEM IDENTIFICATION OF DYNAMIC FULL BODY BALANCE OF 18Q- PATIENTS
Roseann Trevino*, University of Texas at San Antonio, San Antonio, TX
- 8:40 AM U 106 EFFECTS OF NUTRITIONAL SUPPLEMENTATION AND CARDIOVASCULAR DYSFUNCTION IN MIROGRAVITY
Jamail Plumber*, Space and Environment Science Internship Program, Dianne Hammond, Bioanalytical Core Lab EASI, JSC, NASA, and Dr. Alamelu Sundaresan Texas Southern University and Osteoimmunology and Integrative Physiology Laboratory, NASA/Johnson Space Center
- 9:00 AM U 136 RADIO-ADAPTIVE EFFECTS IN HUMAN LYMPHOCYTES
Bianca Garland*, Texas Southern University, Kamal Emami, Wyle ISE Group, Dr. Dianne Hammond, EASI, and Dr. Honglu Wu, NASA/Human Adaptive and Counter Measure Division, Houston, Texas
- 9:20 AM U 237 INFLUENCE OF N-ACETYLCYSTEINE STATUS IN MCF-7 CELL LINE TO ALLOPURINOL/RUTHENIUM TREATMENT
Brittney Williams*, Dr. Jamie Renfro and Dr. Renard Thomas, Department of Chemistry, Texas Southern University

9:40 AM **Poster Session 1 and Break**

Dining Hall & Academic Building B

1:20 PM **Section Meeting**

Admin 201

BIOMEDICAL SCIENCES POSTERS

- G P251 POTENTIAL ROLE OF NATURAL PRODUCTS AS COUNTERMEASURES AGAINST HIGH ENERGY RADIATION
Philys Johnson*, Olufisayo A Jejelowo, Ayodotun Sodipe, Shishir Shishodia, Texas Southern University, Houston, TX.
- U P286 CHARACTERIZATION OF HIGH ENERGY RADIATION AND MICROGRAVITY ON VIRULENCE OF KNOWN BACTERIAL PATHOGENS AND OPPORTUNISTS
Kayama D. Thomas*, Jessica Nguyen, Olufisayo A Jejelowo and Jason A. Rosenzweig, Texas Southern University
- G P241 HIGH ENERGY RADIATION AND MICROGRAVITY-INDUCED EPIGENETIC CHANGES: REVERSAL AND SUPPRESSION BY NATURAL AGENTS
Georgette Rolle*, Olufisayo A Jejelowo, Ayodotun Sodipe, Shishir Shishodia, Texas Southern University, Houston, TX
- U P199 INVESTIGATING THE INHIBITORY EFFECTS OF CAFFEINE AND EPIGALLOCATECHIN GALLATE (EGCG) ON SKIN DEFECTS IN UVB IRRADIATED FISH
Vanessa R. King*, Howard Payne University

BOTANY

8:00 AM **Friday, March 6**

Mockingbird

- 8:00 AM NS 300 ANTIOXIDANT AND FREE RADICAL SCAVENGING ACTIVITIES OF BOTANICAL ESSENTIAL OILS
Mahmoud Saleh*, Fawzia Abdel-Rahman, Olufisayo Jejelowo and Brook Woodard, Texas Southern University
- 8:20 AM NS 73 CHANGES IN VEGETATION PATTERNS AND ITS EFFECT ON TEXAS KANGAROO RATS (DIPODOMYS ELATOR).
Allan D. Nelson* and Jim R. Goetze, Tarleton State University, Stephenville, TX.

8:40 AM U 165 CURCULIO WEEVIL MASS VARIATION BETWEEN TREE SPECIES POST OAK, QUERCUS STELLATA, AND LIVE OAK, QUERCUS VIRGINIANA.

Kelsey Lee Abbott*, Brayden Bunting and Wendi Moran, Hardin-Simmons University Abilene, TX.

9:00 AM U 224 A PHENOLOGICAL STUDY OF LIMESTONE ADDER'S-TONGUE (OPHIOGLOSSUM ENGELMANNII)

Nelson Rich and Casey Camarillo*, Biology Department, Collin College, Plano, TX.

9:20 AM NS 236 COMPETITION BETWEEN SCHIZACHYRIUM SCOPARIUM AND BUCHLOE DACTYLOIDES: THE ROLE OF SOIL NUTRIENTS

Janis K. Bush* and O. W. Van Auken, University of Texas at San Antonio, San Antonio, TX.

9:40 AM Poster Session 1 and Break

Dining Hall & Academic Building B

10:20 AM NS 276 LEAF PHOTOSYNTHESIS OF SUCCESSIONAL SPECIES BELOW A QUERCUS GAMBELII CANOPY

Oscar W. Van Auken* and Janis K. Bush, University of Texas at San Antonio, San Antonio, TX.

10:40 AM G 176 DISCOVERY AND EFFICACY OF A HYPERSENSITIVE-LIKE PLANT DEFENSE IN LIVE OAK AGAINST A HOST-SPECIFIC GALL FORMER.

Cristina M. Campbell*, Glen R. Hood and James R. Ott, Texas State University, San Marcos, TX.

11:00 AM NS 177 LOCALIZATION OF OSMOPHORES IN THE FLOWERS OF STAPELIADS (APOCYNACEAE, ASCLEPIADOIDEAE)

David E. Lemke* and Kort A. Angerstein, Texas State University, San Marcos, TX.

11:20 AM G 185 SEED BIOLOGY OF THE HILL COUNTRY WILD MERCURY (ARGYTHAMNIA APHOROIDES, EUPHORBIACEAE)

Jeffery A. Masters* and Bonnie B. Amos, Angelo State University, San Angelo, TX.

11:40 AM Lunch

Llano Hall Pavillion

12:20 PM Poster Session 2

Dining Hall & Academic Building B

1:00 PM G 194 SUBSPECIFIC CLASSIFICATION WITHIN PHORADENDRON SEROTINUM (SANTALACEAE): DEVELOPMENT OF MICROSATELLITE MARKERS FOR ASSESSMENT OF POPULATION GENETIC STRUCTURE.

Angela K. Hawkins* and Christopher P. Randle, Sam Houston State University, Huntsville, TX.

1:20 PM U 161 POST OAK (QUERCUS STELLATA) ACORN MASS DEMONSTRATES CORRELATION DEFICIENCY IN RATE OF GERMINATION AND SEEDLING GROWTH

Brayden Bunting*, Kelsey Abbott, Wendi Moran and Keith Davis, Hardin-Simmons University, Abilene, TX.

1:40 PM U 132 SYMBIOTIC RELATIONSHIPS BETWEEN RHIZOBIA AND TEXAS BLUEBONNETS

K. Rose Kilber* and William J. Quinn, St. Edward's University, Austin, TX.

2:00 PM Section Meeting

Mockingbird

BOTANY POSTERS

- NS P275 PHOTOSYNTHETIC RATES OF AESCULUS PAVIA VAR. FLAVESCENS (RED BUCKEYE, HIPPOCASTANACEAE)
Oscar W. Van Auken* and Janis K. Bush, University of Texas at San Antonio, San Antonio, TX.
- NS P277 COMPETITION BETWEEN SCHIZACHYRIUM SCOPARIUM AND BUCHLOE DACTYLOIDES: ROLE OF SOIL DEPTH
Janis K. Bush* and Oscar W. Van Auken, University of Texas at San Antonio, San Antonio, TX.
- NS P110 NOVEL INHIBITION OF PLANT PATHOGENIC MYCOTOXIGENIC FUNGI AND HUMAN PATHOGENIC BACTERIA BY NEW PHYTOCHEMICAL COUMARIN DERIVATIVES
Neveen S. Geweely, Cairo University, Giza, Egypt

CELLULAR AND MOLECULAR BIOLOGY

- 8:00 AM** **Friday, March 6** **Tech House**
- 8:00 AM NS 96 ALUMINUM INDUCED CYTOPLASMIC CALCIUM CHANGES IN ARABIDOPSIS THALIANA ROOTS AS REVEALED BY SENSITIZED EMISSION OF THE YELLOW CAMELEON 3.60 CALCIUM REPORTER
Magaly Rincón-Zachary*, Department of Biology, Midwestern State University, Wichita Falls, TX, Aline H. Valster, Elison B. Blancaflor, Plant Biology Division, The Samuel Roberts Noble Foundation, Ardmore, OK
- 8:20 AM G 90 BACTERIAL COMPOSITION IN SOIL COMMUNITIES OF CONTRASTING EAST TEXAS ECOTYPES
Jennifer A Edwards*, Armen Nalian, James Van Kley, Alexandra Martynova-Van Kley, Stephen F. Austin State University, Nacogdoches, TX, Scot Dowd, Research and Testing Laboratory, Lubbock, TX
- 8:40 AM G 93 ASSEMBLY OF A CHIMERA FROM BETA-D-GLUCOSIDASE AND HYPERTHERMOPHILLIC BETA-1,4-ENDOGLUCANSE FROM PYROCOCCLUS HORIKOSHII FOR CELLULOSE HYDROLYSIS.
Srihari Babu Gogineni*, Armen Nalian, Alexandra Martynova-Van kley, Stephen F. Austin State University, Nacogdoches, TX
- 9:00 AM G 291 NANOBIOSENSOR AND INTEGRATED SINGLE CELL MANIPULATION SYSTEM
Paolo Actis*, Senkei Umehara, Miloslav Karhanek, Nader Pourmand, University of California Santa Cruz, Santa Cruz, CA
- 9:20 AM NS 94 BACTERIAL MICROFLORA OF BROILERS CHALLENGED WITH COCCIDIA
Armen Nalian*, Alexandra Martynova-Van Kley, Stephen F. Austin State University, Nacogdoches, TX, Edgar Oviedo-Rond, North Carolina State University, Raleigh, NC and Scot Dowd, Research and Testing Laboratory, Lubbock, TX
- 9:40 AM** **Poster Session 1 and Break** **Dining Hall & Academic Building B**
- 10:20 AM G 293 INVESTIGATING INTEGRATION OF VIRAL DNA INTO THE HUMAN GENOME USING SEQUENCE
Hysung John Kim*, Nader Pourmand, University of California Santa Cruz, Santa Cruz, CA, Olufisayo Jejelowo, Texas Southern University, Houston, TX
- 10:40 AM G 294 FUNGAL DETECTION AND IDENTIFICATION BY NUCLEIC ACID-BASED ASSAYS.

- Cherita Thomas*, Baback Gharizadeh, Olufisayo Jejelowo, Texas Southern University, Houston, TX, Nader Pourmand, Stanford Genome Technology, Palo Alto, CA
- 11:00 AM G 91 PROFILING OF ARBUSCULAR MYCORRHIZAL COMMUNITIES BY HIGH-THROUGHPUT SEQUENCING
Elvira Kurmaeva*, James Van Kley, Armen Nalian, Alexandra Martynova-Van Kley, Stephen F. Austin State University, Nacogdoches, TX, Scot Dowd, Research and Testing Laboratory, Lubbock, TX
- 11:20 AM G 179 DESIGN OF A SYNTHETIC STANDARD FOR A REAL-TIME PCR-BASED QUANTITATIVE ANALYSIS OF EIMERIA SPECIES IN POULTRY FECES
Marina Maksimova*, Armen Nalian, Alexandra Martynova VanKley, Stephen F. Austin State University, Nacogdoches, TX

11:40 AM**Lunch****Llano Hall Pavillion****12:20 PM****Poster Session 2****Dining Hall & Academic Building B**

- 1:00 PM G 111 EFFECT OF FECAL SAMPLE STORAGE CONDITIONS ON RT-PCR FOR QUANTITATIVE ANALYSIS OF EIMERIA IN POULTRY
Ruslan F. Khamadaliyev*, Alexandra Martynova-Van Kley, Armen Nalian, Stephen F. Austin State University, Nacogdoches, TX

- 1:20 PM G 284 EFFICIENCY PROTEIN EXPRESSION IN PLANTS FROM AGROINFECTION-COMPATIBLE SUNN HEMP MOSAIC VIRUS EXPRESSION VECTORS
Zun Liu* and Christopher M. Kearney, Department of Biology, Baylor University, Waco, TX

1:40 PM**Section Meeting****Tech House****CELLULAR AND MOLECULAR BIOLOGY POSTERS**

- NS P52 DETECTING VIRULENT YERSINIA AND LISTERIA IN READY-TO-EAT FOODS.
William J Mackay*, Edinboro University of Pennsylvania, Edinboro, PA, Christopher Sommers, Agricultural Research Service, Wyndmoor, PA, and Jafa Armagost, University of Alabama, Tuscaloosa, AL
- U P259 DETRIMENTAL EFFECTS OF THE INSECTICIDE, IMIDACLOPRID ON ASSOCIATIVE LEARNING IN CAENORHABDITIS ELEGANS
R. Gale Mandapat, Lesser Leslie*, and Fidelma A. O'Leary, St. Edwards University, Austin, TX
- U P89 DISTRIBUTION OF ARBUSCULAR MYCORRHYZAL FUNGI IN DIFFERENT REGIONS OF THE ROOT IN THE GRASS PASPALUM
Nikolaas Van Kley*, Oksana Martyniuk, and Alexandra Martynova-Van Kley, Stephen F. Austin State University, Nacogdoches, TX
- U P273 EFFECTS OF SINGLE, DOUBLE, AND MULTI-WALLED CARBON NANOTUBES IN RAT LUNG EPITHELIAL CELLS
Shamail Allen*, Tochi Ukwu, Natalie Robertson, Renard Thomas and Bobby Wilson, Texas Southern University, Houston, TX
- U P74 GAP GENE EXPRESSION VARIATION AND THE POSITION OF THE CEPHALIC FURROW IN DROSOPHILA MELANOGASTER
Lauren Stewart*, Veronica Gaffney and Lisa M. Goering, St. Edward's University, Austin TX.
- U P228 IDENTIFICATION OF A CYTOPLASMIC MANGANESE SUPEROXIDE DISMUTASE (CMNSOD) IN THE RED SWAMP CRAWFISH PROCAMBARUS CLARKII: CDNA CLONING AND TISSUE EXPRESSION.

- Helen Zhu* and Chris Doumen, Collin County Community College, Spring Creek Campus, Plano, TX
- G P127 INTERLEUKIN-2 INDUCES DNA TOPOISOMERASE I ACTIVITY IN HUT 78 CELLS
Minh-Hieu Pham*, Navya Kondapalli, Leonard Contreras, and P. David Foglesong, Department of Biology, University of the Incarnate Word, San Antonio, TX
- U P75 INVESTIGATING GENETIC PATHWAYS IN DROSOPHILA MELANOGASTER USING REAL TIME PCR
Rose Kilber*, Lisa M. Goering, St. Edward's University, Austin, TX.
- U P230 SEQUENCING OF A MITOCHONDRIAL MANGANESE SUPEROXIDE DISMUTASE (MTMNSOD) CDNA FROM TWO CRUSTACEAN SPECIES.
Wendy Gonzales*, Stephen Teng and Chris Doumen, Collin County Community College, Spring Creek Campu, Plano, TX
- U P201 THE ROLE OF LIPID A PHOSPHATASES AND THE CELL WALL ASSOCIATED LIPOPROTEINS OPRF, OPRI, AND OPRL ON MEMBRANE VESICLE FORMATION IN PSEUDOMONAS AERUGINOSA
Maria Taylor*, Patricia Baynham, Saint Edward's University, Austin, TX, Erica Saenz, Lauren Mashburn-Warren, Marvin Whiteley, Univeristy of Texas at Austin, Austin, TX

CHEMISTRY AND BIOCHEMISTRY

- 8:20 AM** **Friday, March 1** **Packard North**
- 8:20 AM NS 159 POTENTIAL SURFACE BEHAVIOR IN THE PHOTOCHEMISTRY OF STYRENE OXIDE
Benny E. Arney, Jr.*, Rick C. White, Sam Houston State University
- 8:40 AM G 180 A THERMODYNAMIC STUDY OF CATION EXCHANGE IN MONTMORILLONITE CLAYS USING SOLUTION CALORIMETRY
Amy J. Rich * and Alyx S. Frantzen, Department of Chemistry, Stephen F. Austin State University, Nacogdoches, Texas.
- 9:00 AM U 256 METALIZED CARBON NANOTUBE SYNTHESIS IN REDUCED GRAVITY CONDITIONS
Chelsea Harris*, Xin Wei, Bobby Wilson and Renard Thomas, Texas Southern University, Houston, Texas
- 9:20 AM G 232 LIPID PROFILES OF FOUR FAMILIES OF RODENTS: HETEROMYIDAE, MURIDAE, SCIURIDAE, AND GEOMYIDAE
Chris Mitchell* and Michael Shipley, Department of Biology, Midwestern State University, Wichita Falls, TX
- 9:40 AM** **Poster Session 1 and Break** **Dining Hall & Academic Building B**
- 10:20 AM NS 303 UTILIZATION OF ANTI-MICROBIAL NATURAL PRODUCTS FOR THE MANAGEMENT OF MICROORGANISMS IN SPACECRAFT.
Mahmoud Saleh*, Olufisayo Jejelowo, and Fawzia Abdel-Rahman, Texas Southern University
- 10:40 AM G 160 STERIC CONSIDERATIONS IN THE COMBUSTION OF ORGANO-CLAYS
Jason N. Perrin * and Alyx S. Frantzen, Department of Chemistry, Stephen F. Austin State University, Nacogdoches, Texas
- 11:00 AM** **Section Meeting** **Packard North**

CHEMISTRY AND BIOCHEMISTRY POSTERS

- U P56 ACRYLAMIDE PRODUCTION IN FRENCH FRIES COOKED IN TRANS-FAT FREE OIL OR VEGETABLE OIL
Shane Guthrie*, Jared Bird, Nick Flynn, Angelo State University, Chemistry Department
- U P162 BIOLOCALIZATION OF LEAD AND CADMIUM IN BOUTELOUA CURTIPENDULA AND CYNODON DACTYLON
Tonie M. Tercero*, Ashley M. Castillo, Julian M. Davis, University of the Incarnate Word and Alwyn Anfone, Michael Bernard, San Antonio Water System
- U P114 CAPILLARY ELECTROPHORETIC ANALYSIS OF WHEY
Timothy J. Tucker*, and Robert Holloway, Schreiner University
- NS P92 CRUSTACEAN AMYLASES
Francis Horne*, Texas State University
- U P253 INFLUENCE OF DIFFERENT BASES ON THE COMPETITION BETWEEN INTRAMOLECULAR AND INTERMOLECULAR HYDROGEN BONDING IN CATECHOL
Adriana Pavia* and J.D. Lewis, Department of Chemistry, St. Edwards's University, Austin, TX 78704
- U P143 LEAD CONTAMINATION IN CALCIUM SUPPLEMENTS
Leigh Ann Brown* and Dr. Michael M. Looney, Schreiner University
- U P130 LEAD CONTAMINATION IN HAIR DYES
Keleigh Donaldson*, Dr. Michael Looney, Schreiner University, Kerrville TX
- U P116 PESTICIDES IN YOUR FOOD
Andria Marsh*, J.D. Lewis, Donald Wharry, St. Edwards University, Austin, Texas
- U P57 OLIVE OIL PRODUCES LESS ACRYLAMIDE IN FRENCH FRIES COMPARED TO LARD AS ANALYZED BY HPLC AND SPE
Jared Bird*, Aaron Guthrie, Nick Flynn, Angelo State University, Chemistry Department
- U P245 QUANTITATIVE ANALYSIS OF CAFFEINE AND OTHER INGREDIENTS IN ENERGY DRINKS
Rachel Favila*, Julian M. Davis, Jesus Garza, University of the Incarnate Word

COMPUTER SCIENCE

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|----------------|---|------------------------|--|------------------|
| 8:20 AM | | Friday, March 6 | | Admin 207 |
| 8:20 AM | G | 158 | THE REHABILITATION PROFESSIONALS' UTILIZATION OF THE NINTENDO WII AS A THERAPEUTIC MODALITY BY SURVEY
Steven Miller Jr.* and Carol Luckhradt Redfield, Ph.D., St. Mary's University, San Antonio, TX. | |
| 8:40 AM | U | 140 | OPTICAL LITHOGRAPHY ON 3D SURFACES
Daniel Palmer*, Patrick Read, Dan E. Tamir, Conrad Newton, Wilhelmus J. Geerts, Texas State University-San Marcos | |
| 9:00 AM | U | 191 | REMOTE ACCESS PROCESS FOR INTERNATIONAL PARTNERS
Demetrius Powell*, Space and Engineering Science Internship Program (SESIP), Texas Southern University, Houston, TX and Teresa McCoy, NASA-Johnson Space Center, Information Technology Security Team, Houston, TX | |

9:20 AM U 112 THE EFFECTS OF EFFICIENT CPU SCHEDULING ON THE POWER CONSUMPTION OF MOTES
Jay Blanco, St. Edward's University, Austin, TX

9:40 AM Poster Session 1 and Break

Dining Hall & Academic Building B

10:20 AM G 126 STEALTHY IP PREFIX HIJACKING: DON'T BITE OFF MORE THAN YOU CAN CHEW
Christian McArthur*, Texas A&M University and Mina S. Guirguis, Texas State University-San Marcos

10:40 AM NS 207 SOFTWARE DESIGN BY SPREADSHEET PROTOTYPING: AUTOCORRELATION OF CARDIAC PERIOD AS A MEASURE OF HEART RATE VARIABILITY
John A. Ward*, Department of Clinical Investigation, Brooke Army Medical Center, Fort Sam Houston, TX

11:00 AM NS 240 KEPLER-DISCOVERY: AN OPEN SOURCE CYBER-LEARNING RESOURCE FOR AP ENVIRONMENTAL SCIENCE
Anne Ngu*, Sandra West, Texas State University-San Marcos

11:20 AM Section Meeting

Admin 207

CONSERVATION ECOLOGY

8:00 AM Friday, March 6

Juniper House

8:00 AM NS 155 AUDUBON TEXAS IMPORTANT BIRD AREAS: STATUS AND TRENDS
Andrew C. Kasner*, Audubon Texas, San Antonio, TX

8:20 AM G 229 EFFECTS OF CARBON DIOXIDE ON THREE SPECIES OF MILKWEED AND MONARCH BUTTERFLY LARVAE
Terri Matiella*, Janis K. Bush, Department of Biology, University of Texas at San Antonio, San Antonio, TX

8:40 AM G 217 IDENTIFICATION OF TEXAS BUFONIDS USING MITOCHONDRIAL MARKERS.
Diana J. McHenry*, University of Missouri-Columbia, and Michael R. J. Forstner, Texas State University-San Marcos, TX.

9:00 AM G 65 INVESTIGATING THE IMPACT OF URBANIZATION ON ORNATE BOX TURTLES (TERRAPENE ORNATA)
James C. Cureton II*, Christopher P. Randle, William I. Lutterschmidt, and Raelynn Deaton; Sam Houston State University

9:20 AM G 222 PREDATION ON ARTIFICIAL NESTS IN URBAN AND NATURAL ENVIRONMENTS
Anne-Marie Prouty* and Diane Neudorf, Sam Houston State University, Huntsville, TX.

9:40 AM Poster Session 1 and Break

Dining Hall & Academic Building B

10:20 AM G 262 SEASONAL VARIATION IN THE DETECTION OF BATRACHOCHYTRIUM DENDROBATIDIS IN A TEXAS POPULATION OF BLANCHARD'S CRICKET FROG (ACRIS CREPITANS BLANCHARDI)
James P. Gaertner*, Michele A. Gaston, Dana Spontak, Michael R.J. Forstner, Dittmar Hahn; Department of Biology, Texas State University - San Marcos, TX

10:40 AM G 72 THE MILLENNIUM SEED BANK PROJECT: A GLOBAL PLANT CONSERVATION INITIATIVE

F.M. Oxley*, Michael L. Eason, and Minnette Marr, Lady Bird Johnson
Wildflower Center at the University of Texas at Austin

- 11:00 AM NS 109 REINTRODUCTION EFFORTS FOR THE RIO GRANDE SILVERY
MINNOW INTO THE BIG BEND REGION OF TEXAS

Robert J. Edwards*, University of Texas-Pan American, Edinburg, TX and
Gary P. Garrett, HOH Fisheries Science Center, Mountain Home, TX

11:20 AM

Section Meeting

Juniper House

CONSERVATION ECOLOGY POSTER

- G P131 EFFECT OF PRESCRIBED BURNING FOR MANAGEMENT OF THE
RED-COCKADED WOODPECKER ON THE AVIAN COMMUNITY IN
THE SAM HOUSTON NATIONAL FOREST.

Mallory J. Brodrick* and Diane L.H. Neudorf, Sam Houston State University

ENVIRONMENTAL SCIENCE

8:00 AM

Friday, March 6

New Lab

- 8:00 AM NS 150 DETERMINATION OF PESTICIDE RESIDUES IN THE AIR AROUND
PESTICIDE FACTORIES

EL-Saeid, M. H.*, King Saud University

- 8:20 AM G 202 HAIR AS AN INDICATOR OF EXPOSURE TO PESTICIDES

Charlotte A. Smith-Baker*¹, Momoh Yakubu², James H. Nance¹, J.-M.
Dimandja³, and Mahmoud A. Saleh¹ ¹Texas Southern University,
Department of Chemistry, Houston, TX 77004 ² Texas Southern University,
Department of Pharmacy, Houston, TX 77004 ³Spelman College,
Department of Chemistry, Atlanta, GA 30314

- 8:40 AM U 105 OXIDATIVE STRESS IN THE SEAGRASS THALASSIA TESTUDINUM
INDUCED BY LOWERED SALINITY USING SIMULATED AND
NATURAL HURRICANES

Natali Mejia*, Ammie Ortiz, Maria Silva, Michael Persans, and Hudson
DeYoe. Biology Dept and Center for Subtropical Studies, University of Texas
– Pan American.

- 9:00 AM G 242 LOCAL ADAPTATIONS OF MARINE STREPTOMYCES FROM THE
LOWER LAGUNA MADRE

Luis E. Espinoza*, Kristine L. Lowe and Anita L. Davelos Baines; University
of Texas - Pan American

- 9:20 AM U 145 TRACE METAL ANALYSIS OF PRIMARY TEETH AS AN
ENVIRONMENTAL INDICATOR USING INDUCTIVELY COUPLED
PLASMA MASS SPECTROMETRY (ICP-MS)

Claudette Johnson*, Chelsea Harris, Christopher Stevenson, Bobby L.
Wilson, Renard L. Thomas

9:40 AM

Poster Session 1 and Break

**Dining Hall & Academic
Building B**

- 10:20 AM G 220 MILBY PARK COMMUNITY: POTENTIAL EXPOSURE TO ELEVATED
LEVELS OF 1,3- BUTADIENE MAY CAUSE HIGHER RISKS FOR
DEVELOPING ADVERSE BIOLOGICAL EFFECTS

Natalie Roberts*, Dr. Renard Thomas, Dr. Bobby Wilson, Dr. John Sapp, Dr.
Andrew James; Texas Southern University, Houston, TX, 77004

- 10:40 AM G 139 THE APPLICATION OF PULSED FIELD GEL ELECTROPHORESIS TO
DETERMINE SOURCES OF FECAL CONTAMINATION IN MISSION
AND ARANSAS RIVERS, TEXAS

Margaret K. Spoo*, Texas A&M University Corpus Christi

- 11:00 AM NS 302 THE USE OF MICROBIAL CELL TO CELL COMMUNICATION AND QUORUM SENSING FOR CONTROLLING MICROORGANISMS.
Mahmoud Saleh*, Jim Briggs, Fawzia Abdel-Rahman and Olufisayo Jejelowo, Texas Southern University

11:20 AM

Section Meeting**New Lab****ENVIRONMENTAL SCIENCE POSTERS**

- U P184 A GEOCHEMICAL COMPARISON OF DEEP GEOLOGIC RADIOACTIVE WASTE SITES
Jason N. Perrin and Alyx S. Frantzen, Department of Chemistry and Brandon P. Tate * and Melinda G. Shaw, Department of Geology, Stephen F. Austin State University, Nacogdoches, Texas.
- U P250 CHARACTERIZATION AND ANTIMICROBIAL ACTIVITY OF PIGMENTS PRODUCED FROM STREPTOMYCES CULTURES OF THE LOWER LAGUNA MADRE
James A. Berglund*, Anita L. Davelos Baines, and Kristine L. Lowe; University of Texas - Pan American
- G P102 INVESTIGATING HEAVY METAL TOLERANCE IN BRASSICACEAE PLANT SPECIES
Fritzie J. Into*, Amery Yang, Maria S. Calagui and Michael W. Persans, The University of Texas - Pan American
- U P169 CHARACTERIZATION OF ORGANIC COMPOUNDS IN THE EFFLUENT OF WASTE WATER TREATMENT PLANTS
Zuri Dale*, Amber Walker, Anthony Maye, Renard L. Thomas, and Bobby Wilson, 1Space Engineering & Science Internship Program., Texas Southern University, Houston, TX 77004, Environmental Research Technology Transfer Center, (ERT2C), Department of Health Sciences, Texas Southern University, Houston, TX 77004
- NS P280 HEMATOTOXICITY OF METHACRYLONTRILE IN MALE SPRAGUE-DAWLEY RATS
Mohammed Farooqui* and Jose Garcia, Department of Biology, University of Texas Pan American
- U P192 SELECT HERBICIDES AND THEIR EFFECTS ON GROWTH, DEVELOPMENT, AND ACTIVITY LEVEL OF RANA CATESBEIANA TADPOLES
Samantha Cohen* and Chris Ritzi, Sul Ross State University, Alpine, TX
- U P209 THE EFFECT OF OXYGENATION ON SURVIVAL OF THE FATHEAD MINNOW (PIMEPHALES PROMELAS) UPON EXPOSURE TO WEED-B-GON® MAX
S. Dayton*, G. Spieler, B. Hutchinson, A. Almani, J. Olavesen, K. Bills and D. Janes; Concordia University-Texas
- G P188 THE ENVIRONMENTAL AND MORPHOLOGICAL IMPACT OF THE ATLAS MINE TAILINGS ALONG THE COLORADO RIVER NEAR MOAB, UTAH
Amanda B. Cegon * and Melinda G. Shaw, Department of Geology, Stephen F. Austin State University, Nacogdoches, Texas.

FRESHWATER SCIENCE**Session 1****8:20 AM****Friday, March 6****Academic 111**

- 8:20 AM NS 70 GAMBUSIA SPECIOSA AS A VIABLE SPECIES: A RESOLUTION ON ITS DISTINCTION FROM GAMBUSIA AFFINIS
Gary P. Garrett and B. Paul Fleming* Texas Parks and Wildlife Department, Heart of the Hills Fishery Science Center, Mountain Home, TX
- 8:40 AM U 175 EFFECTS OF MALE GONOPODIAL LENGTH ON FEMALE MATE CHOICE IN LIVEBEARING COERCIVE MOSQUITOFISH GAMBUSIA AFFINIS
Sarah Sendlebach*, Sam Houston State University, Elizabeth Lamb, University of Miami, Stacy Stoops and Raelynn Deaton, Sam Houston State University
- 9:00 AM NS 138 EFFECT OF GONOPODIAL LENGTH ON MALE MATING SUCCESS IN THE WESTERN MOSQUITOFISH
Alexandria Titlow*, Raelynn Deaton, Sarah Sendelbach, and Stacy Stoops, Sam Houston State University
- 9:20 AM U 274 A COMPARATIVE FIELD STUDY ON MATING BEHAVIORS ACROSS ISOLATED SPRING POPULATIONS OF THE LARGESPRING GAMBUSIA, GAMBUSIA GEISERI
Richard Lewis*, Chris Kroll, Chad W. Hargrave, Rachel E. Martin, Samir K. Rosado, Landis R. Shoemaker, Pamela Vazquez, Janalyn West, and Raelynn Deaton, Sam Houston State Univ
- 9:40 AM Poster Session 1 and Break**
- 10:20 AM U 100 A CONTEXT-DEPENDENT TROPHIC CASCADE IN A SIMPLE STREAM FOOD WEB
Samir K. Rosado* and Chad W. Hargrave, Center for Biological Field Studies and Department of Biological Sciences, Sam Houston State University, Huntsville, TX
- 10:40 AM U 210 PINK EGGS AND SNAILS: FIELD OVIPOSITION PATTERNS OF P. INSULARUM THAT MAY IDENTIFY WETLANDS OR SHALLOW LAKES SUSCEPTIBLE TO INVASION
James P. McDonough*, Colin H. Kyle and Romi L. Burks, Biology Department, Southwestern University
- 11:00 AM G 212 A NEW DESCRIPTIVE STUDY OF THE STRUCTURES OF THE GONOPODIUM OF THE WESTERN MOSQUITOFISH, GAMBUSIA AFFINIS
Stacy B Stoops*, Raelynn Deaton, Sam Houston State University, B. Paul Fleming and Gary Garrett, Texas Parks and Wildlife
- 11:20 AM G 178 AN ANALYSIS OF TIME AND ENVIRONMENTAL CONDITIONS ON PEAK MATING BEHAVIOR IN THE WESTERN MOSQUITOFISH (POECILIIDAE): IT MATTERS WHEN BUT NOT WHERE
Jacob B Landis*, James C. Cureton II, Chris Kroll, Liz Lamb, Rick Lewis, Samir Rosado, Stacy Stoops, and Raelynn Deaton, Sam Houston State University, Huntsville, TX
- 11:40 AM Lunch**
- 12:20 PM Poster Session 2**
- 1:00 PM U 108 DIRECT EFFECTS ON FEMALE FITNESS VIA MALE COERCION IN A LIVE BEARING FISH, GAMBUSIA AFFINIS
Abigail Marcotte*, Janalyn West and Raelynn Deaton, Sam Houston State University, Hutsville, TX
- 1:20 PM U 95 FISH-MEDIATED BOTTOM-UP REGULATION OF SECONDARY PRODUCTION IN STREAM ECOSYSTEMS
Laura A. Gaides* and Chad W. Hargrave, Sam Houston State University

Dining Hall & Academic Building B

**Llano Hall Pavillion
Dining Hall & Academic Building B**

1:40 PM

Section Meeting

Academic 111

FRESHWATER SCIENCE

Session 2

8:20 AM

Friday, March 6

Academic 113

- 8:20 AM G 54 GREGARINE PARASITISM (APICOMPLEXA: EUGREGARINORIDA) IN CENTRAL TEXAS DRAGONFLIES: HOST, HABITAT, AND TEMPORAL PATTERNS
Jason Locklin* and Darrell Vodopich, Baylor University, Waco, TX
- 8:40 AM NS 119 HIGH INVERTEBRATE DIVERSITY IN AN EDWARDS PLATEAU (CENTRAL TEXAS) STREAM
David Pendergrass*, Texas Institute for Applied Environmental Research, Stephenville, TX, Thomas Arsuffi, Texas Tech University Llano River, Junction, TX, and Timothy Bonner, Texas State University at San Marcos
- 9:00 AM U 164 LOCATION, LOCATION, LOCATION: LABORATORY OVIPOSITION PREFERENCES OF THE EXOTIC, INVASIVE APPLESNAIL POMACEA INSULARUM
Colin H. Kyle.*, James P. McDonough and Romi L. Burks, Department of Biology, Southwestern University, Georgetown, TX 78626
- 9:20 AM U 219 ASSESSMENT OF MERCURY BIOMAGNIFICATION IN CADDO LAKE, TEXAS/LOUISIANA
Matthew M. Chumchal, Texas Christian University, Thomas R. Rainwater, Texas Tech University, Steven C. Osborn*, Texas Christian University, George P. Cobb, Philip N. Smith, Texas Tech University, Frank C. Bailey, Middle Tennessee State University

9:40 AM

Poster Session 1 and Break

Dining Hall & Academic Building B

- 10:20 AM NS 234 NUTRIENT IMPACTS ON AQUATIC COMMUNITIES IN SIX WADEABLE BRAZOS-BASIN STREAMS: PERIPHYTON CHEMISTRY
Cindy Contreras*, Jennifer Bronson*, Patricia Radloff and Adam Whisenant, Texas Parks and Wildlife Department
- 10:40 AM U 123 ON THE POPULATION AND COMMUNITY ECOLOGY OF FISHES IN A SMALL SECOND ORDER STREAM (HARMON CREEK, WALKER CO. TX)
Chad W. Hargrave* and Samir K. Rosado, Sam Houston State University, Huntsville, TX
- 11:00 AM G 117 REGIONAL AND LOCAL VARIATION IN FISHES OF THE BIG THICKET NATIONAL PRESERVE, TEXAS
Kaitlen P. Gary*, Chad W. Hargrave, Landis R. Shoemaker, Sam Houston State University, Huntsville, TX
- 11:20 AM U 249 WETTER ISN'T BETTER: EFFECTS OF DISTURBANCE ON POMACEA INSULARUM HATCHING EFFICIENCY
Matthew K. Trawick* and Romi L. Burks, Ph.D, Department of Biology, Southwestern University, Georgetown, TX

11:40 AM

Lunch

Llano Hall Pavillion

12:20 PM

Poster Session 2

Dining Hall & Academic Building B

- 1:00 PM G 101 SEX RATIO AND DENSITY ALTER MALE AGGRESSION AND HARASSMENT BUT NOT MATING BEHAVIORS IN THE WESTERN MOSQUITOFISH, GAMBUSIA AFFINIS

Rachel E. Martin*, James C. Cureton, and Raelynn Deaton, Sam Houston State University, TX

1:20 PM NS 154 WATER QUALITY OF THE TIDALLY INFLUENCED SEGMENT OF THE RIO GRANDE

Joseph L. Kowalski* and Hudson R. DeYoe, Department of Biology and the Center for Subtropical Studies, The University of Texas - Pan American, Edinburg, TX; Carla Guthrie, Texas Water Development Board, Austin, TX

1:40 PM

Section Meeting

Academic 111

FRESHWATER SCIENCE POSTERS

U P218 A LONG-TERM WATER QUALITY DATASET FOR THE LOWER RIO GRANDE/RIO BRAVO

Jessica Montemayor*, Javier Reynoso, Gamiel Garza, Erika Rodriguez, Leo Saldana, Michelle Cox, and Hudson R. DeYoe, Center for Subtropical Studies and Biology Department, University of Texas – Pan American, Edinburg, TX

G P213 EFFECTS OF MALE BODY SIZE AND TEMPERATURE ON THE MATING BEHAVIOR OF THE WESTERN MOSQUITOFISH, GAMBUSIA AFFINIS

Stacy B Stoops* and Raelynn Deaton, Sam Houston State University

G P308 TEMPORAL PHYTOPLANKTON NUTRIENT-DEPENDENT GROWTH RESPONSES AND SEASONAL ZOOPLANKTON GRAZING ESTIMATES OF THE HIGHLAND LAKES, COLORADO RIVER, CENTRAL TEXAS

M. A. Wallace*, U.S. Geological Survey, Austin, TX and Texas State University, San Marcos, TX and R. L. Kiesling, U.S. Geological Survey, Austin, TX

NS P71 EFFECTS OF VEGETATION ARCHITECTURE AND STEM DENSITY ON PREDATION OF LARGEMOUTH BASS FINGERLINGS

Paul Fleming*, Kerry Reeves, and Warren Schlechte, Texas Parks and Wildlife Department Heart of the Hills Fisheries Science Center, Mountain Home, TX

G P53 THE DISTRIBUTION AND ECOLOGY OF TEXAS ALDERFLIES (MEGALOPTERA: SIALIDAE)

Jason Locklin*, Baylor University

GEOSCIENCES

Session 1

8:20 AM **Friday, March 6**

Academic 117

8:20 AM G 270 COMPARISON OF HURRICANE IKE WITH OTHER MAJOR HURRICANES THAT HAVE STRUCK THE UPPER TEXAS AND SOUTHWESTERN LOUISIANA GULF COASTS

Richard A. Ashmore*, Lamar University, Beaumont, TX and Texas Tech University, Lubbock, TX, and Donald E. Owen, Lamar University, Beaumont, TX.

8:40 AM NS 195 EFFECTS OF HURRICANE IKE FROM BOLIVAR PENINSULA TO SURFSIDE: A PHOTO TRANSECT ALONG THE TEXAS COASTLINE

Chris A. Barker * and R. LaRell Nielson; Stephen F. Austin State University, Nacogdoches, TX

9:00 AM NS 216 EROSION AND SEDIMENTATION PATTERNS PRODUCED BY HURRICANE IKE ALONG THE TEXAS COAST

- Nielson, R. LaRell*, Barker, Chris A. and Sharp, Patricia S, Department of Geology, Stephen F. Austin State University, Nacogdoches, TX
- 9:20 AM NS 238 HOW TO ENHANCE PROPERTY DESTRUCTION BY HURRICANES BY INSTALLING GEOTUBES ON ERODING BEACHES--THE SAGA OF HURRICANE IKE AT GILCHRIST, TEXAS
Donald E. Owen*, Richard A. Ashmore, & Cissie J. Owen, Lamar University, Beaumont, TX
- 9:40 AM Poster Session 1 and Break Dining Hall & Academic Building B**
- 10:20 AM NS 121 HURRICANE IKE AND THE RISE & FALL OF CAPLEN, TEXAS
James W. Westgate*, Earth & Space Sciences, Lamar University, Beaumont, TX
- 10:40 AM G 269 POST-HURRICANE IKE EROSION STUDY ALONG THE UPPER TEXAS GULF COAST BETWEEN SABINE PASS AND HIGH ISLAND
Richard A. Ashmore*, Lamar University, Beaumont, TX and Texas Tech University, Lubbock, TX and Donald E. Owen, Lamar University, Beaumont, TX.
- 11:00 AM G 268 THE EFFECTS OF ROLLOVER PASS ON THE BOLIVAR PENINSULA DURING HURRICANE IKE
Richard A. Ashmore*, Lamar University, Beaumont, TX and Texas Tech University, Lubbock, TX, and Donald E. Owen and Cissie J. Owen, Lamar University, Beaumont, TX.
- 11:20 AM G 115 TECHNIQUES FOR RECOVERING MICRO-MAMMAL REMAINS FROM LOW YIELDING UINTA C FACIES
Susan Harsh*, Jordan Mika, James Burnes, Jennie Knapp, and James Westgate, Lamar University, Beaumont, TX
- 11:40 AM Lunch Llano Hall Pavillion**
- 12:20 PM Poster Session 2 Dining Hall & Academic Building B**
- 1:00 PM NS 62 SURFACE AND GROUNDWATER INTERACTIONS VIA STREAM BANK SEDIMENTS: POTENTIAL SINKS AND SOURCES OF PHOSPHORUS IN A EUTROPHIC HEADWATER STREAM
Carol Thompson* and Anne M. S. McFarland Tarleton State University, Stephenville, TX
- 1:20 PM NS 305 THE LOWER TERTIARY TRANSPRESSIVE COAHUILAN REVOLUTION OF THE SABINAS BASIN, IN NORTHERN MEXICO
Santiago Charleston*, University of Texas - Pan American, Edinburg, TX
- 1:40 PM Section Meeting Academic 117**

GEOSCIENCES

Session 2

- 8:20 AM Friday, March 6 Academic 115**
- 8:20 AM NS 66 HYPOGENE DIAGENESIS IN THE CASTILE FORMATION OF FAR WEST TEXAS
Kevin W. Stafford*, Geology Department, Stephen F. Austin State University, Nacogdoches, TX.
- 8:40 AM G 171 HYPOGENE SPELEOGENESIS WITHIN ELLENBURGER CARBONATES OF CENTRAL TEXAS
Jessica Lucia De Leon*, Kevin W. Stafford, Geology Department, Stephen F. Austin State University, Nacogdoches, TX

9:00 AM NS 166 LOCAL ASCENDING FLUIDS: SPELEOGENESIS IN THE
CRETACEOUS CARBONATES OF SOUTH TEXAS
Melinda G. Shaw * and Kevin W. Stafford, Department of Geology, Stephen
F. Austin State University, Nacogdoches, TX

9:20 AM NS 267 ON MAGMATITES FROM THE CARBONATITIC MAGNET COVE
IGNEOUS COMPLEX, CENTRAL ARKANSAS.
Volker W. Göbel* and Patrice N. Barlow, Dept. of Geology, Stephen F.
Austin State University, Nacogdoches, TX

9:40 AM Poster Session 1 and Break

**Dining Hall & Academic
Building B**

10:20 AM NS 264 OVERVIEW OF RECENT MOUNTAIN-BUILDING EVENTS IN THE
BIG BEND REGION, WEST TEXAS AND NORTHERN MEXICO
Joseph I. Satterfield*, Angelo State University, San Angelo, TX, and Richard
A. Ashmore, Lamar University, Beaumont, TX and Texas Tech University,
Lubbock, TX

10:40 AM U 163 PARAGENETIC SEQUENCE AND GLACIATION EFFECTS OF THE
OPHIOLITE COMPLEX AND SURROUNDING AREA OF GROS
MORNE NATIONAL PARK, CANADA
Sarah M. Power * and Melinda G. Shaw, Department of Geology, Stephen F.
Austin State University, Nacogdoches, TX

11:00 AM U 266 THE CONTROVERSIAL ORIGIN OF THE DAGGER MOUNTAIN
ANTICLINE, BIG BEND NATIONAL PARK, TEXAS
Henry F. Schreiner III*, Ryan C. Sonntag, and Joseph I. Satterfield, Angelo
State University, San Angelo, TX

11:20 AM G 226 THE CRANIAL MORPHOLOGY OF THE LOWER PERMIAN REPTILE
CAPTORHINUS AGUTI
Sebastian Egberts*, Jackson School of Geosciences, The University of Texas
at Austin

11:40 AM Lunch

Llano Hall Pavillion

12:20 PM Poster Session 2

**Dining Hall & Academic
Building B**

1:40 PM Section Meeting

Academic 112

GEOSCIENCES POSTERS

U P258 DETAILED MAPPING OF EASTERNMOST LARAMIDE STRUCTURES,
SOUTHEASTERN MARATHON UPLIFT, WEST TEXAS.

Ryan C. Sonntag*, Joseph I. Satterfield, and Henry F. Schreiner III, Angelo
State University, San Angelo, TX

G P170 GEOMORPHIC CHANGES TO THE GALVESTON REGION AS A
RESULT OF HURRICANE IKE: GIS-BASED ASSESSMENT OF
COASTAL EVOLUTION

Alexcia Gray*, Kevin W. Stafford, Geology Department, Stephen F. Austin
State University, Nacogdoches, TX

NS P64 NEW DINOSAUR DISCOVERIES FROM OCAMPO, COAHUILA,
MEXICO

Héctor E. Rivera-Sylva*, Museo del Saltillo, Coahuila y Desierto, José
Rubén Guzman-Gutiérrez, Centro para la Conservación del Patrimonio
Natural y Cultural de México, A. C.

G P182 THE GEOCHEMISTRY OF SODA DAM IN THE JEMEZ MOUNTAINS,
SANTA FE NATIONAL FOREST, NEW MEXICO

Amy J Rich * and Alyx S. Frantzen, Department of Chemistry and Melinda G. Shaw, Department of Geology, Stephen F. Austin State University, Nacogdoches, TX

- U P255 THE TRIALS AND TRIBULATIONS (AND FINAL SUCCESS) OF SITING EARTHSOPE SEISMIC STATIONS IN EAST AND SE TEXAS

Trishell Joffrion*, Joseph M. Kruger, Ashley Henslee, Lamar University, Beaumont, TX

- NS P208 UTILIZING GEOPHYSICAL METHODS FOR ASSESSMENT AND CHARACTERIZATION OF SEEPAGE FROM THE IRRIGATION CANALS IN EL PASO LOWER VALLEY, TEXAS

Wesley A. Brown*, Stephen F. Austin State University, Nacogdoches, TX and Zhuping Sheng, Texas AgriLIFE Research Center at El Paso, El Paso, TX

MARINE SCIENCE

1:00 PM Friday, March 6

Juniper House

- 1:00 PM NS 151 THE SPATIAL AND SEASONAL DISTRIBUTION OF SAND SEATROUT BETWEEN INSHORE AND OFFSHORE HABITATS OF TEXAS, WITH NOTES ON THEIR MATURITY.

Dusty McDonald* and Britt Bumguardner, Perry R. Bass Marine Fisheries Research Station, Palacios, TX

- 1:20 PM U 221 MERCURY CONCENTRATIONS IN RED SNAPPER (LUTJANUS CAMPECHANUS) FROM THE NORTHERN GULF OF MEXICO

Brianne L. Kiestler*, Matthew M. Chumchal, Texas Christian University, Fort Worth, TX, Kevin M. Boswell, Michelle Zapp, James H. Cowan Jr., Louisiana State University, Baton Rouge, LA, and R. J. David Wells, Texas A&M University at Galveston, Galveston, TX

- 1:40 PM NS 84 GENETIC STRUCTURE IN TARPON (MEGALOPS ATLANTICUS) – PATTERNS ARISING FROM ANALYSES OF ALLOZYMES, MITOCHONDRIAL DNA, AND MICROSATELLITES.

Rocky Ward*, West Texas A&M University, Canyon, Texas and Ivonne R. Blandon, Texas Parks & Wildlife Department, Corpus Christi, Texas.

2:00 PM Section Meeting

Juniper House

MARINE SCIENCE POSTERS

- NS P153 A GENETIC ASSESSMENT OF CURRENT MANAGEMENT STRATEGIES FOR SPOTTED SEATROUT IN TEXAS

Joel Anderson* and William Karel, Texas Parks and Wildlife

- U P156 BAHIA GRANDE WATER QUALITY, 2005-2008.

Priscilla Saenz*, Barbara Garza, Javier Reynoso, Dora Cedillo, Antonio Villarreal, Christian Garcia, Ruben Trevino, Erin Bieberbach, Hudson DeYoe and Thomas Whelan, University of Texas-Pan American. Edinburg, TX.

- U P134 DISTRIBUTION AND ABUNDANCE OF A BRAIN-ENCYSTING PARASITE IN KILLIFISH OF THE LOWER LAGUNA MADRE, SOUTH TEXAS

Ashley Longoria*, Brian L. Fredensborg, University of Texas-Pan American

- U P122 MERCURY CONCENTRATIONS IN SPORT FISHES IN SOUTH TEXAS BAYS

Christopher Bost*, Texas Lutheran University, Seguin, TX, Greg Stunz, Texas A&M University, Corpus Christi, TX, Ben Hale, Truman State University, Kirksville, MO and Eugene Billiot, Texas A&M University, Corpus Christi, TX

- U P135 PARASITE TRANSMISSION IN A SOUTH TEXAS ESTUARY:
SALINITY CHANGE FACILITATES A SHIFT IN THE PRODUCTION OF
PARASITE INFECTIVE STAGES
Milena Melo* and Brian L. Fredensborg, University of Texas, Pan American
- NS P152 THE EFFECTS OF WINTER SEVERITY ON THREE LIFE STAGES OF
SPOTTED SEATROUT (CYNOSCION NEBULOSUS)
Dusty McDonald*, Britt Bumguardner, TPWD- Perry R. Bass Marine
Fisheries Research Station, Palacios, TX, and Mark Fisher, TPWD-Rockport
Marine Lab
- U P133 THE POTENTIAL EFFECT OF PARASITISM ON CHLOROPHYLL-A
ABUNDANCE ON A MUDFLAT IN LAGUNA MADRE, SOUTH TEXAS
Carolina Servin*, Hudson DeYoe and Brian L. Fredensborg, University of
Texas-Pan American, TX
- U P157 USE OF PAM FLUOROMETRY TO DETECT STRESS IN THE
SEAGRASS THALASSIA TESTUDINUM.
Ammie Ortiz*, Maria Silva, Natalie Mejia, Michael Persans and Hudson
DeYoe, Center for Subtropical Studies and Department of Biology,
University of Texas-Pan American, Edinburg, TX

MATHEMATICS

- 1:00 PM Friday, March 6 Academic 115**
- 1:00 PM NS 76 ANOTHER APPROACH TO SOLVING $A=MP$ FOR TRIANGLES
Elsie M. Campbell*, Angelo State University, and Dionne T. Bailey*, Angelo
State University, jointly
- 1:20 PM U 223 THE CONTROL OF AN INVERTED PENDULUM USING CHAOS
THEORY
Katherine Bateman* and Michael Frye, University of the Incarnate Word,
San Antonio, TX
- 1:40 PM U 265 WAVELET MATRIX COMPLETION METHODS AND THEIR EFFECTS
IN IMAGE COMPRESSION
Henry F. Schreiner III*, Massooma Pirbhai, and Roger E. Zarnowski, Angelo
State University, San Angelo, TX.
- 2:00 PM U 282 APPLICATION OF MATRIX COMPLETION METHODS TO PARTIAL
IMAGE RECONSTRUCTION
Massooma Pirbhai*, Henry F. Schreiner III, and Roger E. Zarnowski, Angelo
State University, San Angelo, TX
- 2:20 PM G 227 OPTIMIZATION OF NONLINEAR FUNCTIONS USING PSO
Luis Alonso* and Michael Frye, Univeristy of the Incarnate Word, San
Antonio, TX
- 2:40 PM NS 296 EMPIRICAL LIKELIHOOD SPIROMETRY REFERENCE VALUES.
Nancy Glenn*, Center for Bionanotechnology and Environmental Research,
Texas Southern University
- 3:00 PM Section Meeting Academic 115**

PHYSICS

- 1:00 PM Friday, March 6 New Lab**
- 1:00 PM U 82 DIFFERENTIAL PHOTOMETRY: A MEASUREMENT OF LIGHT
CURVES FOR ASTEROIDS & VARIABLE STARS
Dwayne Caldwell, Brookhaven College & Matthew Davis*, Hardin-Simmons
University

1:20 PM U 81 LIBYA TOTAL SOLAR ECLIPSE 2006: A REPEAT OF THE
EDDINGTON-EINSTEIN EXPERIMENT
James D. Martin* & Ashley D. Delgado, Hardin-Simmons University

1:40 PM Section Meeting

New Lab

SCIENCE EDUCATION

8:00 AM Friday, March 6

Packard South

8:00 AM NS 149 CAN CLASSROOM INTERACTION WITH SCIENTISTS POSITIVELY
INFLUENCE SCIENCE MAJORS TO CONSIDER A RESEARCH
CAREER?

St. Edward's University, Austin, TX

8:20 AM NS 86 CORRELATED SCIENCE & MATH: A NEW MODEL FOR SCIENCE &
MATH TEACHER TRAINING

Sandra West*, Texas State University, San Marcos, TX and Sandra Browning,
University of Houston - Clear Lake, Clear Lake, TX

8:40 AM G 125 CORRELATED SPACE SCIENCE, GEOLOGY & MATH PROGRAM
EVALUATION

9:00 AM G 196 DEMOGRAPHIC AND ACADEMIC FACTORS RELATED TO STUDENT
PERFORMANCE AND SUCCESS IN ENTRY-LEVEL BIOLOGY,
CHEMISTRY, AND PHYSICS COURSES

Mamta Singh* and Sandra West, Texas State University, San Marcos, TX

9:20 AM NS 146 GETTING COMMUNITY COLLEGE STUDENTS INVOLVED IN
RESEARCH

C. Frederick Jury *, Nelson Rich and Cameron Neal, Collin College, Plano,
TX

9:40 AM Poster Session 1 and Break

**Dining Hall & Academic
Building B**

10:20 AM NS 167 GEOCHEMISTRY OF THE SOUTHWEST PART ONE: CHEMISTRY IN
THE GREAT OUTDOORS

Alyx S. Frantzen *, Department of Chemistry and Melinda G. Shaw,
Department of Geology, Stephen F. Austin State University, Nacogdoches,
Texas

10:40 AM NS 287 GEOCHEMISTRY OF THE SOUTHWEST PART TWO: GEOLOGY AND
CHEMISTRY, TOGETHER AGAIN

Melinda G. Shaw *, Department of Geology and Alyx S. Frantzen,
Department of Chemistry, Stephen F. Austin State University, Nacogdoches,
Texas.

11:00 AM NS 80 INTERNATIONAL ASTRONOMICAL SEARCH COLLABORATION:
HANDS-ON ASTRONOMY RESEARCH PROGRAMS FOR HIGH
SCHOOL & COLLEGES

J. Patrick Miller, Hardin-Simmons University

11:20 AM U 128 INVESTING WISELY: EDUCATION AS A MEANS TO FUND SEA
TURTLE CONSERVATION ON SOUTH PADRE ISLAND

Anna Frankel*, Southwestern University, Georgetown, TX and Jeff George,
Sea Turtle, Inc., South Padre Island, TX

11:40 AM Lunch

Llano Hall Pavillion

12:20 PM Poster Session 2

**Dining Hall & Academic
Building B**

1:00 PM NS 252 LEAST SQUARES OPTIMIZATION OF LINEAR SPECTRAL
SUPERPOSITION FOR QUANTITATION OF MIXTURES.

Benny E. Arney, Jr.*, Sam Houston State University

- 1:20 PM NS 99 PREDICTORS OF STUDENT SUCCESS IN A HUMAN ANATOMY COURSE FOR NON-MAJORS
R. Russell Wilke* and Christie L. Adkins, Angelo State University
- 1:40 PM G 98 PROGRAM EVALUATION OF A CORRELATED PHYSICS, CHEMISTRY AND MATH TRAINING PROJECT
Lisa Gloyna, and Melissa Ponce*, Texas State University, San Marcos, TX
- 2:00 PM G 129 THE EFFECT OF LEARNING STYLES ON COGNITION AND SATISFACTION IN ONLINE BIOLOGY LABORATORIES FOR NON-SCIENCE MAJOR UNDERGRADUATES
Patricia Ritschel-Trifilo, Hardin-Simmons University, Abilene Texas, and Capella University, Minneapolis, MN
- 2:20 PM G 197 THE EFFECTS OF CLICKER FEEDBACK ON STUDENT SUCCESS
Brittany Heath*, Connie Russell, and J. Kelly McCoy, Angelo State University
- 2:40 PM NS 299 WEB ASSISTED INSTRUCTION USING THE AGILE MIND
Demerios Kazakos*, Center for Bionanotechnology and Environmental Research, Texas Southern University

3:00 PM Section Meeting

Packard South

SYSTEMATICS AND EVOLUTIONARY BIOLOGY

1:00 AM Friday, March 6

Hummingbird

- 8:00 AM NS 83 FURTHER OBSERVATIONS ON THE NESTING BIOLOGY OF TRYPOXYLON SPECIES (HYMENOPTERA: CRABRONIDAE) IN TRINIDAD, WEST INDIES
Allan W. Hook*, St. Edward's University, Austin, TX
- 8:20 AM U 181 TAXONOMIC AND DISTRIBUTIONAL ICHTHYOFAUNA STUDY OF THE SELECTED AREAS IN THE NORTH OF THE ZACATECAS STATE, MEXICO.
Fernando Solís-Carlos*, Maria de Lourdes Lozano-Vilano y Maria Elena García-Ramírez. Universidad Autonoma de Nuevo León.
- 8:40 AM G 173 SYSTEMATICS OF THE ELECTRIC RAYS (TORPEDINIFORMES: BATOIDEA)
Kerin M. Claeson*, Department of Geological Sciences, The Jackson School of Geosciences, The University of Texas at Austin
- 9:00 AM G 50 ASYMMETRIES IN INVESTMENT AND SCALING OF REPRODUCTIVE PARAMETERS BETWEEN GENERATIONS IN A CYNIPID EXPRESSING HETEROGONY
Glen R. Hood*, Cristina Campbell, and James R. Ott, Texas State University-San Marcos, TX
- 9:20 AM G 113 THE ROLE OF HOST PLANT FIDELITY IN THE EVOLUTION OF REPRODUCTIVE ISOLATION
Michelle Downey*, Texas State University, San Marcos, TX

9:40 AM Poster Session 1 and Break

Dining Hall & Academic Building B

- 10:20 AM NS 137 NATURAL AND SEXUAL SELECTION IN POISON DART FROGS
Tara Maginnis*, St. Edward's University, Austin, TX, Molly Cummings, Martine Maan, and Mary Ramsey, The University of Texas, Austin, TX
- 10:40 AM U 285 PEACEFUL PARTHENOGENS? SOCIAL BEHAVIOR OF MARMORKREBS, A PARTHENOGENETIC CRAYFISH
Stephanie Ann Jimenez*, Zen Faulkes, University of Texas Pan-American

11:00 AM G 247 MOLECULAR PHYLOGEOGRAPHY OF SOUTHEAST ASIAN PERCHING BIRDS (PASSERIFORMES) BASED ON COI BARCODE.
Leighann Pollard* and Hector C. Miranda, Jr. NASA Center for Bionanotechnology and Environmental Research, Texas Southern University, Houston TX

11:20 AM G 183 TAXONOMIC STATUS OF THE DAVIS MOUNTAINS COTTONTAIL, SYLVILAGUS ROBUSTUS (LAGOMORPHA: LEPORIDAE) REVEALED BY AMPLIFIED FRAGMENT LENGTH POLYMORPHISM
Dana Lee*, Loren K. Ammerman, Angelo State University, San Angelo, Texas and Russell S. Pfau, Tarleton State University, Stephenville, Texas

11:40 AM

Lunch

Llano Hall Pavillion

12:20 PM

Poster Session 2

Dining Hall & Academic Building B

1:00 PM G 215 A GEOGRAPHIC INFORMATION SYSTEMS (GIS) ANALYSIS OF THE MODERN DISTRIBUTIONS OF SOUTHERN AFRICAN OTOMYS (RODENTIA: OTOMYINAE) WITH IMPLICATIONS FOR PLIO-PLEISTOCENE PALEOENVIRONMENTAL RECONSTRUCTION
Timothy L. Campbell*, Patrick J. Lewis, Sam Houston State University

1:20 PM G 239 MOLECULAR IDENTIFICATION OF SMALL MAMMALS FROM THE KOANAKA HILLS (NQCUMTSA HILLS) REGION, NGAMILAND, BOTSWANA
Molly M. McDonough*, Adam W. Ferguson, and Robert J. Baker, Texas Tech University, Lubbock, TX and Monte L. Thies and Patrick J. Lewis, Sam Houston State University, Huntsville, TX and Mohutsiwa Gabadirwe, Botswana National Museum, Gaborone, Botswana.

1:40 PM G 172 CRANIAL ANATOMY AND ONTOGENY IN PANTYLUS CORDATUS BASED ON HIGH RESOLUTION X-RAY COMPUTED TOMOGRAPHY
Jennifer C. Olori*, Jackson School of Geosciences, The University of Texas at Austin

2:00 PM G 211 A DIGITAL ENDOCAST OF PROCYON LOTOR
Heather Ahrens*, University of Texas at Austin

2:20 PM

Section Meeting

Hummingbird

SYSTEMATICS AND EVOLUTIONARY BIOLOGY POSTERS

U P257 COLOR VARIATION AND ITS POSSIBLE ROLES IN SAND CRABS
Unnam Nasir* and Dr. Zen Faulkes, University of Texas-Pan American, Edinburg, TX

U P58 COMPARATIVE ETHOLOGY OF THREE SPECIES OF BICRYTES SAND WASPS IN CENTRAL TEXAS
Andrew Henry* and Allan Hook, St. Edward's University, Austin, TX

U P87 DIFFERENTIATION BETWEEN MITOCHONDRIAL DNA OF TEXAS LESSER SIRENS
Areeba Anam*, Kara Maas, Richard Kazmaier, Rocky Ward, West Texas A&M University, Canyon, Texas and Ivonne R. Blandon, Texas Parks & Wildlife Department, Corpus Christi, Texas

NS P345 LEG REGENERATION TRADEOFFS IN THE SOUTHERN WALKING STICK, ANISOMORPHA BUPRESTOIDES
Christopher R. Redmond*, Tara L. Maginnis, St. Edward's University, Austin, TX

- U P55 FURTHER STUDIES OF EXOPROSOPA ALBICOLLARIS (DIPTERA: BOMBYLIIDAE) A PARASITE OF BEMBECINUS NEGLECTUS (HYMENOPTERA: CRABRONIDAE): ACTIVITY PATTERNS, FLY LONGEVITY, AND TESTS OF FACTORS INFLUENCING RATES OF OVIPOSITION.
Martha Gonzalez* and Allan Hook, St Edward's University, Austin, TX
- G P246 RATES AND PATTERNS OF MITOCHONDRIAL COI DNA CHANGE IN ASPERGILLUS FOUND IN MANNED SPACE STATIONS
Shaunte Hulett-Abdin*, Olufisayo Jejelowo, Ayodotun Sodipe and Hector C. Miranda Jr. NASA Center for Bionanotechnology and Environmental Research, Texas Southern University, Houston TX
- U P79 THE INFLUENCE OF THERMAL ECOLOGY VIA SURFACE TEMPERATURE ON THE NEST DIGGING AND PROVISIONING BEHAVIOR OF THE SAND WASP BEMBECINUS NEGLECTUS (CRABRONIDAE: BEMBECINAE) AT PEDERNALES FALLS STATE PARK IN BLANCO COUNTY, TEXAS
Brittany J. Gillard* and Allan W. Hook, St. Edward's University, Austin, TX

TERRESTRIAL ECOLOGY AND MANAGEMENT

- 8:00 AM Friday, March 6 Bluebonnet**
- 8:00 AM NS 272 ASSESSMENT OF THE ALLELOPATHIC POTENTIAL OF JUNIPERUS ASHEI ON GERMINATION AND GROWTH OF BOUTELOUA CURTIPENDULA
G. K. Young* and J. K. Bush, College of Sciences, The University of Texas at San Antonio, San Antonio, TX
- 8:20 AM G 248 AMPHIBIAN, REPTILE, AND SMALL MAMMAL INVENTORY OF PALMETTO STATE PARK AND THE OTTINE WETLANDS WITH COMMENTS ON HISTORICAL DATA
Romey Swanson*, Thomas R. Simpson, Department of Biology, Texas State University
- 8:40 AM U 254 THE WESTERN COTTONMOUTH (AGKISTRODON PISCIVORUS LEUCOSTOMA) IN WEST-CENTRAL TEXAS: THE DEMOGRAPHY AND VENOM COLLECTION IN A PERIPHERAL POPULATION
Jason Strickland* and Kelly McCoy, Angelo State University, San Angelo, TX
- 9:00 AM G 200 TWO ARE BETTER THAN ONE: IMPROVED FUNNEL TRAP DESIGN
Vincent R. Farallo*, Michael R.J. Forstner, Texas State University, San Marcos, TX
- 9:20 AM G 214 DETECTION OF BATRACHOCHYTRIUM DENDROBATIDIS IN AMPHIBIANS FROM THE FOREST FLOOR TO THE UPPER CANOPY OF AN ECUADORIAN AMAZON LOWLAND RAINFOREST
Shawn F. McCracken*, James P. Gaertner, Michael R. J. Forstner and Dittmar Hahn, Texas State University, San Marcos, TX.
- 9:40 AM Poster Session 1 and Break Dining Hall & Academic Building B**
- 10:20 AM NS 278 POPULATION DYNAMICS OF AN ARTIFICIAL PARASITOID COMMUNITY ASSOCIATED WITH IMPORTED FIRE ANTS
R.J.W. Patrock*, Rob Plowes, Lawrence E. Gilbert, Brackenridge Field Laboratories, University of Texas at Austin
- 10:40 AM U 281 CHANGES IN SMALL MAMMALIAN POPULATIONS FOLLOWING A PRESCRIBED BURN

Fernando Martinez*, Janis K. Bush, University of Texas at San Antonio, San Antonio, TX

11:00 AM U 142 THE REPTILES OF THE KOANAKA HILLS, NGAMILAND, BOTSWANA

Alicia M. Kennedy*, Department of Biological Sciences, Sam Houston State University; Aaron M. Bauer, Department of Biology, Villanova University; Patrick J. Lewis, Department of Biological Sciences, Sam Houston State University

11:20 AM U 235 DEN-SITE SELECTION IN THE AMERICAN HOG-NOSED SKUNK, CONEPATUS LEUCONOTUS

Wesley A. Brashear*, Robert C. Dowler, Angelo State University, San Angelo, TX and Adam W. Ferguson, Texas Tech University, Lubbock, TX

11:40 AM

Lunch

Llano Hall Pavillion

12:20 PM

Poster Session 2

Dining Hall & Academic Building B

1:00 PM G 141 RELATING MOURNING AND WHITE-WINGED DOVE DENSITY ESTIMATES TO SOUTH TEXAS HABITAT TYPES

Margaret L. Collins*, Michael F. Small, John T. Baccus, Brian L. Pierce, Dept. of Biology, Texas State University-San Marcos, and Michael C. Frisbee, Texas Parks and Wildlife Department

1:20 PM G 97 SEED DISPERSAL BY AMERICAN BLACK BEARS (URSUS AMERICANUS) IN BIG BEND NATIONAL PARK, TEXAS

Andrew Berezin*, Steven Platt, Sul Ross State University, Alpine, Texas

1:40 PM NS 120 EVALUATION OF DISKING TO PROMOTE COTTONWOOD GERMINATION IN THE ROLLING PLAINS OF TEXAS

Michael Janis* and Donald Ruthven, Texas Parks and Wildlife Department, Matador Wildlife Management Area, Paducah, TX

2:00 PM

Section Meeting

Bluebonnet

TERRESTRIAL ECOLOGY AND MANAGEMENT POSTERS

U P193 A SURVEY OF ECTOPARASITES OF SMALL MAMMALS FROM NICARAGUA

Jo Gina Gallego* & Christopher M. Ritzi, Sul Ross State University

NS P260 POPULATION STRUCTURE OF URBAN GREAT-TAILED GRACKLES (QUISCALUS MEXICANUS) AT WINTER ROOST SITES

Beverly L. Cochran* and Jeffrey G. Kopachena, Texas A&M University-Commerce, Commerce, TX.

U P85 THE RATTLE - A NON-INVASIVE SOURCE OF DNA FOR PHYLOGEOGRAPHIC STUDIES OF RATTLESNAKES (GENUS CROTALUS).

Benjamin Brooks*, Nikki Encinias, Teal Perry, Whitley Cadenhead, and Rocky Ward, West Texas A&M University, Canyon, Texas.

G P189 VARIATION IN THE OWL PELLETS FROM KOANAKA HILLS, BOTSWANA AND ITS IMPLICATIONS FOR REGIONAL PALEOENVIRONMENTAL RECONSTRUCTION

Richard S. Tutalo*, Patrick J. Lewis, Monte L. Thies, Sam Houston State University

Special Presentation for All Disciplines - Academic 117

2:00 PM G 271 A HISTORY OF THE USE OF PHOTOGRAPHY IN SCIENCE

Richard A. Ashmore*, Lamar University, Beaumont, TX and Texas Tech University, Lubbock, TX.

ALL SECTION MEETING

4:15 PM FOR NEW CHAIRS AND VICE-CHAIRS COKE-STEVENSON CENTER

ACADEMY BUSINESS MEETING

4:45 PM ALL MEMBERS COKE-STEVENSON CENTER

OUTSTANDING TEXAS EDUCATOR

5:20 PM CANDY ELLARD COKE-STEVENSON CENTER

TEXAS DISTINGUISHED SCIENTIST

5:45 PM OWEN LIND COKE-STEVENSON CENTER

SOCIAL HOUR

6:30 PM ALL MEMBERS COKE-STEVENSON CENTER

AWARDS BANQUET

7:30 PM ALL MEMBERS COKE-STEVENSON CENTER

Abstracts

343 **Thursday Evening Sessions****TAS POSITION STATEMENT ON TEACHING OF EVOLUTIONARY THEORY IN TEXAS' PUBLIC SCHOOLS**

Invited Panel of Board Officers

For more than a year, board members have been consulting with each other and the membership to develop a position statement on the teaching of evolution in public schools. Several members have represented TAS at meetings of the Higher Education Coordinating Board and the State Board of Education. In this session, the current TAS position statement and the process through which it was developed will be reviewed. The panel members will also review the status of the Texas Essential Knowledge and Skills guidelines being developed by the State Board. The audience will be invited to provide feedback on the statement, its development, and likely future activities.

344 **Thursday Evening Sessions****TAS ON THE INTERNET: IMPROVING COMMUNICATION AND OUTREACH**

Willaim Quinn, St. Edward's University, Austin, TX, Ray Mathews, Texas Water Development Board, Austin, TX

Until recently, the TAS web-based information and communication system has been limited. The TAS website is undergoing a substantial revision, and we have developed the potential to manage a much more dynamic site. In addition to the website, TAS has developed a blog site that increases the level of interaction by several orders of magnitude. The panel members will provide a background on these developments and discuss tools that might be useful to TAS. They will also describe how the web site and the blog be used to improve our communication and outreach, both internally and externally.

342 **Symposium on Environmental Education and Outreach Programs in Texas****INTRODUCTORY REMARKS**

T. L. Arsuffi, Llano River Field Station, Texas Tech University, Junction, TX

323 **Symposium on Environmental Education and Outreach Programs in Texas****TEXAS PARKS AND WILDLIFE DEPARTMENT'S PROJECT WILD SHOWCASE**

Nancy Herron and Kiki Corry, Texas Parks and Wildlife Department, Austin, TX

Texas Parks and Wildlife Department (TPWD) offers a suite of programs through Project WILD - hands-on activities that help foster ecological and science literacy for K-12. Here we explore these programs and their correlations to science and natural resource education. Also covered will be the newest addition, a set of customized activities and a DVD, Keep Texas Wild, based on regional wildlife issues and the Texas Wildlife Action Plan. TPWD trained, volunteer facilitators train nearly 3,000 educators annually with this set of award-winning programs

324 **Symposium on Environmental Education and Outreach Programs in Texas****THE IMPORTANCE OF PLACE-BASED EDUCATION AND BIOREGIONAL WEBSITES**

Burr Williams, Sibley Nature Center, Midland, TX

Bioregional education or place-based education has been almost totally ignored by the public education system at all levels (from pre-K to college level). Environmental educators should be lobbying in all avenues to rectify this grievous oversight. Because less than 10 percent of educators (private and public) and 2 percent of the public do not know the most common flora and fauna, the names of the major habitats and watersheds, or the human and ecological history of their local regions, environmental conservation has little chance of becoming part of everyday life. To preserve something, one must know what is there, and knowledge brings the love, emotional, and spiritual attachment that creates the passion needed to actively make conservation a way of life. One of those basic tools needed for every bioregion is a website that becomes a library of information about that bioregion. My talk focuses on creating such a website and how to begin building the networks that connect people within the bioregion.

325 **Symposium on Environmental Education and Outreach Programs in Texas****HOLISTIC, ADAPTIVE, STANDARD-BASED NATURAL RESOURCE, SCIENCE K-12 EDUCATION AND CURRICULUM AT TEXAS TECH UNIVERSITY'S OUTDOOR SCHOOL AND LLANO RIVER FIELD STATION**

Dixie Mayer, Bonnie Loeffler, Victoria Faubion, Marcia Clark, Wynn Simon, Kaycie Sullivan and T.L. Arsuffi, Llano River Field Station, Texas Tech University, Junction, TX

Many of tomorrow's decision-makers and voters are today's urban youths, with increasing minority composition in need of effective STEM and natural resource appreciation/understanding. Yet Texas is 97% private property, limiting its 85% urban population access to natural areas. The TTU Outdoor School (OS) at the LRFS is a transdisciplinary, inquiry-based, STEM program with an innovative curriculum (12 content areas) that incorporates multiple best learning practices to improve instruction for at-risk students and teachers from urban environments. The OS is effective: all attending Title 1 schools (7, 3,250 students) had a 15–30% increase in TAKS testing scores. Units taught are aligned with TEKS individualized to each school and teacher. Activities and skills learned are related to real world natural resource jobs, reinforcing that a college going culture is important to accessing STEM careers. OS effectiveness is attributable to: 1) TEKS based curriculum, 2) auditory, visual and kinesthetic instruction/learning, 3) inquiry based pedagogy, 4) teacher observation of OS instruction that includes team building, manners and self-confidence. The Texas High School Project recognizes the OS as an Exemplar Program. The OS instructional model is flexible, adaptive, transportable and can be effectively replicated. In 2007, House Bill 1700 was designed to expand OS impact to benefit more students through collaboration with Texas Parks and Wildlife. Implementation of HB 1700 is in a pilot phase, but with more than 130 state parks in Texas in proximity to the 1000+ school districts; training, transfer and tailoring of the OS curriculum and instruction to TPW parks has great potential to provide urban youth with critical STEM and natural resource education.

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FAMILIES IN NATURE: RENEWAL OF A DISCONNECT

Angela Soldinger, Texas Forest Service, College Station, TX

The foundation of awareness and appreciation for the outdoors is formed during childhood. To instill a conservation ethic in children today, the Texas Forest Service and Texas Parks and Wildlife have teamed up with two innovative programs to reach adults about the importance of nature in children's lives. Family members and influential adults are the gatekeepers to children's exploration of their environment. Through intentional opportunities provided by adults, children are more likely to have positive, consistent and repeated exposure to nature. The intended outcome of this program is the development of awareness, appreciation and skills for adults to positively instill a conservation ethic in the children they impact. The potential outcome for families is increased time and exposure to the outdoors spent together creating memories and growing the family bond.

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THE NATIONAL PROJECT FOR EXCELLENCE IN ENVIRONMENTAL EDUCATION

Christine Moseley, Department of Interdisciplinary Learning and Teaching, University of Texas at San Antonio, San Antonio, TX

The National Project for Excellence in Environmental Education has developed a series of Guidelines that set the standards for high-quality environmental education. A diverse team of professionals developed each of these publications, and each has gone through a substantive review by thousands of professionals prior to its publication. These Guidelines establish the standards for the development of balanced, scientifically accurate, and comprehensive environmental education programs. Quality environmental education programs help develop an environmentally literate citizenry that can compete in our global economy; has the skills, knowledge, and inclinations to make well-informed choices; and exercises the rights and responsibilities of members of a community. The National Project for Excellence in Environmental Education is funded by the U.S. Environmental Protection Agency through the Environmental Education and Training Partnership (EETAP) and the U.S. Forest Service, plus the National Environmental Education and Training Foundation, the National Fish and Wildlife Foundation, Northern Illinois University, and World Wildlife Fund.

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EXPLORING THE NATIVE PLANT WORLD: INFORMAL EDUCATION AT THE LADY BIRD JOHNSON WILDFLOWER CENTER

F.M. Oxley and R. Stephen Brueggerhoff, Lady Bird Johnson Wildflower Center, Austin, TX

The Lady Bird Johnson Wildflower Center's informal, nature-based education programs teach children and their families about the natural world and how native plants are an integral part of their lives. Programs include teacher training in the Wildflower Center's nature-based science curriculum, Exploring the Native Plant World which provides teachers with materials to use both in the classroom and in the field; Nature Nights, a special series of evening programs designed to share the wondrous nature in Central Texas with children and their families; and, First Bloom, a national nature program founded by the National Park Foundation in 2007 as a tribute to Lady Bird Johnson with the goal of giving children a sense of pride in our natural resources, encouraging them to be good stewards of this beautiful country by planting and taking care of native plants.

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THE CHILDREN AND NATURE MOVEMENT

Nancy Herron. Texas Parks and Wildlife Department, Austin, TX

Learn about the new interest in reconnecting children with nature. Richard Louv's, *Last Child in the Woods* has spawned an international movement, inspiring people from all sectors such as health, the environment, education and media. I will summarize efforts at the national and state level and how you can take advantage of this inspiring initiative.

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THE TEXAS ENVIROTHON: BLENDING SCIENCE AND THE OUTDOORS

Brenda G. Weiser, Environmental Institute of Houston & School of Education-UHCL, Houston, TX

Today, society is faced with many challenges regarding our natural resources and the environment. Yet, many of our present decision-makers know little about the interdependencies among wildlife, forests, water, and soil. The teachers of today are educating the decision-makers of tomorrow and are seeking fresh, innovative and interactive educational aids to increase environmental literacy, social studies, science and math achievement, and application of subjects to real world experiences for their students. The Envirothon is an academic, multidisciplinary, environmental problem-solving program that culminates in an annual series of competitions from local to state to national. The Envirothon program originated in Pennsylvania in 1979 and in Texas in 2001. This past year 17 teams competed. The mission of the Envirothon is to develop knowledgeable, skilled and dedicated citizens who are willing to work towards achieving and maintaining a natural balance between the quality of life and the quality of the environment. To accomplish this task, teams of five high school students compete in the areas of soils, aquatics, wildlife, forestry, and a current environmental issue, which changes yearly. The ultimate goal of the Texas Envirothon is to have an environmentally literate citizenry that can make decisions regarding the environment and become good stewards of the land. Participation in the Envirothon program has a statistically significant positive impact on the environmental literacy of those students who participated in the Envirothon program in the cognitive component of environmental literacy. Thus, students participating in the Envirothon should become more informed and better decision makers regarding natural resources and environment issues.

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RENEWABLE ENERGY PROGRAM: COLLABORATION BETWEEN LCRA AND SECO PROVIDES A SOLAR-WIND HYBRID SYSTEM FOR EXHIBITION, ENERGY AND EDUCATION OF NATURE PARK STUDENTS AND VISITORS

Beth W. Banks, McKinney Roughs, Lower Colorado River Authority, West Cedar Creek, TX

The Lower Colorado River Authority (LCRA) has long supported development of wind energy in Texas. In 1995, LCRA invested in the state's first commercial scale wind project and now purchases electricity from three West Texas wind farms. The mission of LCRA's Natural Science Centers is to respond to an increased demand on our natural and cultural resources through educational and recreational opportunities designed to provide awareness of conservation and stewardship. There is a strong need to educate youth and the general public on the emerging renewable energy technology and its benefits. LCRA's Natural Science Centers secured a grant from the State Energy Conservation Office (SECO) for a hybrid wind and solar system. The primary goal of this project is education and increased awareness. Since monitoring began in 2008, the solar system alone has produced 777 kWh of electrical energy, enough energy for the electrical needs of 23 Americans for one day or 4.7 M minutes on a cell phone. The wind and solar system has the potential of reaching up to 20,000 students, teachers and visitors at McKinney Roughs annually. TEKS-aligned curriculum provided by SECO and real-time performance monitoring software enable educators to bring the technology into the classroom and for McKinney Roughs to provide this curriculum as part of our course offerings. Such hands-on learning experiences enable students to learn about the science, mathematics, economics, management and social impacts of the technology. We will host teacher and general public workshops and use surveys as well as pre/post field trip tests to measure the effectiveness of the program.

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TEXAS PARKS AND WILDLIFE DEPARTMENT'S APPROACH TO BEST PRACTICES FOR CONSERVATION EDUCATION

Nancy Herron. Texas Parks and Wildlife Department, Austin, TX

Based on years of research and input from national, expert review teams, the Association of Fish and Wildlife Agencies (AFWA) developed a best practices planning guide for conservation stewardship. Here I will cover how Texas Parks and Wildlife Department put AFWA best practices into practice through its conservation education strategy. Participants will receive handouts of the stewardship planning guide.

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THE TEXAS ASSOCIATION FOR ENVIRONMENTAL EDUCATION: ITS MISSION, STRATEGIC INITIATIVES AND PROGRAMS

Haily Summerford, Fort Worth Botanic Garden, Fort Worth TX

Current and future generations of Texas deserve healthy air to breathe, clean water to drink and green spaces to explore. The Texas Association for Environmental Education (TAE) supports efforts to develop environmental literacy and responsible behavior. TAE supports environmental education by utilizing partnerships, providing professional development and recognizing EE excellence in the State of Texas. The Texas Association for Environmental Education serves all regions of the Texas community by increasing the effectiveness of environmental education (EE). TAE is dedicated to supporting and promoting quality environmental education opportunities by facilitating communication, coordination and professional development among the varied environmental education programs in the state. During the last 30 years, TAE has grown to include more than 400+ members and active volunteers and is proud to be the NAAEE Affiliate for Texas. Here, I will give participants information about the TAE membership, programs and its affiliation with the North American Association for Environmental Education (NAAEE). NAAEE is a network of professionals, students, and volunteers working in the field of environmental education throughout North America and in over 55 countries around the world. Since 1971, the Association has promoted environmental education and supported the work of environmental educators. There are many environmental interest groups, and many organizations dedicated to improving education. NAAEE uniquely combines and integrates both of these perspectives, and takes a cooperative, nonconfrontational, scientifically balanced approach to promoting education about environmental issues.

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PROGRAMS AND EXHIBITS AT AN URBAN NATURE CENTER: PROVIDING CHILDREN AND FAMILIES WITH OPPORTUNITIES TO EXPLORE THE OUTDOORS

Janice Sturrock, Austin Nature and Science Center, Austin, TX

The Austin Nature and Science Center (ANSC) is an urban nature center located in Austin, Texas and is a part of the of the City of Austin's Parks and Recreation Department. The 60-acre site located in the middle of town is truly an island for science learning. The mission of ANSC is to provide educational and recreational opportunities that increase awareness of and appreciation for the natural environment and that participants learn to conserve and preserve the environment. As a regional environmental education center, we offer a variety of structured programs and interesting, hands on exhibits to engage participants in discovery learning about the natural world. Here I provide an overview of the programs and exhibits at ANSC and the variety of programs and exhibits including partnerships with local school districts and agencies. Programs include the innovative "Nature's Way Preschool" enrichment program for ages 3 to 5 years old and summer day camp programs to reconnect urban youth with nature and the outdoors. Camps include half-day programs for 3-6 year olds and full day fun for ages 7-12. Thirteen to 16 year olds attend a counselor in training camp and assist counselors with activities for young children. ANSC school field trip programs offer environmental education activities and hands on learning opportunities for pre-K to 7th grade where they may observe and learn about Texas Mammals; Minerals, Rocks and Fossils; Pond Study; Birds of Prey; Bird Basics; Frogs and Toads and much more. This area partners with local school districts to offer a variety of field experiences to local and regional students while meeting guidelines set by National Science Standards and Texas Essential Knowledge and Skills (TEKS). The Naturalist Workshop's Trade Counter offers nature lovers a place to trade and collect natural treasures. Other exhibits include over 50 resident wildlife representatives of central Texas, birds of prey and the Eco Pond Trail.

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AUDUBON TEXAS NATURE CENTERS AND CONSERVATION EDUCATION PROGRAMS

Andrew C. Kasner, Audubon Texas, San Antonio, TX

Through Audubon Centers and in partnership with local chapters and schools, Audubon Texas seeks to connect people of all ages and backgrounds to nature through our conservation and education programs. We are committed to ensuring that every child in Texas participates in a natural resource education program that will improve critical thinking skills while connecting students to nature, either at one of our Audubon Centers or in the classroom thru science curricula. Audubon Texas has 3 nature centers in Texas where educational programs are held for adults and children: Mitchell Lake Audubon Center in San Antonio, Trinity River Audubon Center in Dallas, and Sabal Palm Audubon Center in Brownsville. At our centers we have full-time education staff that work with local school districts and provide on-site outdoor science education opportunities via curricula designed specifically for the center. Also, educational programs such as Birding 101 are offered at Audubon Centers on weekends to reach the surrounding community. In addition, we our working to implement a program called Soundscapes Science, a curriculum designed around the Texas Essential Knowledge and Skills (TEKS) requirements for science, which is used in the school classroom to teach an appreciation for nature while simultaneously meeting TEKS standards and incorporating technology in the classroom. Through our centers and school curricula we have the potential to effectively reach 50,000 adults and school children each year.

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THE VISION AND STRATEGIC INITIATIVES IN OUTREACH AND EDUCATION FROM THE TEXAS WATER DEVELOPMENT BOARD

Linda Ruiz McCall, Texas Water Development Board, Austin, TX

Future decision-makers in Texas will need to be scientifically literate in natural resources in order to face the challenge of managing and conserving dwindling water supplies. The Texas Water Development Board (TWDB) is the state agency charged to ensure sustainable, affordable, and quality water for Texans, our economy, and our environment. The results of the 2007 State Water Plan, which is produced by the TWDB through a regional planning process, shows that statewide projected water needs will exceed water supplies beginning in 2010 and continuing into the future. To help address this projected water shortage, the TWDB is working to provide decision-makers with the knowledge needed to be effective stewards of our water resources. With scientific and engineering research as the cornerstone, TWDB offers educational programs ranging from coloring books for younger children to complete curricula for older students, with teachers' guides and alignment with the Texas Essential Knowledge and Skills (TEKS) guidelines. The TWDB Kids website www.twdb.state.tx.us/kids serves as the gateway to the agency's K-12 water education resources. Learning activities include hands-on/minds-on laboratories, as well as, maps, web-based interactive games and visualizations that are designed to complement classroom and outdoor learning. Key concepts include; the water cycle, watersheds, surface water and groundwater, water treatment, water use, water protection, and water conservation. In addition to the educational programs for students, TWDB also provides many workshops and outreach events for adults including professional development workshops for teachers.

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ENVIRONMENTAL EDUCATION IN SAN MARCOS, TX: A NEW LOCAL INITIATIVE TO BROADEN EXPOSURE AMONG SCHOOL-AGED CHILDREN

Jenna Winters, Department of Biology, Texas State University, San Marcos, TX, Melani Howard and Julie King, Parks and Recreation – City of San Marcos, San Marcos, TX

The City of San Marcos is an ethnically diverse town of 50,000 located between Austin and San Antonio. Home to Texas State University, the most notable natural feature is the San Marcos River. While the headwaters are protected on University property, the first mile of the river is developed and heavily used for recreation resulting in severely degraded habitat. Further complicating the issue of overuse, is the presence of four listed species in this portion of the river: the fountain darter (*Etheostoma fonticola*), the San Marcos salamander (*Eurycea nana*), Texas Wild-rice (*Zizaniaopsis texana*) and the Comal Springs riffle beetle (*Heterelmis comalensis*). To raise awareness of environmental issues on the river and the larger watershed, the City of San Marcos opened a nature center in 2000 and began sponsoring environmental education programs. A survey of recreational users during the summers of 2007/2008 assessed the level of endangered species awareness among recreational river users to assess the efficacy of education programs. Fifty-eight percent of users report being aware of endangered species and identified school programs (27%) or "friends and family" (18%) as the most common source of their knowledge. Based on the success of school programming, a new initiative is underway to link the City's outreach efforts with programs at Aquarena Springs, the San Marcos Independent School District, and the USFWS National Fish hatchery. The program will provide field trips and outreach based on TEKS curriculum for 6th graders with expansion to include students in 4th and 9th grades.

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HEALTHY HABITATS PROGRAM FOR HIGH SCHOOL STUDENTS: A PARTNERSHIP BETWEEN TEXAS PARKS AND WILDLIFE DEPARTMENT AND TEXAS CENTER FOR SERVICE-LEARNING TO PROVIDE HANDS-ON LEARNING IN RESTORATION AND ENVIRONMENTAL LITERACY

Nancy Herron and John Spence, Texas Parks and Wildlife Department, Austin, TX

Launching this year, Texas Parks and Wildlife Department is teaming up with the Texas Center for Service-Learning in a cooperative grant program for high schools. High school students will actively engage in habitat restoration projects through this unique, new partnership program. Projects will be based on critical habitat projects identified in the state Wildlife Action Plan. Schools will be encouraged to partner with local conservation efforts for authentic service, community engagement and learning. The Healthy Habitats initiative integrates the most effective and proven practices to increase awareness, knowledge and commitment to local environmental issues.

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ADDING SUSTAINABILITY TO ENVIRONMENTAL EDUCATION PROGRAMS: AWARENESS AND GREEN STEM APPROACHES

Jenny Strovass and T.L. Arsuffi, Llano River Field Station, Texas Tech University, Junction, TX

Sustainability is a hot topic in today's society. The rapidly changing climate and the known and unknown effects thereof are creating a worldwide environmental awareness. As outdoor and environmental educators and leaders we stress the ethics relating to future use and care of wilderness areas and natural resources. However, the ethics we convey in the classroom may not always correspond with the ethics we practice in the field or as organizations. One way for our profession to have a positive impact on climate change, alternative energy programs, conservation and sustainability, is that we must better connect the classroom rhetoric with actual practices in the field - specifically an evaluation of how we conduct our field environmental education and outdoor programs from a sustainability and environmental impact perspective. You will have the opportunity to evaluate your program's current sustainability status and consider possible program changes. We will evaluate the amount of energy used to produce the equipment and food that we use, along with the amount of energy it takes to drive to our destination – to/from school, nature centers, parks etc. We also will address proactive changes in programs which can lessen our environmental impact and footprint, while still providing quality experiences that can be integrated into the pedagogy, curricula and provide critical thinking experiences involving: 1) current "green" practices to improve the energy efficiency of your program and 2) teaching strategies that can be used for various age groups.

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USE OF MULTIPLE PARTNERSHIPS AT THE LOWER COLORADO RIVER AUTHORITY'S MATAGORDA BAY NATURE PARK TO DEVELOP, ASSESS AND IMPLEMENT A TEXAS ESSENTIAL KNOWLEDGE BASED CURRICULUM TO IMPROVE STUDENT LEARNING AND NATURAL RESOURCE AWARENESS

Betsy Terrel, McKinney Roughs, Lower Colorado River Authority, West?Cedar Creek, TX

Testing results reveal Texas students are routinely scoring low in sciences. Such academic performance has ramifications on student understanding of environmental issues facing the state and suggests a real need to build awareness of the importance of conserving and protecting Texas' natural resources. Texas' population is expected to double by mid-century, putting great stress on natural and water resources. To address these concerns, LCRA Matagorda Bay Nature Park (MBNP), with Colorado River Foundation, Bay City Independent School District, Texas A&M and Texas State (TSU) universities developed River Stewards, a three-year field-based learning program designed to help middle school students better understand science and develop connections to their local environment. Beginning in 2006, MBNP's River Stewards Project served roughly 300 Bay City ISD 6th graders. For the following two academic years, this student group participated in two, one-day outdoor education experiences. Each year MBNP staff consult with Bay City science teachers and a curriculum specialist from TSU to design an outdoor focused, conservation driven, TEKS aligned, curriculum. The LCRA staff serves as the program facilitators and all activities take place at MBNP. Texas A&M Public Policy Research Institute (PPRI) staff create and analyze pre/post test results, interview students and teachers for qualitative information, and by using a control group, PPRI staff are able to isolate the addition of the field-based learning program as the "only" variable of difference between the two groups. One of the long term goals of this project is for MBNP to provide stimulating, hands-on learning experiences that assist students reach their academic potential and help today's youth appreciate and protect the environment which is crucial to the long-term health of our natural resources.

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SYMPOSIUM SUMMARY AND SYNTHESIS WITH PANEL/AUDIENCE DISCUSSION

T.L. Arsuffi, Llano River Field Station, Texas Tech University, Junction, TX

Presentations in this symposium shows Texas has a diverse number of programs and initiatives that provide innovative educational experiences that immerse learners into authentic, real-world, hands-on activities that stimulate imagination and understanding of difficult abstract concepts associated with science, ecology, and natural resources. Integrating research with the educational experiences seems in the early stages of implementation for K-12, but there are numerous successful undergraduate and graduate programs. This final panel discussion will focus on elements of a strategic initiative that integrates and develops all levels of environmental education, outreach and research activities as a component of Texas Academy of Science and other scientific and educational organizations efforts to improve ecological and scientific literacy of a public and generation increasingly removed from the natural resources on which they depend.

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OPENING REMARKS

Sunny Ohia*, Provost and Vice President for Academic Affairs, Texas Southern University, Houston, TX

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OVERVIEW OF THE CENTER FOR BIONANOTECHNOLOGY AND ENVIRONMENTAL RESEARCH

Olufisayo Jejelowo*, Texas Southern University, Houston, TX

Astronauts are exposed to a wide variety of environmental hazards while in space, including radiation, microgravity, and microorganisms. These hazards present critical barriers to long-term missions. They also constitute some of the major initiatives within the NASA research programs. To identify and understand the risks associated with these factors and to design countermeasures to mitigate these risks, Texas Southern University has established the Center for Bionanotechnology and Environmental Research (C-BER) with capital funds from the NASA office of Education. The NASA C-BER is funded through the NASAB University Research Centers Program. The Center addresses the important environmental and human health concerns related to manned exploration of space listed above. Techniques for detecting, monitoring and controlling microorganisms are being developed, and the effects of microgravity, radiation and other space travel-induced stress factors on living organisms are being investigated with the intent of developing countermeasures. Center is also investigating the additive, synergistic, antagonistic and the confounding effects of microgravity and radiation on living organisms. The research of C-BER is closely aligned with NASA's Exploration Systems Mission Directorate and is relevant to all of NASA's mission Directorates. NASA C-BER research focuses on four main Thrusts: Radiation and Microgravity Research Thrust, Space Microbiology Research Thrust, Biosensors, Bioinformatics, and Bionanotechnology Research Thrust and Workforce Development Thrust. The interaction between the thrust areas will be discussed. Researches at CBER provide participants (many belonging to groups that are underrepresented in STEM) with training in research areas that is fundamental for improving the competitiveness of the participants in joining the STEM workforce.

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MANAGEMENT OF MICROORGANISMS IN CLOSED ENVIRONMENT

Mahmoud Saleh*, Olufisayo Jejelowo, Abdel Rahman, Texas Southern University, Houston, TX, James Briggs, University of Houston, Houston, TX

Microorganisms in the space travel environment represent a hidden but dangerous risk factor. Bacteria and fungi interact with materials and change their properties, form biofilms, provoke ageing, induce direct and indirect damages in materials, causing failures and disturbances in the operation of various technical systems and equipment. In the NASA Space programs microbiological investigations are an important aspect of the Health Stabilization Program. Traditional techniques that are used for controlling microorganisms on earth can not be used in spacecraft due to lack of gravity and closed environment. In this work we are using to mechanisms for controlling microorganisms; the first is dealing with immobilizing antimicrobial natural compounds on surfaces of materials in the space craft by using co polymeric materials. The second approach relays on interrupting cellular communication mechanisms in bacterial or fungi cells by either capturing or destroying quorum signaling molecules, therefore preventing the growing or biofilm formation of microorganisms. This work was supported by funding from NASA NCC 9-165. arial;">

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SPACE-LIKE STRESS (SLS) AND SPACE MICROBIOLOGY: IS THIS THE FINAL FRONTIER?

Jason A. Rosenzweig*, Olufisayo Jejelowo, Texas Southern University, Houston, TX, C. Mark Ott, Duane L. Pierson, NASA-Johnson Space Center, Houston, TX

Microbes are highly evolved and occupy unique environmental niches. In order for the plethora of microbes to persist and thrive, they must be highly responsive to changes in their local environments. Some of these environmental changes are experienced in the form of temperature, oxidative, host-cell induced, and/or chemical stresses. Only those microbes which can readily reprogram themselves (in response to the stress) will be successful in staying the course and enjoying the benefits of post-stress conditions. Space flight poses two unique microbial stresses: microgravity and other low shear environments, and space irradiation from various sources. Both of the aforementioned stresses could be experienced by either normal flora microbes (i.e. resident flora present on astronauts) or by exogenous and sometimes unavoidable sources of contamination ferried beyond or Earth's atmosphere during space flight. One of the potential fears is that through SLS-induced responses resident flora could become opportunistic and function more as a pathogen. Opportunistic infection coupled with compromised immune responses of a space bound astronaut hosts could have potentially life-threatening consequences. This mini-review will be primarily focused on the former space-like stress (SLS), microgravity and other low shear environments, and its physiological and genetic changes induced on microbes. This work was supported by funding from NASA Grant NNX08BA47A

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FUNCTIONALIZED NANOPIPETTE: A VERSATILE BIO/CHEMO SENSOR

P. Actis, M. Karhanek, University of California Santa Cruz, Santa Cruz, CA, O. Jejelowo, Texas Southern University, Houston, TX, N. Pourmand, 3Stanford Genome Technology Center, Stanford University, Palo Alto, CA

We have developed a sensitive nanopipette assay for detection and functional analysis of pathogens. This unique label free biosensor is inexpensive, easy to fabricate and versatile. It gives a fast and real time output even in small reaction volume (attoliters). At this point, the nanopipette size and geometry, together with the surface chemistry preparation was optimized for application as a biosensor and a chemosensor. Preliminary biosensing experiments are demonstrating the sensitivity and selectivity of the technique with specific antibodies targeting Human Papillomavirus as a model organism. These results demonstrate that nanopipettes functionalized with appropriate molecular recognition elements can be used as biosensors. A highly sensitive nanopipette probe can be precisely positioned, unlike other nanosensing technologies, at any subcellular region of a single living cell with submicron accuracy using a micromanipulator. This approach uses a movable sensor on an attached cell, in contrast to a fixed sensor detecting responses from floating cells. The functionalized nanopipette paves the way for in vivo immunoassay down to a single cell level. In addition, we have optimized the nanopipette as a sensitive tool for heavy metals detection in sewage and drinking water. The nanopipette fictionalization with chitosan, a natural polysaccharide, known for his unique capability of sequestering heavy metals ions, led to preliminary results showing a specific binding of Fe³⁺ ions. Currently we aim to determine the detection limit and validate the assay with respect to other metal ions such as Pb²⁺, Cd²⁺ and Cr⁶⁺.

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CAENORHABDITIS ELEGANS AS MODEL ORGANISM FOR STUDYING RADIATION AND MICROGRAVITY EFFECTS

Fawzia Abdel-Rahman*, Texas Southern University, Houston, TX.

The combined action of ionizing radiation and microgravity will continue to influence future manned space missions, with special risks for astronauts on the Moon surface or for long duration missions to Mars. There is increasing evidence that basic cellular functions are sensitive not only to radiation but also to microgravity. Earlier space flight experiments reported interactions of radiation and microgravity; which were classified as synergistic or antagonistic. Alterations in response to microgravity have been reported on molecular, cellular, and systemic levels. Most of the knowledge regarding the effect of radiation and microgravity, as well as about antioxidants have originated from in vitro studies while data from in vivo studies that also take into consideration the complete complex interplay of diverse processes like uptake, metabolism, organ and tissue interactions within a whole animal, are more limited. In order to overcome this limitation and to gain additional data about the effects of simultaneous radiation and microgravity in an in vivo model, especially with respect to stress resistance and aging, *Caenorhabditis elegans* is a good organism to overcome the above limitations. Besides others, the reasons for using *C. elegans* as an in vivo model are the ease of handling, the strong conservation between *C. elegans* and mammals in biologic principles and the multicellularity of this organism with the presence of important tissues and organ systems raising the possibility to consider interactions and metabolism. This work was supported by funding from NASA Grant NNX08BA47A.

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IN VIVO AND IN VITRO EFFECTS OF SIMULATED MICROGRAVITY ON BRAIN

Govindarajan Ramesh*, Norfolk State University, Norfolk, VA

Microgravity induces inflammatory response and also modulates immune functions, which may increase oxidative stress. Exposure to the microgravity environment induces adverse neurological effects. However, there is little research exploring the etiology of neurological effects of exposure to this environment. To explore this area we evaluated changes in Nuclear Factor kappa B, Activator Protein 1, MAPP kinase and N terminal c-Jun kinase in mouse brain exposed to a simulated microgravity environment using the hindlimb unloading model. BALB/c male mice were randomly assigned to hindlimb unloading group (n=12) and control group (n=12) to simulate a microgravity environment, for 7 days. Changes observed in NF???, AP-1 DNA binding, MAPKK and N terminal c-Jun kinase were measured using electrophoretic mobility shift assay (EMSA) and western blot analysis and compared to unexposed brain regions. Hindlimb unloading exposed mice showed significant increases in generated NF???, AP-1, MAPKK and Kinase in all regions of the brain exposed to hindlimb unloading as compared to the control brain regions. Results suggest that exposure to simulated microgravity can induce expression of certain transcription factors and protein kinases. This work was supported by funding from NASA NCC 9-165.

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SUPPRESSED EXPRESSION OF NON-DSB REPAIR GENES INHIBITS GAMMA-RADIATION-INDUCED CYTOGENETIC REPAIR AND CELL CYCLE ARREST

Honglu Wu, Ye Zhang¹, Kamal Emami¹, Dianne Hammond, Rachael Casey, Satish K. Mehta, Antony S. Jeevarajan, Duane L. Pierson, NASA Johnson Space Center, Houston, TX, Larry H. Rohde, University of Houston - Clear Lake, Houston, TX

Changes of gene expression profile are one of the most important biological responses in living cells after ionizing radiation (IR) exposure. Although some studies have shown that genes up-regulated by IR may play important roles in DNA damage repair, the relationship between the regulation of gene expression by IR, particularly genes not known for their roles in double-strand break (DSB) repair, and its impact on cytogenetic responses has not been well studied. The purpose of this study is to identify new roles of IR inducible genes in regulating DSB repair and cell cycle progression. In this study, the expression of 25 genes selected on the basis of their transcriptional changes in response to IR was individually knocked down by small interfering RNA in human fibroblast cells. Frequency of micronuclei (MN) formation and chromosome aberrations were measured to determine efficiency of cytogenetic repair, especially DSB repair. In response to IR, the formation of MN was significantly increased by suppressed expression of 5 genes: Ku70 (DSB repair pathway), XPA (NER pathway), RPA1 (MMR pathway), RAD17 and RBBP8 (cell cycle control). Knocked-down expression of 4 genes (MRE11A, RAD51 in the DSB pathway, SESN1, and SUMO1) significantly inhibited cell cycle progression, possibly because of severe impairment of DNA damage repair. Moreover, decreased XPA, p21, or MLH1 expression resulted in both significantly enhanced cell cycle progression and increased yields of chromosome aberrations, indicating that these gene products modulate both cell cycle control and DNA damage repair. Nine of these 11 genes, whose knock-down expression affected cytogenetic repair, were up-regulated in cells exposed to gamma radiation, suggesting that genes transcriptionally modulated by IR were critical to regulate IR-induced biological consequences. Furthermore, 8 non-DSB repair genes showed involvement in regulating DSB repair, indicating that successful DSB repair requires both DSB repair mechanisms and non-DSB repair systems. These results reveal that many genes play previously unrecognized roles in multiple DNA repair responses, all of which are required for successful repair of IR-induced damage.

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NATURAL PRODUCT COUNTERMEASURES AGAINST THE ADVERSE EFFECTS OF RADIATION AND MICROGRAVITY

Shishir Shishodia, Mahmoud Saleh, and Olufisayo A. Jejelowo, Texas Southern University, Houston, TX

Astronauts engaged in space research are exposed to both space radiation and microgravity. Both space radiation and microgravity are harmful to human body. Exposure of human body to space radiation removes the electrons from the atoms they strike causing damage to human DNA, cells, and tissues leading to cancer, cataracts, and damage to the central nervous system. Experiencing microgravity for longer period of time has been shown to cause atrophy, reduced functional capacity, and increased fatigue in limb skeletal muscles. Microgravity and space radiation induces inflammatory responses and modulates immune functions that may increase oxidative stress. Abundant evidence implicates oxidative stress as a potential regulator of radiation- and microgravity-induced deleterious effects. The pro-inflammatory transcription factor, NF- κ B is activated during oxidative stress and may be a key intracellular signal transducer in radiation and microgravity induced adverse effects, however the exact effect of space radiation and microgravity on NF- κ B activation is less understood. We are investigating the effect of modeled microgravity and space radiation on the mechanism of NF- κ B activation in vitro and in vivo. The major emphasis of this study will be to gain a clear understanding of radiation- and microgravity-induced changes in biological processes with the ultimate goal to develop natural products as countermeasures through modulation of NF- κ B signaling pathway. This work was supported by funding from NASA Grant NNX08BA47A.

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ROLE OF MICROGRAVITY-INDUCED EPIGENETIC CHANGES AND CHROMATIN REMODELING ON GENE EXPRESSION PATTERN

Kamaleshwar P Singh*, Ragini Kumari, Olufisayo Jejelowo, Department of Biology/NASA-URC, Texas Southern University, Houston, TX

Studies of simulated microgravity and real space flights suggest that microgravity and space radiation conditions result in several physiological changes that may increase the risk of human diseases including the cancer. However, the molecular mechanisms for these adverse effects on living cells are not clear. The aberrant expression of genes that control important cellular functions are the hallmarks for human diseases. Real space flight and modeled microgravity conditions result in changes in the expression of genes that controls important cellular function, such as, cell proliferation, apoptosis, and DNA repair. Despite these evidences, the information on "the target of, and molecular basis for" microgravity and space radiation-induced gene expression changes are very limited. The epigenetic changes of DNA methylation patterns and chromatin structural modification by histone methylation and acetylation changes are crucial factors that regulate the gene expression and genomic instability. Based on these evidences our hypothesis is that epigenetic changes of DNA methylation and chromatin remodeling by histone modification as a result of exposure to microgravity and space radiation contribute to gene expression changes and genomic instability. To address this hypothesis, our objective is to identify the target genes controlled by epigenetic modifications in microgravity and space radiation conditions using in vitro cell model. Our preliminary studies suggest that exposure to simulated microgravity results in epigenetic changes. Our goal is to determine whether exposure to microgravity and space radiation conditions induce epigenetic changes of histone modification. Changes

in the expression of genes for histone modifications will be measured. This work was supported by funding from NASA Grant NNX08BA47A.

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RADIATION BIOLOGY BASICS

John Ford*, Texas A&M University, College Station. Honglu Wu, NASA Johnson Space Center, Houston, TX Marian Hela, Texas Southern University, Houston, TX

The presentation will describe the types and methods of detecting ionizing radiation and interactions with matter. The participants will be introduced to the important concepts of high and low linear energy transfer, dosimetric quantities and methods. The majority of the workshop will describe the interactions of radiation with living matter working from the initial interactions with cell constituents to the response of tissues and whole organisms. This is an important area of research for the Departments of Homeland Security, Defense and Energy, as well as for the National Aeronautics and Space Administration and National Institutes of Health. This workshop was supported by funding from NASA Grant NNX08BA47A.

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RADIATION RESEARCH SAFETY & REGULATIONS

Marion Hillar, Texas Southern University, Houston, TX

The presentation will describe radiation safety regulations relevant to research at TSU's NASA CBER. This includes licensing issues and certification requirements that researchers must obtain when submitting research proposals and prior to handling radioactive materials.

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ON SCIENCE, TECHNOLOGY AND ENVIRONMENTAL POLICY

Oluponmile Olonilua, Michael Adams, Texas Southern University, Houston, TX

Various environmental policies are influenced by science and technology. This paper examines the role of scientists in the formulation and implementation of environmental policies, particularly, on the issues of air pollution and global warming. Using specific case studies, the paper analyzes the role of science and environmentalists and reports that the outcome of the interaction among science, technology and environmental policy depends on how the "experts" or the technocrats present the issue versus how the public reacts to such issues. The issue of convincing and involving the public is always going to be an issue because consensus is an issue for scientists.

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SYMPOSIUM SUMMARY AND PANEL DISCUSSION

Dan Davis, Olufisayo Jejelowo, Texas Southern University, Houston, TX

The symposium has provided NASA CBER's implementation plan, review of key research topics, a necessary radiation workshop and progress reports. Thus, providing the newly selected NASA Scholars, Fellows needed information as they begin their research careers. Symposium participants will engage in an interactive session to assess symposium, discuss ongoing research and outreach activities.

1 **Anthropology**

EXPLORING THE IMPACTS OF RAW MATERIAL AVAILABILITY AND SIZE ON PREHISTORIC CHIPPED STONE ASSEMBLAGES IN CENTRAL AND SOUTH TEXAS

Antonia Figueroa*, Cynthia Munoz, Steve Smith, and Raymond Mauldin, The University of Texas at San Antonio

Prehistoric populations commonly use lithic materials, such as chert, to produce projectile points, scrapers, and other tools. One byproduct of that production process is the generation of lithic waste debris termed debitage. Traditionally, sites with high percentages of debitage that lack cortex, referred to as non-cortical or tertiary debitage, are thought to be locations that reflect late stage reduction activities. Sites dominated by cortical debitage, conversely, reflect the early stages of tool preparation. However, variability in reduction intensity is only one element that potentially influences variability in the percentage of cortical debitage at a location. Here we focus on raw material availability and, by extension, raw material size, as a conditioning element. We use geological data on the distribution of chert within Texas to define three broad zones of tool stone availability. Using data from over 200 individual sites from 34 different counties across Central and South Texas, we consider the relative frequency of non-cortical (tertiary) debitage in assemblages. We demonstrate that areas characterized as having high chert availability are dominated by assemblages with high non-cortical frequencies, areas of low availability are dominated by cortical debris, and areas of moderate chert availability fall between these two extremes. These patterns are probably a function of raw material size, with larger parent material present in high availability areas.

2 **Anthropology**

CERAMICS FROM MISSION ESPADA AND RANCHO DE LAS CABRAS: A QUESTION OF ORIGINS

Lori Barkwill Love*, Steve Tomka, Antonia L. Figueroa, The University of Texas at San Antonio, San Antonio, TX, Jeffrey R. Ferguson and Michael D. Glasscock, The University of Missouri, Columbia, Missouri

This presentation reports on the results of INAA, petrographic and macroscopic analyses of a small sample of Goliad sherds from two Colonial Period sites: Mission Espada and its ranch, Rancho de las Cabras. The INAA analysis identified three groupings of sherds based on elemental composition. Neither group matches two clay sources collected from near the two sites along the San Antonio River Basin. The petrographic analysis indicates a high degree of technological similarity within the Goliad sherds from the two sites and across the three elemental groupings. The metric analysis of the specimens finds differences between the members of the three groups that may have functional significance. The implications of the results are discussed in terms of the manufacture origins of Goliad wares.

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EXPLORING ECOLOGICAL CONDITIONS USING STABLE CARBON AND OXYGEN ISOTOPIC COMPOSITION OF SOIL AND SNAIL SHELL RECOVERED FROM ARCHAEOLOGICAL SITE 41KM69, JUNCTION, TEXAS

Kristi Salazar*, Department of Geological Sciences, and Jennifer Thompson, Center for Archaeological Research, Department of Anthropology, University of Texas at San Antonio

The Center for Archaeological Research conducted excavations at site 41KM69, located adjacent to the TTU Llano River Field Station in Junction, Texas. Research into the ecological conditions present during the occupation of the site included the use of stable carbon and oxygen isotopic composition of soil inorganic carbonate, soil organic matter (SOM), and shell carbonates. Here we focus on investigating a 130 cm soil profile. $\delta^{13}C$ of carbonates in the profile varies from -2.15 to -4.63‰, while the $\delta^{18}O$ of carbonates show little variation (ranging from -3.22 to -3.92‰). There is no correlation between $\delta^{13}C$ of carbonates and SOM in the profile. $\delta^{13}C$ of snail shells show strong linear correlation with depth ($R^2 = 0.89$).

Excluding one shell analysis, $\delta^{13}C$ of shells and SOM exhibit good correlation ($R^2 = 0.75$). Carbon isotopic composition of shell carbonate is influenced by snail diet and the isotopic composition of soil carbonate. Isotopic compositions of archaeological shells are consistent with that observed in modern shells from the study area. Although the interpretation of oxygen isotope composition in land snails is not straightforward, values are probably related to several different climate signals including temperature, rainfall, and relative humidity, and may potentially be used as markers of local climate conditions.

190 Anthropology

PALEOECOLOGICAL RECONSTRUCTION USING SMALL HERBIVORES FROM ARCHAEOLOGICAL SITES.

Cynthia Munoz*, Lynn Wack, Kevin Daiber, Olivia Short, Center for Archaeological Research, Department of Anthropology, University of Texas at San Antonio (UTSA), TX, and Patrick Villanueva, Department of Geological Sciences, UTSA, TX.

Proxy data (e.g., pollen analysis, stable isotopes in paleosols) that reflect long-term, large scale climate patterns are commonly used to reconstruct paleoecological conditions. Yet, prehistoric hunter-gatherers adapt to short-term (e.g., seasonal), local conditions, not multi-century, regional trends. Stable carbon isotope analyses of collagen from cottontails (*Sylvilagus* sp.) and jackrabbits (*Lepus californicus*), both common in Texas archaeological sites, has the potential to monitor these short-term local conditions. Because leporids occupy small home ranges (ca. 300-500 ha) and have short lives (<3 years), their bone collagen should reflect local diet during this brief lifetime. Change in leporid collagen signatures should track ecological shifts at short temporal and limited spatial scales. Preliminary analysis of collagen extracted from leporids from two Central Texas archaeological sites (41MM340 and 41MM341) occupied between 3050-2060 BP and 1350-650 BP, respectively, as well as collagen from modern leporids from central and west Texas demonstrates that stable isotope composition can yield ecological reconstructions at scales informative of local conditions. While a large number of analyses are required, we show that carbon isotopic analysis of collagen from these species has the potential to yield fine-grained ecological reconstructions.

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CONTINUING STUDIES ON THE POTENTIAL UTILITY OF BORONIC ACIDS AS NOVEL INSECTICIDES

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There is a continuing need for the discovery and development of novel insecticides that are both environmentally-friendly and non-toxic to mammals at commonly-used concentrations. Several factors contribute to this need: the development of insect strains that are resistant to the chemical compounds commonly used as pesticides; the need for new compounds that are more specific, biodegradable, and environmentally-friendly; and evolving governmental standards that restrict the usage of existing insecticides. Boron-containing compounds, including boric acid, have a long history of use as insecticides. [1] However, boric acid is only a weak insecticide, displaying insecticidal activity only at relatively high concentrations. [2] In addition, neither the mechanism by which boric acid exerts its insecticidal activity, nor the biochemical target on which it acts, is

known. [1,2] Results from ongoing research regarding the potential utility of boronic acids (including the selected compounds shown at left) as novel insecticides, using the German cockroach (*Blattella germanica*) as a model system, will be presented. [1] D. G. Cochran, *Cell. Mol. Life Sciences* 1995, 51, 1420. [2] J. C. Gore, C. Schal, *J. Econ. Entomology* 2004, 97, 581.

233 Biomedical

SYSTEM IDENTIFICATION OF DYNAMIC FULL BODY BALANCE OF 18Q- PATIENTS

Roseann Trevino*, University of Texas at San Antonio, San Antonio, TX

Patients subject to 18q- deficiency adhere to missing an arm of chromosome 18. Individuals with this deficiency acquire certain characteristics physically and mentally caused by the chromosome deficiency. These characteristics include and do not limit to a person's growth development, impact on neurological changes, cause minor visual impairment and affect a person hearing and musculoskeletal changes, among numerous others. Because persons suffering from chromosome 18q- deficiency attain these characteristics, they have a slightly abnormal gait pattern possibly to keep balance while in motion. The purpose of this research is a system identification of an 18Q dynamic balance model. This research entails the study of dynamic stability within the 18Q population. In this study we analyze the gait motion and balance of 11 18Q patients, focusing on the center of mass. In order to specifically analyze balance, the center of mass is a critical factor to specify certain balance characteristics that affect the body in general. Data was taken using an 8 camera VICON motion capture system at the Andrew Gitter GAIT Laboratory located in the Audie L. Murphy Veterans hospital. The markers placed at joints of the body were captured to give a 3-D position at a sampling rate of 120 MHz. The body's center of mass was calculated using the subject's motion capture data. A Neural Network was then used for a 3rd order linear transfer function thus establishing a system identification using the given data.

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EFFECTS OF NUTRITIONAL SUPPLEMENTATION AND CARDIOVASCULAR DYSFUNCTION IN MIROGRAVITY

Jamail Plumber*, Space and Environment Science Internship Program, Dianne Hammond, Bioanalytical Core Lab EASI, JSC, NASA, and Dr. Alamelu Sundaresan Texas Southern University and Osteoimmunology and Integrative Physiology Laboratory, NASA/Johnson Space Center

Many space missions have shown that prolonged space flight may increase the risk of cardiovascular problems. Alterations of the vascular endothelium together with a decreased release of endothelin-1 may entail post-flight health hazards for astronauts. In our study, Placental induced growth factor (PLGf) gene expression was up regulated in modeled microgravity (MMG). This is a cardiovascular mediator and a negative regulator of VEGF (Vascular endothelial growth factor) and is now clinically considered a more specific biomarker than C-reactive protein for predicting stroke and heart attacks. It can also be detected in early onset and progressive stages of cardiovascular dysfunction. This newly described molecular marker of inflammation is the best indicator yet of trouble for people who suffer chest pain serious enough to bring them to emergency rooms, according to German cardiologists. To assess the role of PLGf in microgravity, experiments will be performed to assess expression in hind limb unloaded mouse hearts and compare with those of 1g controls. Also mechanistic studies with endothelial cells in modeled microgravity and 1g will be conducted. Also ELISA assays on normal control subjects will be done to compare the test data against.

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RADIO-ADAPTIVE EFFECTS IN HUMAN LYMPHOCYTES

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On Earth all living things are protected from cosmic radiation by the magnetosphere that surrounds the Earth. Without the protection of the magnetosphere in space the astronauts are subject to consistently higher doses of radiation. In order to prepare for future missions to the moon and to Mars, there are a number of tests that must be performed to ensure the health of the astronauts. The harmful biological effects of high-energy charged particles and secondary protons and neutrons are of prime concern. The effect that radiation has on the biological process can induce resistance, a phenomenon generally known as adaptive response (AR). Adaptive response is a phenomenon, which occurs when cells or organisms are exposed to very low doses of radiation and which makes the cells resistant to higher doses. This project consists of isolating lymphocytes from whole blood, exposing them to radiation at a low exposure level to induce the AR, then exposing them at a high dose of radiation. The AR is measured using the micronuclei frequency as an indicator of DNA damage. The presence of adaptive response will then be determined by the amount of damaged DNA. If the cells sustain minimum damage when a low inducing exposure occurs, then there are signs of adaptive response, but if there is significant damage to the cells then there is no sign of response. Studying and analyzing human cells for this possible trait may allow astronauts to inhabit the moon and Mars without fear of radioactive effects.

237 Biomedical**INFLUENCE OF N-ACETYLCYSTEINE STATUS IN MCF-7 CELL LINE TO ALLOPURINOL/RUTHENIUM TREATMENT**

Brittney Williams*, Dr. Jamie Renfro and Dr. Renard Thomas, Department of Chemistry, Texas Southern University
Breast cancer is the second leading cause of death among American women in the United States. Breast cancer treatment includes several modalities such as radiation, chemotherapy and surgery. As with other cancers, the impact of diet on breast cancer has long been an interest to a number of investigators. Investigators have examined the impact of various diet manipulations on the response to drugs used to treat breast cancer. The aim of this project is to investigate the response of the MCF-7 cancer cell line grown in media supplemented with N-AcetylCysteine to Allopurinol/Ruthenium treatment. The MCF-7 cell line was derived from a 69-year old Caucasian woman who underwent two mastectomies in a five year span. Allopurinol is used to lower blood uric acid levels. Ruthenium is a rare transitional metal of the platinum group. This study will investigate cell viability, apoptosis, and oxidative stress. Cell viability will be evaluated by flow cytometry. Apoptosis will be evaluated by immunoblotting for caspase activity. Oxidative stress will be determined by flow cytometry.

P251 Biomedical**POTENTIAL ROLE OF NATURAL PRODUCTS AS COUNTERMEASURES AGAINST HIGH ENERGY RADIATION**

Philys Johnson*, Olufisayo A Jejelowo, Ayodotun Sodipe, Shishir Shishodia, Texas Southern University, Houston, TX.
Astronauts aboard the space station are subject to the hazardous effects of radiation and microgravity. Astronauts receive an average of 80mSv radiation for a six-month stay in the space. Whole-body exposure to ionizing radiations causes increased ionization in the cells and tissues that severely affects the central nervous system, gastrointestinal tract, and bone marrow. Chronic irradiation causes cancer, birth anomalies, erythema, and dysfunctions to almost all organs of the body depending on the total dose and site of irradiation. Ionizing radiation has been shown to activate the pro-inflammatory transcription factor Nuclear Factor (NF)-kB. NF-kB regulates the expression of over 200 genes that control the immune system, growth, and inflammation. The dysregulation of NF-kB can mediate a wide variety of diseases including cancer; therefore, a robust effort is necessary to understand the effect of high-energy space radiation on NF-kB activation. Identification of specific and pharmacologically safe inhibitors of NF-kB activation can have considerable therapeutic potential against high-energy radiation related damage. A large number of phytochemicals are known to mediate therapeutic effects, possibly through suppression of the NF-kB activation pathway. The mechanism of high-energy radiation induced activation of NF-kB and NF-kB-regulated inflammatory gene products will be examined in vitro and in vivo models. The effect of natural agents like curcumin and resveratrol on high-energy radiation induced NF-kB activation will be evaluated. Future research may use these phytochemicals in the design of better countermeasures against high-energy radiation.

P286 Biomedical**CHARACTERIZATION OF HIGH ENERGY RADIATION AND MICROGRAVITY ON VIRULENCE OF KNOWN BACTERIAL PATHOGENS AND OPPORTUNISTS**

Kayama D. Thomas*, Jessica Nguyen, Olufisayo A Jejelowo and Jason A. Rosenzweig, Texas Southern University
When astronauts embark upon space missions, they don't travel alone. In fact, they are serving as cargo transporting a number of opportunistic bacteria that inhabit their bodies as part of their normal flora. Some of these bacteria are able to cause disease when the host's immune system becomes compromised in some way. Space travel itself, has been a well documented source of immune-suppression in astronauts. In this study, we are characterizing two bacterial pathogens, *Streptococcus pyogenes* (an oral pathogen) and the *yersinae* (Gram-negative enteric bacteria), and their responses to two distinct space-like stresses (SLS), microgravity and space-like irradiation. We will evaluate global changes at the transcriptome level as well as evaluate any modifications in bacterial virulence through the use of cell culture infection models. Documented modifications in virulence could be a significant concern for our astronauts as they could potentially bring back to Earth hyper-virulent bacteria that have been modified by SLS. Additionally, various mutant strains of the aforementioned bacteria that are attenuated in virulence will be exposed to space like irradiation and evaluated for the frequency of their reversion to wt-like levels of virulence.

P241 Biomedical**HIGH ENERGY RADIATION AND MICROGRAVITY-INDUCED EPIGENETIC CHANGES: REVERSAL AND SUPPRESSION BY NATURAL AGENTS**

Georgette Rolle*, Olufisayo A Jejelowo, Ayodotun Sodipe, Shishir Shishodia, Texas Southern University, Houston, TX

Astronauts on space flights are exposed both to radiation and microgravity. Space radiation causes increased ionization in the cells and tissues resulting in various adverse effects on human DNA, cells and tissues. This effect can damage the atoms in human cells, leading to health problems such as cataracts, cancer and damage to the central nervous system. The DNA lesions and oxidative damage produced by radiation are non-specific and most likely induce epigenetic changes. Therefore it is extremely necessary to understand the effect of high-energy radiation on cell and tissue physiology and to seek effective and safe countermeasures to prevent from radiation related damage. Curcumin (diferuloylmethane), a dietary agent also used as a traditional medicine in India has been reported to protect from deleterious effects of ionizing radiation. The radioprotective effect of curcumin might be mainly due to its ability to reduce oxidative stress and inhibit transcription of genes related to oxidative stress and inflammatory responses. The safety of the natural agents, combined with their ability to suppress inflammatory gene products suggests their usefulness in preventing radiation-induced damage. The effect of curcumin on high-energy radiation induced epigenetic changes will be evaluated. To determine this the expression of genes down regulated by hypermethylation such, as P53 will be examined. Human lymphocyte cells will be treated with demethylating agent 5Ade and the expression of those genes will be checked. Increased expression of these genes after 5Ade treatment will indicate hypermethylation resulting in down regulation of these genes. Whether curcumin or resveratrol suppresses or reverses high-energy radiation-induced epigenetic changes will be examined.

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INVESTIGATING THE INHIBITORY EFFECTS OF CAFFEINE AND EPIGALLOCATECHIN GALLATE (EGCG) ON SKIN DEFECTS IN UVB IRRADIATED FISH

Vanessa R. King*, Howard Payne University

Investigating the Inhibitory Effects of Caffeine and Epigallocatechin Gallate (EGCG) on Skin Defects in UVB Irradiated Fish
 Vanessa R. King
 Abstract Green tea has continually shown promising results in numerous areas of disease and cancer research, specifically skin cancer. These cancer preventing properties are mainly attributed to the phytochemical in tea leaves, epigallocatechin gallate (EGCG). Caffeine, which is also found in small amounts in green tea, has also shown potential to inhibit skin cancer in mice. Other studies have shown enhanced effectiveness of green tea's antioxidant properties using regular rather than decaffeinated green tea. This experiment used fish irradiated with ultraviolet B (UVB) rays, which put them at high risk for developing skin defects. The water of the irradiated fish was then infused with caffeine, EGCG, or a combination, to determine which of these substances was most effective in decreasing the number and appearance of these defects in the fish skin.

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ANTIOXIDANT AND FREE RADICAL SCAVENGING ACTIVITIES OF BOTANICAL ESSENTIAL OILS

Mahmoud Saleh*, Fawzia Abdel-Rahman, Olufisayo Jejelowo and Brook Woodard, Texas Southern University

Reactive oxygen and nitrogen free radicals are produced during immune activity, and are triggered by several environmental factors such as pollution, smoke, and sunlight. Harmful effects of these reactive species include cellular damage to RNA, DNA, proteins and lipids. These radicals damage or modify nucleic acids resulting in mutations, development of tumors, cell death and tissue necrosis. In humans several diseases including those connected with the heart, lung, and the eye, etc. are associated with the accumulation of reactive oxygen and nitrogen species (ROS/RNS). In chronic inflammatory conditions, the oxidative damage is accelerated, causing further deregulation involving inflammatory reactions that contribute to many degenerative diseases and aging. Antioxidants in blood, cells, and tissue fluids play an important role in neutralizing the normal level of oxidative damage caused by these free radicals. Methods: Studies have been conducted on the utilization of natural products for improving human health. In an effort to minimize the impact of environmental pollution on humans, identification of natural product antioxidants has become a realistic and powerful tool in the dietary and natural products industry. Over 200 essential oils belonging to 30 botanical families of medicinal, herbal and wild flora were evaluated for their antioxidant and ROS/RNS radical scavenging activities using high performance thin layer chromatography/bioautography and the DPPH(2,2-diphenyl-picrylhydrazyl) assay (Braca et al. J Ethnopharmacol 79: 379–381 (2002)). Results: Twenty (10%) of the tested essential oils were found to have very high antioxidant activity, these were further fractionated by HPTLC/HPLC and their chemical composition was identified using GCMS. The majority of the active samples showed no more than one or two spots in their TLC profile will be presented indicating that antioxidant activity is only associated with certain type of chemicals.

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CHANGES IN VEGETATION PATTERNS AND ITS EFFECT ON TEXAS KANGAROO RATS (DIPDOMYS ELATOR).

Allan D. Nelson* and Jim R. Goetze, Tarleton State University, Stephenville, TX.

Investigations of vegetation in Wichita County, Texas, indicate that changes in patterns of grazing and the introduction of non-native plant species may affect populations of the Texas kangaroo rat. Intensely and moderately grazed areas were compared to each other and to a previous investigation involving an ungrazed pasture dominated by introduced Japanese brome (*Bromus japonicus*). Thirty *Dipodomys elator* were trapped at the intensely and moderately grazed sites, whereas only two animals were caught on the periphery of the ungrazed site in Wichita County. In addition, the moderately grazed site was compared to the intensely grazed site and no significant differences in vegetative richness or percentages grass and forb were found between sites. Height of vegetation, percentage bare ground and woody species coverage were significantly different in comparisons between the two grazed sites. Because the two sites contained populations of *D. elator*, it appears that they can use moderately to heavily grazed habitats as burrow locations and can tolerate significant differences in vegetation height and amount of bare ground and woody vegetation. They rarely use ungrazed sites as habitat and in a previous investigation, an ungrazed site was significantly different from the grazed sites in vegetational height, percentage bare ground, and percentage grass coverage. Grazing regimes, amount of bare ground coverage, and introduction of tall dense growing grasses may be important in managing habitat for Texas kangaroo rats.

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CURCULIO WEEVIL MASS VARIATION BETWEEN TREE SPECIES POST OAK, QUERCUS STELLATA, AND LIVE OAK, QUERCUS VIRGINIANA.

Kelsey Lee Abbott*, Brayden Bunting and Wendi Moran, Hardin-Simmons University Abilene, TX.

Significant acorn production in both live oak, *Quercus virginiana*, and post oak, *Quercus stellata*, was noted in a tree grove in south Taylor County, Texas, during the months of October-November 2007. A random sampling of acorns for both oak species was collected with initial observations from 2007-2008 demonstrating 85% of *Quercus virginiana* acorns and 50% of *Quercus stellata* acorns undergoing predation by *Curculio* weevils. Analysis of weevil mass between species indicates a statistical difference between the weevil masses of live oak, *Quercus virginiana* versus weevil masses of post oak, *Quercus stellata*, acorns.

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A PHENOLOGICAL STUDY OF LIMESTONE ADDER'S-TONGUE (OPHIOGLOSSUM ENGELMANNII)

Nelson Rich and Casey Camarillo*, Biology Department, Collin College, Plano, TX.

Limestone adder's-tongue (*Ophioglossum engelmannii*) is a small, inconspicuous fern species known to begin leaf production in the early spring, mature, release spores and die back in late spring. Plants are typically dormant throughout the summer, and depending on soil moisture, a second season of growth may occur in early fall. Although some aspects of the ecology have been reported, relatively little is known about the life history of this unusual species. A long term population monitoring study is being conducted in Collin County, Texas, to determine seasonal and annual variations in growth and phenology. Total numbers of plants and numbers of plants in various life stages are counted in a permanently marked belt transect consisting of five 1-m² quadrats. Data are collected on a biweekly basis from September-November as well as from February-May and are reported in this study for the four year period from February 2005 to December 2008. Peak population size in the five quadrats ranged from 638 to 1074 plants in the spring and from 0 to 280 plants in the fall. First spore release in the spring occurred during the last week of April with a maximum of only 1.7% of the plants releasing spores. Fall plants rarely achieved fertility and only one plant was observed releasing spores in the fall during the four year period. Additional data for leaf production, phenological patterns, and analysis of possible relationships with climate factors will also be discussed.

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COMPETITION BETWEEN SCHIZACHYRIUM SCOPARIUM AND BUCHLOE DACTYLOIDES: THE ROLE OF SOIL NUTRIENTS

Janis K. Bush* and O. W. Van Auken, University of Texas at San Antonio, San Antonio, TX.

A greenhouse experiment was conducted to evaluate the competitive abilities of *Schizachyrium scoparium* (little bluestem) and *Buchloe dactyloides* (buffalograss) in low and high nutrient soil. These species have overlapping ranges and co-occur in semi-arid North American grasslands. Both species showed increases of approximately 2 g/plant in aboveground dry mass when soil nutrients were added. Aboveground dry mass of *S. scoparium* was slightly higher in mixture than in monoculture in low nutrient soil; however, in high nutrient soil, aboveground dry mass in mixture was significantly less than in monoculture. *Buchloe dactyloides* aboveground dry mass was the same in mixture and monoculture in low nutrient soil; in high nutrient soil, aboveground dry mass was significantly higher in mixture than monoculture. The competitive abilities of the species in shallow soils are dependent upon soil resource levels. At low soil resource levels, competitive intensity is not great and the two species appear to be equal competitors. At high soil resource levels, competitive intensity is greater and *B. dactyloides* reduces the growth of *S. scoparium* in mixtures. Differences in competitive abilities suggest that in shallow high nutrient soils, *B. dactyloides* would dominate and that coexistence would occur in low nutrient soils.

276 **Botany****LEAF PHOTOSYNTHESIS OF SUCCESSIONAL SPECIES BELOW A QUERCUS GAMBELII CANOPY**

Oscar W. Van Auken* and Janis K. Bush, University of Texas at San Antonio, San Antonio, TX.

Quercus gambelii (Gambel's oak) communities are found in the mountains of the southwestern United States. Leaf gas exchange rates were measured for potential successional species growing in the open and understory of *Q. gambelii* communities in the Lincoln National Forest, New Mexico, USA. Mean daily light levels or photosynthetic flux density (PFD) in the understory was $124 \pm 109 \mu\text{mol}/\text{m}^2/\text{sec}$ (15% of open community light levels). Light response curves indicated that *Pinus ponderosa* is a sun plant with high maximum photosynthetic rates ($A_{\text{max}} = 14.13 \pm 1.02 \mu\text{mol CO}_2/\text{m}^2/\text{sec}$; mean \pm 1 standard deviation). *Abies concolor* is a shade plant with a low A_{max} ($3.71 \pm 0.79 \mu\text{mol CO}_2/\text{m}^2/\text{sec}$). *Acer glabrum* and *Fraxinus velutina* had intermediate A_{max} rates. Photosynthetic rates for these species in the canopy shade were 2.44 to 5.48 $\mu\text{mol CO}_2/\text{m}^2/\text{sec}$. Light compensation points (L_{cps}) and respiration rates (R_d) were low. *Pinus ponderosa* had the highest stomatal conductance and transpiration in the canopy shade while *A. concolor* had the lowest rates. Low light levels below the *Quercus gambelii* canopy would cause a 76% reduction of photosynthetic rates of *P. ponderosa* and probably prevent it from reaching the canopy. Low light levels would have little effect on the growth of *A. concolor* because of its low light saturation and low light compensation point. *Abies concolor* would probably be the major replacement species for *Q. gambelii* in the future because of its continuous growth in the low light of the canopy especially in winter with the fall of the *Quercus* leaves.

176 **Botany****DISCOVERY AND EFFICACY OF A HYPERSENSITIVE-LIKE PLANT DEFENSE IN LIVE OAK AGAINST A HOST-SPECIFIC GALL FORMER.**

Cristina M. Campbell*, Glen R. Hood and James R. Ott, Texas State University, San Marcos, TX.

Hypersensitive response (HR) in plants is a well-characterized gene-for-gene interaction between plant and pathogen (microbial) genomes that involves a chemical cascade within plant cells in response to pathogen detection leading to cell lysis and lesion formation in plant tissue at the site of pathogen infection. HR is established as a host plant defense against pathogens. Recently, HR has been postulated as a defense mechanism against macroscopic plant invaders (such as gall-forming insects) that feed within plant tissue. HR-like responses are just beginning to be characterized for macroscopic plant invaders. Herein we document the presence, and examine the effects, of an HR-like response in the leaves of live oak, *Quercus fusiformis*, to oviposition by the gall-forming wasp, *Belonocnema treatae*. We investigate (a) the incidence of tissue lysis, (b) its effects on gall initiation, and (c) whether among-tree variation in lysis incidence correlates with gall density/tree. In 2008, *B. treatae* oviposition scars were scored for the presence of lesions and galls from an average of 196 (\pm 15) leaves from each of 58 live oaks at Texas State University's Freeman Ranch, San Marcos, Texas. Across all leaves and trees, 14% of 142,707 ovipositions led to lesion formation. Lesion incidence varied from 3.1 to 46% of oviposition scars/tree and was negatively correlated with gall density ($r = -0.40$; $P = 0.001$). Only 8% of ovipositions associated with lesions lead to gall initiation. This study demonstrates that an HR-like response of live oak to *B. treatae* oviposition functions as a plant defense.

177 **Botany****LOCALIZATION OF OSMOPHORES IN THE FLOWERS OF STAPELIADS (APOCYNACEAE, ASCLEPIADOIDEAE)**

David E. Lemke* and Kort A. Angerstein, Texas State University, San Marcos, TX.

The fragrance of flowers is commonly produced by volatile substances that often originate in specialized glands termed osmophores. Such glands were first described from representatives of the family Asclepiadaceae but have since been found in families as diverse as Aristolochiaceae, Solanaceae, Araceae and Orchidaceae. Osmophores typically consist of glandular tissue several cell layers in thickness with the epidermal layer involved in the accumulation and release of the fragrance and the lower layers responsible for fragrance synthesis. Although osmophores were originally described as occurring on the petals of certain milkweeds, we have found that among the stapeliads, a group of Old World genera commonly known as the "carrion flowers," osmophores appear to be restricted to the corona, the often elaborate set of appendages between the corolla and androecium. This study will present a detailed examination of the morphology and anatomy of osmophores in the primitive stapeliad *Frerea indica*, as well as in species of the more specialized genera *Orbea* and *Piarranthus*.

185 **Botany****SEED BIOLOGY OF THE HILL COUNTRY WILD MERCURY (ARGYTHAMNIA APHOROIDES, EUPHORBIACEAE)**

Jeffery A. Masters* and Bonnie B. Amos, Angelo State University, San Angelo, TX.

The Hill Country wild mercury (*Argythamnia aphoroides*, Euphorbiaceae) is a rare endemic perennial of the Edwards Plateau. Seed germination studies were conducted as part of an ongoing investigation of the taxon's reproductive biology. The study site is located in Brown County, which may represent the northern edge of the species range. The primary objectives of the seed study were to compare the seed ecology of monoecious and pistillate plants, estimate viability, define dormancy mechanisms, and determine seed longevity and the impact of aging on germination success. Preliminary results suggest an intermediate or deep dormancy mechanism that affects approximately 75% of the seeds for seven months after dehiscence. By month eight, germination rates are higher (90-100%; $p = 0.001$) and germination occurs much faster than in the <7 month seeds ($p = 0.003$). Germination totals for seeds from monoecious plants were not significantly different from those of pistillate plants. However, seeds from monoecious plants began germinating later and more of the seeds from monoecious plants were inviable. Although high viability and germination rates were observed in the laboratory, seedling establishment in a one-year field experiment was low. In this study, 600 seeds were placed along transects representing three different treatments; only 6 seedlings were produced.

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SUBSPECIFIC CLASSIFICATION WITHIN PHORADENDRON SEROTINUM (SANTALACEAE): DEVELOPMENT OF MICROSATELLITE MARKERS FOR ASSESSMENT OF POPULATION GENETIC STRUCTURE.

Angela K. Hawkins* and Christopher P. Randle, Sam Houston State University, Huntsville, TX.

Phoradendron serotinum (leafy mistletoe) is a hemi-parasitic plant of the family Santalaceae found in the United States and Mexico. *Phoradendron serotinum* has been divided into four subspecies: subsp. *tomentosum*, subsp. *macrophyllum* and subsp. *serotinum*, which occur in the eastern United States from southern New Jersey to southern Florida, through the Midwest south of Oklahoma and into Mexico, and on the west coast from Oregon to Baja California; and subsp. *angustifolium*, which grows in isolated regions of Central Mexico. Subspecies may be difficult to identify based on morphology alone. This overlap is especially evident in eastern Texas as these characters that may otherwise be diagnostic of subspecies do not adequately separate three of the subspecies (*macrophyllum*, *tomentosum*, and *serotinum*) that grow in this region. Molecular and morphometric analyses are being utilized to resolve taxonomic confusion within *Phoradendron serotinum*. Total genomic DNA has been isolated from fresh tissue of more than 350 *Phoradendron serotinum* samples from three areas in Texas (Huntsville, College Station, and Del Rio) and samples collected in New Jersey, Delaware, Maryland, North and South Carolina, Georgia, Florida, Alabama, Mississippi, and Louisiana. Microsatellite regions have been isolated using a hybridization-capture method. Twelve primer sequences have been identified and were used for molecular assessments. Additional specimens will be collected from the remainder of the species' western distribution and sampled for genetic differentiation. Ultimately, we hope to provide genetic evidence for classification that will be used in conjunction with morphology.

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POST OAK (QUERCUS STELLATA) ACORN MASS DEMONSTRATES CORRELATION DEFICIENCY IN RATE OF GERMINATION AND SEEDLING GROWTH

Brayden Bunting*, Kelsey Abbott, Wendi Moran and Keith Davis, Hardin-Simmons University, Abilene, TX.

In November 2007, acorns were collected from the branches of two separate post oak (*Quercus stellata*) stands in Taylor County, Texas. The ripened acorns taken directly from the tree were weighed and observed for insect predation, rate of germination, and seedling growth. Observations of initial mass, growth, and rate of germination were recorded for a 7-month period between November 2007 and May 2008. Upon initial observation it was believed that greater initial acorn mass would result in faster germination rates and increased seedling height. However, the analysis of collected data illustrated that a direct correlation between initial acorn mass, rate of germination and seedling growth rates was unfounded.

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SYMBIOTIC RELATIONSHIPS BETWEEN RHIZOBIA AND TEXAS BLUEBONNETS

K. Rose Kilber* and William J. Quinn, St. Edward's University, Austin, TX.

The symbiotic relationship between rhizobial bacteria and the plant family Fabaceae is especially important in the agricultural industry because numerous crop legumes provide sustenance for humans and livestock. A significantly decreased crop yield will result if the soil does not contain an adequate population of the beneficial *Rhizobium* specific to the target crop. Here, various methods of inoculating soil were tested and plant biomass and nodule formation in different groups of *Lupinus texensis* Hook. (Texas bluebonnet) were then measured in response to the inoculation treatments. Three species of rhizobia were used to inoculate bluebonnet seeds: *Bradyrhizobium japonicum*, *Rhizobium meliloti* and *Rhizobium leguminosarum* biovar *trifolii*, as well as a mixture called "GUARD-N" used for all varieties of garden peas, beans, and peanuts. Results confirmed previous research that found that initial soil populations of rhizobia were most important in plant growth. They also revealed that successful inoculation could occur post-germination by repeatedly flooding the soil with desired rhizobial populations.

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PHOTOSYNTHETIC RATES OF AESCULUS PAVIA VAR. FLAVESCENS (RED BUCKEYE, HIPPOCASTANACEAE)

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Light levels were measured in both sun and shade communities in the southeastern part of the Edwards Plateau. In addition, light response curves were measured for *Aesculus pavia* var. *flavescens* (red buckeye) from this area. *Aesculus pavia* is commonly found in the understory of mature forest or woodland communities in this area. Light levels measured in open communities at mid-day in June ranged from 1400 to 1900 $\mu\text{mol}/\text{m}^2/\text{sec}$. Light levels measured in the understory of woodland communities at mid-day in June ranged from 600 to 750 $\mu\text{mol}/\text{m}^2/\text{sec}$. Changes in photosynthetic rate, stomatal conductance, and transpiration rates were examined starting at a photosynthetic flux density (PFD) of 2000 $\mu\text{mol}/\text{m}^2/\text{sec}$ and then at decreasing light levels. The maximum rate of photosynthesis, dark respiration, light saturation point, and light compensation point were determined. The maximum photosynthetic rate of *A. pavia* var. *flavescens* ($11.9 \pm 2.3 \mu\text{M CO}_2/\text{m}^2/\text{s}$) occurred at a PFD of $2000 \pm 0.0 \mu\text{M}/\text{m}^2/\text{s}$ and was not significantly greater than the photosynthetic rate at a PFD of 600 $\mu\text{M}/\text{m}^2/\text{s}$. Light saturation, light compensation point, dark respiration rates, stomatal conductance and transpiration rates for *A. pavia* var. *flavescens* were slightly higher, but similar to other shade plants. This species is usually found in shaded, understory habitats and its gas exchange measurements reflect this habitat preference. Based on measurements, *A. pavia* var. *flavescens* is a shade plant.

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COMPETITION BETWEEN SCHIZACHYRIUM SCOPARIUM AND BUCHLOE DACTYLOIDES: ROLE OF SOIL DEPTH

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A greenhouse experiment was conducted to determine the effects of soil depth on the competitive interaction between *Schizachyrium scoparium* and *Buchloe dactyloides*. Species were grown in monoculture and mixture at soil depths of 30, 90, and 180 cm. In monoculture, *S. scoparium* total and belowground dry mass increased from 30 to 90 cm soil depth and remained the same at the greatest depth. Aboveground dry mass was the same at all depths. *Buchloe dactyloides* total dry mass in monoculture increased significantly with increasing depth. Aboveground dry mass increased from 30 to 90 cm soil depth and remained the same at the greatest depth. Belowground dry mass was the same at all depths. In the 180 cm pots, 53% of *S. scoparium* root dry mass was found in the top 30 cm, while for *B. dactyloides*, 74% was in the top 30 cm segment. Aboveground dry mass of *S. scoparium* was not significantly different in mixture and monoculture at all three soil depths. *Buchloe dactyloides* aboveground dry mass in mixture was significantly lower than monoculture in the 30 cm soil depth, but not significant differences were found in the 90 and 180 cm depths. Data suggest that in deeper soils, resource partitioning occurs which may allow coexistence in semi-arid grasslands of North America.

P110 Botany

NOVEL INHIBITION OF PLANT PATHOGENIC MYCOTOXIGENIC FUNGI AND HUMAN PATHOGENIC BACTERIA BY NEW PHYTOCHEMICAL COUMARIN DERIVATIVES

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Antifungal and antibacterial activity of the new synthesized phytochemical coumarin and their copper (II) complexes were evaluated against nine plant pathogenic mycotoxigenic plant fungal species (*Alternaria alternate*, *Aspergillus flavus*, *Botrytis cinerea*, *Cladosporium herbarum*, *Fusarium moniliforme*, *Helminthosporium tetramera*, *Penicillium expansum*, *Rhizopus stolonifer* and *Verticillium albo-atrum*) and eight pathogenic bacterial species, from which four Gram-positive bacteria (*Staphylococcus citrus*, *Streptococcus pneumoniae*, *Bacillus subtilis* and *Micrococcus luteus*) and four Gram-negative bacteria (*Enterobacter aerogenes*, *Escherchia coli*, *Pseudomonas aeruginosa* and *Salmonella typhi*). Microbial study on phytochemical Cu complex [L2Cu(OAc)] indicated that it was the most effective (90 to 100% inhibition) were showed in the most sensitive pathogens (*B. subtilis* and *A. flavus*), respectively accompanied with a significant variable reduction in pectinolytic and cellulolytic enzyme activities in all tested pathogenic species. Addition of [L2Cu(OAc)] leading to leakage of sugars and electrolytes from the tested sensitive microbial cells accompanied with collapsed hyphae of *A. flavus* and membrane blobbing of *B. subtilis*. The production of mycotoxins decreased with the extension exposure to [L2Cu(OAc)] reaching to a minimum values for the mycelium originating from inoculum exposed to the minimum inhibitory concentration (2%). Both aflatoxin (AFB1) and citrinin were the most sensitive toxins.

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ALUMINUM INDUCED CYTOPLASMIC CALCIUM CHANGES IN ARABIDOPSIS THALIANA ROOTS AS REVEALED BY SENSITIZED EMISSION OF THE YELLOW CAMELEON 3.60 CALCIUM REPORTER

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The yellow cameleon (YC) 3.60 and fluorescence resonance energy transfer (FRET) sensitized emission were used to study changes in cytoplasmic calcium concentration ($[Ca^{2+}]_{cyt}$) in *Arabidopsis thaliana* root cells in response to aluminum (Al^{3+}), lanthanum (La^{3+}), and gadolinium (Gd^{3+}) on the $[Ca^{2+}]_{cyt}$. The three ions evoked transient increases in the $[Ca^{2+}]_{cyt}$ within approximately 60 s upon addition of the ion. Al^{3+} treatment (0.1 mM) resulted in spatio-temporal changes in $[Ca^{2+}]_{cyt}$ in the growing root tip. Al^{3+} -induced increase in $[Ca^{2+}]_{cyt}$ was faster in cells from the distal elongation zone than in cells from the mature zone. The $[Ca^{2+}]_{cyt}$ returned to the initial levels in cells from the distal elongation zone, whereas it stayed elevated in the more mature cells. Verapamil, a plasma membrane voltage-regulated Ca^{2+} channel blocker, inhibited the Al^{3+} -induced rise in $[Ca^{2+}]_{cyt}$ only by 31%. The results suggest that Al^{3+} -, La^{3+} -, and Gd^{3+} -induced increase in $[Ca^{2+}]_{cyt}$ are the result of Ca^{2+} entry via verapamil-insensitive Ca^{2+} permeable channels and of Ca^{2+} release from internal stores. The effect of short-term Al^{3+} exposure on root growth was examined. Al^{3+} at both 0.1 mM and 1 mM concentrations increased root growth rate for a short period of time followed by growth inhibition. The data support the hypothesis that the toxic effects of Al^{3+} (and of other toxic trivalent ions) are due to disruption of the cellular Ca^{2+} homeostasis.

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BACTERIAL COMPOSITION IN SOIL COMMUNITIES OF CONTRASTING EAST TEXAS ECOTYPES

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Bacteria are the most diverse component of terrestrial microbial communities and thus greatly influence the quality and health of soil ecosystems. Comprehensive data and information on the classification and ecology of soil bacterial communities is currently lacking due to inadequacy of traditional culturing methods. This study employs molecular techniques to genotypically classify the diversity of bacteria indigenous to east Texas forest habitats, providing a necessary addition to an existing ecological classification system for the West Gulf coastal plain. Direct extraction of total DNA from environmental soil samples and analysis of 16S rDNA allowed for separation of bacteria from other microbial members within samples and provided simultaneous screening of bacterial communities present. The relative abundance of bacterial operational taxonomic units (OTUs) within soil microbial communities from east Texas forests representing the full range of local ecological types was determined.

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ASSEMBLY OF A CHIMERA FROM BETA-D-GLUCOSIDASE AND HYPERTHERMOPHILIC BETA-1,4-ENDOGLUCANSE FROM PYROCOCBUS HORIKOSHII FOR CELLULOSE HYDROLYSIS.

Srihari Babu Gogineni*, Armen Nalian, Alexandra Martynova-Van kley, Stephen F. Austin State University, Nacogdoches, TX

Ethanol production from biomass requires cellulose to be hydrolysed into its monomer units of glucose. Generally this is accomplished by first employing beta-1,4-endoglucanase, a hyperthermophilic endoglucanase from *Pyrococcus horikoshii*, to degrade crystalline cellulose to cellobiose. Then the cellobiose is degraded by employing other cellulases. In the current study beta-D-glucosidase, a cellulase produced by *Pyrococcus horikoshii*, was combined with hyperthermophilic beta-1,4-endoglucanase to form a chimeric protein to simplify the degradation of crystalline cellulose to its monomeric units at high temperatures (95°C). These two enzymes were combined through sequential cloning into a pET11a plasmid. The chimera was produced in *E. coli* BL21-Codon plus (DE3)-RIL cells by induction with IPTG. The activity of the chimera was determined using the substrates, p-nitrophenyl beta-D-glucopyranoside and p-nitrophenyl beta-D-cellobiose.

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NANOBIOSENSOR AND INTEGRATED SINGLE CELL MANIPULATION SYSTEM

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Manipulation of cells is a challenging task as it requires not only a precise, controllable manipulator set-up but also a suitable end-effector which can be actuated to perform desired tasks without damaging the cells. We will further develop and integrate our newly developed advanced tools, based on nanopipettes and cell-sifter technologies, to capture, deliver, manipulate and detect cell functions at the single single-cell level.

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BACTERIAL MICROFLORA OF BROILERS CHALLENGED WITH COCCIDIA

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One of the most ubiquitous pathogens affecting industrial poultry is coccidia causing mucosal damage and predisposing the birds to bacterial infections such as necrotic enteritis. The advent of pyrosequencing - parallel sequencing of individual DNA molecules, allows examination of the dynamics of intestinal flora quantitatively and far more precisely than previously possible. In this study we examined the effects of different supplements such as essential oil blends or antibiotics on the dynamics of the intestinal flora during coccidia-challenge in broiler chickens. We have identified the bacterial species most affected by coccidia challenge as well as the pathogenic bacteria such as *Salmonella enterica* and *Bacteroides vulgatus* which dominated the post challenge microbiota.

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INVESTIGATING INTEGRATION OF VIRAL DNA INTO THE HUMAN GENOME USING SEQUENCE

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Many viruses are known to integrate their DNA into the human genome. In some cases, integration of viral DNA is highly correlated with disease and cancer. Using human papilloma virus (HPV) as a model virus, integration site locations are pinpointed within the human genome using DNA capture probes and paired end sequencing. Automation of sample preparation as well as parallelized sequencing allows for the identification of integration sites in multiple individuals with speed and precision. Known integration sites will be clustered and sequence and secondary structure motifs can be identified. The findings of this experiment will shed light onto the integration mechanism of viral DNA as well as setting a precedent for future viral integration studies.

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FUNGAL DETECTION AND IDENTIFICATION BY NUCLEIC ACID-BASED ASSAYS.

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Microorganisms have been reported in closed environments at different NASA facilities, from past NASA missions, and in the Russian Space Station MIR. Microorganisms were the first inhabitants of the International Space Station (ISS). They can impact human health and plant health, and cause damage to construction materials in space as well as on earth. Information on microorganisms and their impact on environmental safety during Human Exploration Missions is important, especially for missions of longer duration. The main objective of this project was to develop an easy to use, rapid, sensitive and accurate model for the identification of relevant fungal species using molecular techniques such as polymerase chain reaction, Sanger sequencing and a novel technology, Pyrosequencing. Conventional methods of identification, such as culturing and morphological analysis, have been proven problematic. These methods are typically time-consuming and laborious. Additionally, microscopic analysis and identification based on morphology requires a highly skilled technician in order to avoid misidentification. Preliminary experiments based on initial isolates received indicate some discrepancy in identification. Nucleic acid-based identification provides great accuracy and efficiency. Pyrosequencing technology and a multiple sequencing primer method designed for the detection of multiple species in a sample were therefore used for identifying the relevant fungal species.

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PROFILING OF ARBUSCULAR MYCORRHIZAL COMMUNITIES BY HIGH-THROUGHPUT SEQUENCING

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Arbuscular mycorrhizal fungi (AMF) form a symbiosis with plant roots in more than 80% of terrestrial plant species. AMF enhance plant nutrient absorption, increase soil stability and protect plants against soil pathogens. Samples were collected from 25 sites in the Stephen F. Austin Experimental Forest, Angelina National Forest and Sabine National Forest, Texas, USA and were sequenced using the 454 FLX pyrosequencing and 18S fungal primers. Each sample produced from 2000 to 13,000 reads, from which the exact OTUs presented in the sample were determined. The sequences obtained were processed using a python script. Their origin was determined by Basic Local Alignment Search Tool. Two binary matrixes were constructed: an OTU-by-samples matrix and an environmental matrix. Patterns of AMF diversity as expressed by relative percent abundance were compared with patterns of soils, topography, and vegetation across the sites using multivariate methods including cluster analysis, correspondence analysis, detrended correspondence analysis, and regression of ordination scores/principal components on external (soil vegetative, topographic) factors. Fifty three distinct OTUs of AMF were found and relative percent abundance of *Glomus* species ranged from 0.3 to 6.8%. Describing the diversity of AMF across several east Texas habitat types will help better understand the genetic organization and taxonomy of AMF and may enhance local forest management and agriculture.

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DESIGN OF A SYNTHETIC STANDARD FOR A REAL-TIME PCR-BASED QUANTITATIVE ANALYSIS OF EIMERIA SPECIES IN POULTRY FECES

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Coccidiosis is one of the most widespread and economically important parasitic diseases in poultry production, especially in broiler lines. The disease is caused by a single-cell organism protozoan of the genus *Eimeria*. To control coccidiosis in broiler production a routine monitoring of birds is used. Chicken are treated with anticoccidial drugs, and its dosage depends on severity of the disease and amount of parasites in broilers; however their constant consumption causes resistance to these drugs. For successful development and assessment of anticoccidial drug efficiency, identification and quantification of the parasites are required. Identification and quantification of oocysts in feces based on Real Time PCR (RT-PCR) is easy and inexpensive and can be routinely used in laboratories. A RT-PCR assay based on TaqMan fluorogenic probes species-specific to the 18S rRNA gene was previously developed for quantitative and qualitative analysis of chicken parasites. However, the DNA polymerase utilized for DNA amplification is very sensitive to reaction conditions such as temperature, concentration of magnesium ions, amount of DNA-template and various chemical substances. Moreover, DNA-templates for RT-PCR isolated from fecal samples contain inhibitors that affect Taq polymerase and increase Ct values. In order to assess and take into account the effect of inhibition, a synthetic standard was designed. It consists of a plasmid carrying a unique sequence complementary to the specific TaqMan probe. Use of this standard will eliminate inaccuracy in RT-PCR quantification and make it more reliable for monitoring of *Eimeria* parasites.

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EFFECT OF FECAL SAMPLE STORAGE CONDITIONS ON RT-PCR FOR QUANTITATIVE ANALYSIS OF EIMERIA IN POULTRY

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Coccidiosis is caused by parasitic protozoa *Eimeria*, an obligatory intracellular parasite which affects poultry worldwide. The parasite causes gut cell apoptosis and leads to weight loss and overall deterioration of health. Quantitative detection of *Eimeria* from fecal samples can be done by real-time PCR; however, the sample storage conditions can affect DNA extraction and real-time PCR results. In this study, fresh samples and samples stored for three, seven and ten days at 25oC, 4oC and -20oC were used to extract DNA with the Personal Automation™ Maxwell® 16 system (Promega Inc). In addition, the purified DNA was stored for two and four weeks at -20oC to examine the effect of DNA freezing. Concentration and purity of DNA were measured by spectrophotometry. We detected the highest gene copy numbers in fresh samples and the lowest gene copy numbers in samples after three days of storage at room temperature. Moreover additional freezing of purified DNA increased the detection threshold for all the samples.

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EFFICIENCY PROTEIN EXPRESSION IN PLANTS FROM AGROINFECTION-COMPATIBLE SUNN HEMP MOSAIC VIRUS EXPRESSION VECTORS

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Plants viruses are increasingly being examined as alternative recombinant protein expression systems. The current generation of plant virus expression vectors is designed with a single host plant in mind, namely, the tobacco, *Nicotiana benthamiana*. Vectors for new hosts are needed, for example, for oral delivery of vaccines and for functional genomics. Sunn Hemp Mosaic virus (SHMV) is a tobamovirus, which infects leguminous plants. A new SHMV vector has been constructed for high yield of target proteins in plants. The coat protein gene of SHMV was substituted either by only a reporter gene or by a reporter gene and the coat protein gene from tobacco mild green mosaic tobamovirus (TMGMV). These SHMV constructs are driven by 35S promoter and can be delivered as a T-DNA to plant cells by *Agrobacterium tumefaciens*. Co-agroinfiltration of these SHMV with RNA silencing suppressor p19 (from tomato bushy stunt virus) and HcPro (from tobacco etch virus) resulted in high levels of GFP expression by 6 days post inoculation (dpi). Three length of subgenomic promoter were tested for target protein expression, and all functioned similarly. Recombinant protein (GFP) in the coat protein construct was detected in systemically infected plant 12-19 dpi. These modifications to the SHMV-based expression vector system have made SHMV vectors an easier, more reliable and more cost-effective way to produce recombinant proteins. These improvements should facilitate the production of recombinant proteins in legume for both research and product development purposes. This study reports the first SHMV agroinfection expression vectors.

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DETECTING VIRULENT YERSINIA AND LISTERIA IN READY-TO-EAT FOODS.

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Yersinia and *Listeria* are two pathogens that can cause invasive disease in humans, yersinosis and listeriosis, respectively. Approximately 99% of infections appear to be food borne by the consumption of ready-to-eat (RTE) foods that permit postcontamination growth of these micro-organisms. Yersinosis and listeriosis have become a great concern for the RTE food-processors of the United States. Eating raw or undercooked RTE products can infect individuals. These diseases are estimated to be responsible for more than 3000 deaths per year in the United States. Both *Yersinia* and *Listeria* can survive in cold temperatures and after irradiation of processed RTE foods. The objective of this study is to identify *Yersinia* and *Listeria* in RTE foods by detecting virulence genes using the polymerase chain reaction (PCR).

P259 Cell and Molecular Biology

DETRIMENTAL EFFECTS OF THE INSECTICIDE, IMIDACLOPRID ON ASSOCIATIVE LEARNING IN CAENORHABDITIS ELEGANS

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Recent studies reveal that imidacloprid, along with other neonicotinoids, is partly responsible for colony collapse disorder (CCD). In honeybees (*Apis mellifera*) CCD occurs when the ability to create or store memories is lost. Imidacloprid is a commonly used insecticide that is part of the family of neonicotinoids interacting with insect nicotinic acetylcholine receptors. When CCD occurs, the bees cannot return to their hive and the colony dies. Studies reveal that when imidacloprid was administered, it impaired the proboscis extension reflex (PER) of the honey bees, which also weakened the honeybees' medium-term olfactory memory. To further extend this research, and to examine broader effects of imidacloprid on other organisms that might commonly come in contact with it, imidacloprid was administered to *Caenorhabditis elegans* and the impact of the treatment on learning and memory was examined. In this experiment, the thermotaxis model for food-temperature associative learning was used as a paradigm to observe the effects of imidacloprid on *C. elegans* associative learning. Imidacloprid was added to the feeding media of *C. elegans*. It was expected that imidacloprid would adversely affect memory in *C. elegans*. The results show that after a 24-hour training period, *C. elegans* failed to avoid the temperature in which they were starved. These results suggest that imidacloprid may disrupt food temperature associative learning in *C. elegans*.

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DISTRIBUTION OF ARBUSCULAR MYCORRHYZAL FUNGI IN DIFFERENT REGIONS OF THE ROOT IN THE GRASS PASPALUM

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Different taxa of plant root-symbiotic arbuscular mycorrhizal fungi (AMF), show habitat, plant host, and seasonal preferences and preferences for different soil depths. Our study investigates whether AMF taxa also have preferences for different regions of their host's root system. The perennial grass *Paspalum notatum* Fluegge was chosen for our assay. Plants from a road-side lawn in Nacogdoches, Texas, USA were collected for DNA isolation and amplification of the 18S rDNA gene fragment using the NS31 and AM1R primers. DNA was extracted from young root tips distant from the rhizome, old and young lateral roots adjacent to the rhizome, and from portions of the rhizome itself. Amplified DNA was subjected to denaturing gradient gel electrophoresis (DGGE). The resulting patterns of DNA bands on the gel (each band represents a

fungal genotype), were compared by multivariate methods including ordination and cluster analysis. Results have implications for future investigations of AMF communities on various plant hosts from natural, agricultural and other habitats.

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EFFECTS OF SINGLE, DOUBLE, AND MULTI-WALLED CARBON NANOTUBES IN RAT LUNG EPITHELIAL CELLS

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Carbon Nanotubes (CN) have unique electronic properties that have many uses for the future, including: advanced miniaturization of electronic components, improved gas mileage, longer balls, better sunscreens, pharmaceuticals and drug delivery systems. Although CNs are promising technology for the future, there is still a dark side about CN that we are ignoring. A study shows that when CNs were inhaled and reached the lungs they were more toxic than carbon black. Moreover, the toxicity effects of CNs can lead to precancerous symptoms and even cancer. The objective of our study is to use a cell line to test CN toxicity at the cellular level.

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GAP GENE EXPRESSION VARIATION AND THE POSITION OF THE CEPHALIC FURROW IN DROSOPHILA MELANOGASTER

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The study of phenotypic and genotypic variation in *Drosophila melanogaster* can provide insight into the evolution of new phenotypes. Variation important for phenotypic evolution arises at the population level. Thus, we examine intra-specific variation, using anterior-posterior patterning of the *D. melanogaster* embryo as a model system. The cephalic furrow is the first of several gastrulation events and distinguishes the head from the thorax. The cephalic furrow forms at approximately 67% egg length, although previous research indicates that within inbred lines of *D. melanogaster*, placement of the cephalic furrow can vary along the anterior-posterior axis. To investigate whether the expression pattern of genes responsible for anterior-posterior patterning also varies in these lines, we use in situ hybridization to examine mRNA localization of orthodenticle (*otd*), Hunchback (*Hb*) and Kruppel (*Kr*). Our hypothesis is that the anterior gap genes, *Hb* and *otd*, will show a corresponding anterior shift of their expression boundaries in embryos with a more anteriorly placed cephalic furrow. Likewise, the posterior gap gene *Kr* may show a posterior shift in the expression boundaries in embryos with a more central or posterior cephalic furrow. This approach reaches a first step in understanding the variation possible for phenotypic evolution.

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IDENTIFICATION OF A CYTOPLASMIC MANGANESE SUPEROXIDE DISMUTASE (CMNSOD) IN THE RED SWAMP CRAWFISH PROCAMBARUS CLARKII: CDNA CLONING AND TISSUE EXPRESSION.

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A cytoplasmic manganese superoxide dismutase (cMnSOD) cDNA was cloned from the hepatopancreas of the red swamp crawfish *Procambarus clarkii*. An initial cDNA fragment was identified using degenerative primers and the complete sequence was obtained using RACE methodology. The full sequence comprises 1140 bp with an open reading frame of 858 bp encoding a protein of 286 amino acids. Sequence analysis showed that this protein is highly homologous to previously obtained crustacean cMnSODs. Phylogenetic analysis clusters it with all known cMnSODs and in a distinct group from mitochondrial MnSODs. cMnSOD transcripts were detected in gills, tail muscle, green glands and hepatopancreas. The data provides additional evidence for the hypothesis that cMnSOD replaced CuZnSOD in crustaceans that use haemocyanin as the respiratory pigment.

P127 Cell and Molecular Biology

INTERLEUKIN-2 INDUCES DNA TOPOISOMERASE I ACTIVITY IN HUT 78 CELLS

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Interleukin-2 (IL-2) is a lymphokine that binds to a high affinity receptor on the surface of human T lymphocytes. Transduction of this signal activates biochemical pathways that result in increased transcription and DNA replication. HuT 78 is a human T cell lymphoma line that expresses the high affinity IL-2 receptor. These cells were treated with 1,000 U IL-2/ml, and nuclear extracts were prepared at various times after treatment. The nuclear extracts were assayed quantitatively for the catalytic activity of DNA topoisomerase I by relaxation of supercoiled plasmid pHC624 DNA. The concentrations of protein in the nuclear extracts were determined by a modified Bradford assay, and the specific activity of topoisomerase I in the nuclear extracts was calculated. The specific activity of topoisomerase I increased two to five-fold after treatment of HuT 78 cells with IL-2. The specific activity of topoisomerase I increased with peaks observed at 0.5, 4

and 10 hours following treatment. The times of increased specific activities of topoisomerase I coincide with periods of increased transcription (0.5 - 4 hours) and increased DNA replication (10 hours) in HuT 78 cells following treatment with IL-2. These results reveal that the activity of topoisomerase I is tightly regulated in activated HuT 78 cells and they suggest that topoisomerase I functions in both transcription and DNA replication in human T lymphocytes.

P75 Cell and Molecular Biology

INVESTIGATING GENETIC PATHWAYS IN DROSOPHILA MELANOGASTER USING REAL TIME PCR

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For over a century, *Drosophila melanogaster* has been used as a model system to study genetics and development. Many genetic pathways found in *D. melanogaster* are also found in human systems; thus, *D. melanogaster* provides an excellent system to study the causes of developmental malformations, which can be used as models for many human diseases. Its fast life cycle and easy maintenance make *D. melanogaster* an ideal system to use in undergraduate teaching and research laboratories. This project was designed to develop a teaching tool for an upper level Developmental Biology course investigating the genetic pathways of wing development in *Drosophila*. We focus on Vestigial (Vg), a transcription factor required for proper wing outgrowth, and its target gene *Drosophila Serum Response Factor* (DSRF). Wing imaginal discs were harvested from third instar larvae of wild type (WT) and *vg* mutants, the mRNA was isolated and reverse transcribed to cDNA, and Real-Time Polymerase Chain Reaction (RT-PCR) was used measure expression of *vg*, DSRF, and Ribosomal Protein 49, used as a control. RT-PCR was chosen instead of regular PCR because it provides a method to quantify the original levels of mRNA transcripts present in the cells of the wing disc. With RT-PCR, students are able to gain a better understanding of exactly how regulatory signals influence transcriptional output and morphological development. They are also introduced to a prevalent technique used in modern Developmental Biology research.

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SEQUENCING OF A MITOCHONDRIAL MANGANESE SUPEROXIDE DISMUTASE (MTMNSOD) CDNA FROM TWO CRUSTACEAN SPECIES.

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The mitochondrial manganese superoxide dismutase (mtMnSOD) cDNA was cloned from flash-frozen hepatopancreas samples from the red swamp crawfish (*Procambarus clarkii*) and from claw muscle tissue from the marsh fiddler crab (*Uca pugnax*). Using degenerative primers, initial cDNA amplicons of 300 and 400 bp were isolated and sequenced respectively. BLAST analysis confirmed these partial sequences to be highly homologous to mtMnSOD from other crustaceans. Phylogenetic analysis groups the sequences together with all known mtMnSODs and in a distinct group from other known SODs.

P201 Cell and Molecular Biology

THE ROLE OF LIPID A PHOSPHATASES AND THE CELL WALL ASSOCIATED LIPOPROTEINS OPRF, OPRI, AND OPRL ON MEMBRANE VESICLE FORMATION IN PSEUDOMONAS AERUGINOSA

Maria Taylor*, Patricia Baynham, Saint Edward's University, Austin, TX, Erica Saenz, Lauren Mashburn-Warren, Marvin Whiteley, Univeristy of Texas at Austin, Austin, TX

The gram-negative bacterium *Pseudomonas aeruginosa* is an opportunistic pathogen known for causing lethal pulmonary infections in patients suffering from the genetic disease cystic fibrosis. The bacterium is especially dangerous due to its intrinsic resistance to many antibiotics. *P. aeruginosa* produces outer membrane vesicles (MVs) that enable the bacterium to transport virulence factors to target cells and permit cell:cell signaling. *P. aeruginosa* produces the signaling molecule 2-heptyl-3-hydroxy-4-quinolone (*Pseudomonas* Quinolone Signal, or PQS) which has been shown to regulate the production of MVs by inducing proper curvature of the outer membrane which may be achieved by interaction of PQS with the 4'-phosphate of Lipid A, a component of LPS. The fluidity of the outer membrane is also hypothesized to be important in MV formation. The objective of this study was to explore what change in MV formation, if any, may result from the removal of the 4'-phosphate of Lipid A and deletion of each of three outer membrane lipoprotein genes (*oprF*, *oprI*, and *oprL*). Upon expression of the phosphatases, the quantity of MV formation in those with the 4'-phosphatase would likely decrease and the topography of MVs may also be altered. Upon deletion of the lipoprotein genes, MV formation may change as the outer membrane would be less anchored to the cell wall. Alternatively, the deletion of one lipoprotein may result in increased production of others in order to compensate and maintain outer membrane stability. An understanding of how MVs are formed may lead to therapies that interfere with this ability and lead to a decrease in virulence.

159 Chemistry and Biochemistry

POTENTIAL SURFACE BEHAVIOR IN THE PHOTOCHEMISTRY OF STYRENE OXIDE

Benny E. Arney, Jr.*, Rick C. White, Sam Houston State University

Examination of the photochemistry of styrene oxide revealed the existence of a triplet reactive pathway that produces toluene and bibenzyl as primary photoproducts in addition to the known phenylacetaldehyde primary photoproduct. The establishment of the triplet nature of the toluene experimentally and the results of a computational search for the excited state source of the triplet pathway will be presented and discussed.

180 **Chemistry and Biochemistry**

A THERMODYNAMIC STUDY OF CATION EXCHANGE IN MONTMORILLONITE CLAYS USING SOLUTION CALORIMETRY

Amy J. Rich * and Alyx S. Frantzen, Department of Chemistry, Stephen F. Austin State University, Nacogdoches, Texas. Δ Solution calorimetry is a precise method of determining enthalpy changes that occur when two substances are mixed. This technique is sensitive enough to detect very small temperature changes and has been used to determine the cation exchange capacity (CEC) of clays. Known qualitative trends of cation exchange will be confirmed by quantifying the enthalpy change that occurs during the exchange. Each heat exchange will be measured in calories per gram and average values will be determined. This quantitative data will then be compared to known trends based on size and charge of the cation. This proven thermodynamic technique is being used to determine the amount of energy released when cations are exchanged in montmorillonite clay. Knowledge of the amount of energy needed for exchange will give information about heat exchange that will verify these trends. The resulting enthalpies (ΔH) also allow the effects of temperature and pressure on exchange equilibria to be examined to improve understanding of exchange processes.

256 **Chemistry and Biochemistry**

METALIZED CARBON NANOTUBE SYNTHESIS IN REDUCED GRAVITY CONDITIONS

Chelsea Harris*, Xin Wei, Bobby Wilson and Renard Thomas, Texas Southern University, Houston, Texas
Carbon nanotubes are considered a corner stone for future scientific research and advance functional material applications. It is highly desirable for individual CNTs to be well dispersed when manipulated in practical polymeric applications. However, this important goal is a major limitation for nano-material scientists, because of complications of processing into material systems. Thus, in order to take full advantages of individualized CNT's properties and achieve functional nano-materials, engineering design of functionalized CNTs is a must. The goal of this research is to study the effects of reduced-gravity on TSU's proprietary nanotechnology that deposits atomic metallized nanostructures on the surface of CNTs. We propose to systematically explore and compare reduced-gravity metallized carbon nanotubes in terms of material fabrication and characterization. Metallized CNTs have been considered a next-generation nano-material that is promising in many applications. TSU's new provisional patent offers an ideal scalable platform, where metallized nanostructures, varying from discrete atom clusters to uniform thin coatings, can be deposited on CNT surfaces with great manageability and reproducibility. Silver rgm-CNTs will be synthesized, and their morphological structure, biological properties will be studied. The following hypothesis will be investigated: Electrochemical deposition of atomic Ag nanostructures in reduced-gravity conditions will enhance the properties of rgm-CNTs because of the potential unique functionalized character of electrochemical deposition in reduced-gravity.

232 **Chemistry and Biochemistry**

LIPID PROFILES OF FOUR FAMILIES OF RODENTS: HETEROMYIDAE, MURIDAE, SCIURIDAE, AND GEOMYIDAE

Chris Mitchell* and Michael Shipley, Department of Biology, Midwestern State University, Wichita Falls, TX
Variation in lipid and fatty acid composition of four organs from representatives of four different families (Heteromyidae, Muridae, Sciuridae, and Geomyidae) of free-ranging rodents were determined by thin-layer chromatography (TLC) and gas chromatography-mass spectrometry (GC-MS). Extracts of heart, skeletal muscle, liver, and kidney were analyzed from 12 species of north central Texas rodents. The most abundant saturated fatty acid in all samples was palmitic acid (16:0). Oleic acid (18:1) was the most abundant monounsaturated fatty acid, while linoleic acid (18:2) was the most abundant polyunsaturated fatty acid. Smaller amounts of other fatty acids (such as myristic acid; 14:0, and arachidonic acid; 20:4) were also detected. A major difference between the various organs is the percentage of polyunsaturated fatty acids they contain. The heart contains high percentages of 20:4 and docosahexaenoic acid (DHA; 22:6), for example. The percentage of unsaturated fatty acids was generally higher than the saturated fatty acids. The Sciuridae, however, showed a relatively equal amount of saturates versus unsaturates. Four classes of lipids (phospholipids, diglycerides, triglycerides, and free fatty acids) were present in all four organs across the four families, with most of the fatty acids present in the phospholipid and triglyceride classes. Unique lipid profiles were not identified for specific rodent species or families, yet this study provides a baseline for more thorough studies of rodent fatty acid composition.

303 **Chemistry and Biochemistry**

UTILIZATION OF ANTI-MICROBIAL NATURAL PRODUCTS FOR THE MANAGEMENT OF MICROORGANISMS IN SPACECRAFT.

Mahmoud Saleh*, Olufisayo Jejelowo, and Fawzia Abdel-Rahman, Texas Southern University

The main focus of this project is to attempt to immobilize natural antimicrobial agent to a polymer that can be applied to surfaces, tubes or water filters. Based on our previously reported data, three monoterpenes which were shown to have wide antimicrobial and antifungal activities were chosen to be used as model for experimenting on how to immobilize them on appropriate polymers. The three chosen monoterpenes were anethol, carvacrol and carvone. In this report we will present results on procedures for immobilizing monoterpenes to polymers related to polystyrene, poly ethylene and methyl acrylates. Antimicrobial activities of the copolymers will be presented.

160 Chemistry and Biochemistry

STERIC CONSIDERATIONS IN THE COMBUSTION OF ORGANO-CLAYS

Jason N. Perrin * and Alyx S. Frantzen, Department of Chemistry, Stephen F. Austin State University, Nacogdoches, Texas
Bomb calorimetry has been successfully used as a method to determine the cation exchange capacity (CEC) of clay minerals. An examination of the combustion energies of tetraalkylammonium exchanged clays shows a stair-step jump generally between the tetrapentyl- and tetrahexylammonium exchanged clays. A similar trend is seen in the d-spacing: a stair-step increase occurring around the tetrapentyl- and tetrahexylammonium exchanged clays. X-ray diffraction (XRD) was used to elucidate the steric arrangement of the organic cations within the clay. Analysis shows as the chain length of the tetraalkylammonium salt increases, the ions begin to form bilayers and pseudotrayers. Further investigation of this effect involves the exchange, combustion analysis, and XRD analysis of methyl-trialkylammonium and trimethyl-alkylammonium salts with the standard clays to examine steric interactions within the interlamellar region.

P56 Chemistry and Biochemistry

ACRYLAMIDE PRODUCTION IN FRENCH FRIES COOKED IN TRANS-FAT FREE OIL OR VEGETABLE OIL

Shane Guthrie*, Jared Bird, Nick Flynn, Angelo State University, Chemistry Department

Acrylamide has been identified as a human neurotoxin and a possible human carcinogen and is formed in fried, starchy foods. This study evaluated French fries that were fried in vegetable oil (VO) or trans-fat free oil (TFO) and pre-soaked in distilled water for 0, 10, 20, and 40 minutes. The 0 minute VO treatment produced an acrylamide concentration of 57.50 ± 14.69 $\mu\text{g}/\text{kg}$ while the VO 40 minute produced an acrylamide concentration of 58.29 ± 16.64 $\mu\text{g}/\text{kg}$. The TFO 0 minute soak produced an acrylamide concentration of 62.94 ± 48.02 $\mu\text{g}/\text{kg}$ while the TFO 40 minute had an acrylamide concentration of 36.08 ± 5.99 $\mu\text{g}/\text{kg}$. The results from the TFO correlated with our previous findings stating that the longer the soak the lower the acrylamide concentration. The use of other pre-soak solutions in combination with preferred cooking oils requires further evaluation.

P162 Chemistry and Biochemistry

BIOLOCALIZATION OF LEAD AND CADMIUM IN BOUTELOUA CURTIPENDULA AND CYNODON DACTYLON

Tonie M. Tercero*, Ashley M. Castillo, Julian M. Davis, University of the Incarnate Word and Alwyn Anfone, Michael Bernard, San Antonio Water System

Elevated levels of heavy metals such as lead and cadmium in the soil and water pose an environmental and human health threat. Phytoextraction is a method of removing pollutants, such as heavy metals, from the environment using plants. Our previous studies have shown that two common Texas grazing grasses, Sideoats Grama (*Bouteloua curtipendula*) and Bermuda (*Cynodon dactylon*), can absorb lead and cadmium ions through the root system and into the blades of grass. Our current study focuses on which parts of the plants, roots, shoots, or both, that the metals localize to as well as a closer look at the concentration limitations of metals in both water and soil that the plants are exposed to. Lead and cadmium is extracted from samples of plant material and soil by acid digestion and measured by ICP-OES.

P114 Chemistry and Biochemistry

CAPILLARY ELECTROPHORETIC ANALYSIS OF WHEY

Timothy J. Tucker*, and Robert Holloway, Schreiner University

Whey, a popular source of nutritional protein, is conveniently analyzed by capillary electrophoresis (Gutierrez and Jakobovits, Capillary electrophoresis of α -Lactalbumin in Milk Powders, *J. Agric. Food Chem.* 2003, 51, 3280-3286). Other popular sources like soy protein are also of interest. α -Lactalbumin, β -lactoglobulin A, and β -lactoglobulin B are all present, as well as other, as yet, unidentified electrophoretic objects.

P92 Chemistry and Biochemistry

CRUSTACEAN AMYLASES

Francis Horne*, Texas State University

The digestive enzyme, amylase, is an ideal enzyme to teach students about basic ecology, physiology and biochemistry. The crayfish, *Procambarus simulans*, and lobster, *Homarus americanus*, are easily and economically obtained by collection or purchase. Extraction from the stomach fluid is easily accomplished by inexperienced students. The enzyme retains activity after much mistreatment. Activity can be quantitatively measured colorimetrically, and enzyme activity ascertained at different concentrations, pHs and temperatures. Molecular weight can be estimated by separating the enzyme via Amicon Ultra filters (10, 30 & 50 kDa), and then running SDS-PAGE electrophoresis on the filtrates. For comparative purposes human salivary amylase can be treated in the same manner as the crustacean enzyme. Molecular weight of the crustacean amylase is much smaller than that of vertebrate salivary amylase (32 kDa versus 55-65kDa). Results of these experiments will be presented.

P253 Chemistry and Biochemistry

INFLUENCE OF DIFFERENT BASES ON THE COMPETITION BETWEEN INTRAMOLECULAR AND INTERMOLECULAR HYDROGEN BONDING IN CATECHOL

Adriana Pavia* and J.D. Lewis, Department of Chemistry, St. Edwards's University, Austin, TX 78704

We have begun an infrared study of the competition between intramolecular and intermolecular hydrogen bonding in catechol in the presence of various hydrogen bonding bases such as acetone, THF, and p-xylene. The solvent for our studies is cyclohexane since this solvent produces relatively sharp OH stretching bands for dilute solutions. For example, the infrared spectrum of 0.003M catechol in cyclohexane exhibits two OH-stretching bands at 3622 cm⁻¹ and 3576 cm⁻¹, one assigned to a free OH conformation (free band) and the other to a OH conformation with intramolecular hydrogen bonding (intra HB band). As acetone is added to the solution at increasing concentrations varying from 0.1 M to 1.0 M, the free band and original intra HB band decrease in intensity, and a broad band appears at 3460-3300 cm⁻¹ assigned to OH conformations with intermolecular hydrogen bonding. A second shifted intra HB band also appears at 3561 cm⁻¹. The changes in band intensity are obviously related to concentration changes of different conformations. The intra HB band shift indicates the influence of inter HB formation on the intra HB conformation. We have examined the effect on the locations of the OH stretching bands when other bases such as p-xylene and THF are used.

P143 Chemistry and Biochemistry

LEAD CONTAMINATION IN CALCIUM SUPPLEMENTS

Leigh Ann Brown* and Dr. Michael M. Looney, Schreiner University

Researchers and Medical Practitioners have become aware of the dangers of lead poisoning over the past decades. Low levels of lead exposure have been found to correlate with irreversible fetal brain damage, hypertension, cardiovascular disease, kidney dysfunction, impaired bone synthesis, impaired sperm production and osteoporosis. Young children and the elderly are especially susceptible to lead exposure. There are federal and state regulations restricting the amount of lead allowed in food products. Recently it has come to attention that calcium supplements may contain amounts of lead. In this research project, samples of calcium supplements purchased in Texas are being tested for lead content through atomic absorption spectrophotometry. Lead was found to be a contaminant in all of the calcium supplements that were studied, but it is not an ingredient. Thus its presence may not be uniform in the samples. Only future testing will ensure that the concentration of lead in the samples is consistent throughout.

P130 Chemistry and Biochemistry

LEAD CONTAMINATION IN HAIR DYES

Keleigh Donaldson*, Dr. Michael Looney, Schreiner University, Kerrville TX

The effects of lead on people, namely children, have been extensively broadcast. Some recent studies have shown that there is a detectable amount of lead acetate in hair dyes. Gradual dyes are among the most common that use lead acetate to achieve a darker hair color. This research uses flame atomic absorption spectroscopy in order to test multiple types of hair dyes for lead content.

P116 Chemistry and Biochemistry

PESTICIDES IN YOUR FOOD

Andria Marsh*, J.D. Lewis, Donald Wharry, St. Edwards University, Austin, Texas

Determine a method of analyzing the residues of pesticides on leafy vegetables. Diazinon, Chlorpyrifos and Permethrin are the three pesticides to be identified using the HPLC and GC/MS. These pesticides are used widely in agricultural practices for pest control. These substances have been known to have adverse effects when released into the environment beyond certain levels. My undergraduate research will focus on utilizing HPLC and GC/MS to identify and relatively quantify the levels of these different pesticides on leafy vegetables. Green leaf lettuce and spinach will be tested to determine how much of each pesticide remains on the vegetable by the time of consumption and whether those levels exceed federal regulation issued by the Environmental Protection Agency.

P57 Chemistry and Biochemistry

OLIVE OIL PRODUCES LESS ACRYLAMIDE IN FRENCH FRIES COMPARED TO LARD AS ANALYZED BY HPLC AND SPE

Jared Bird*, Aaron Guthrie, Nick Flynn, Angelo State University, Chemistry Department

The presence of acrylamide, a known carcinogen and neurotoxin, in fried starchy foods prompted our observational study of variances in acrylamide concentration in french fries prepared in olive oil, vegetable oil or lard. Analysis was conducted using Solid Phase Extraction and samples were analyzed via HPLC. Corrected acrylamide concentrations were obtained using methacrylamide as an internal standard to verify retention times and calculate the extraction efficiency for each sample. Olive oil produced the lowest average acrylamide concentration of 65.12 ± 8.23 $\mu\text{g}/\text{kg}$. Vegetable oil had an intermediate concentration of 260.22 ± 50.29 $\mu\text{g}/\text{kg}$ and lard had the greatest concentration with 325.69 ± 85.07 $\mu\text{g}/\text{kg}$. Olive oil statistically produced less acrylamide than lard. This study reveals the value of using olive oil while cooking to reduce the amount of acrylamide produced in french fries and further supports the use of olive oil as a healthy cooking oil.

P245 Chemistry and Biochemistry

QUANTITATIVE ANALYSIS OF CAFFEINE AND OTHER INGREDIENTS IN ENERGY DRINKS

Rachel Favila*, Julian M. Davis, Jesus Garza, University of the Incarnate Word

Caffeinated beverages have been consumed for their stimulating properties for a very long time. Recently additional compounds such as B-vitamins, taurine, and ginseng have been introduced into so-called energy drinks to supplement the stimulating effects of caffeine. These types of beverages are popular among college students, and having a laboratory experiment that involves testing energy drinks is useful to engage student interest. Towards that end we have developed an experiment suitable for a junior or senior level analytical chemistry course such as instrumental analysis in which students will analyze the amount of caffeine and other additives in energy drinks using solid phase extraction and high performance liquid chromatography.

158 Computer Science

THE REHABILITATION PROFESSIONALS' UTILIZATION OF THE NINTENDO WII AS A THERAPEUTIC MODALITY BY SURVEY

Steven Miller Jr.* and Carol Luckhradt Redfield, Ph.D., St. Mary's University, San Antonio, TX.

In the early 1980's, researchers began finding evidence to suggest the use of video games in patients' rehabilitation sessions. The Nintendo Wii is currently used in rehabilitation sessions as reported in mainstream media. However, there is little evidence of scientific studies having been performed. The purposes of a survey reported in this presentation is to identify what percentage of rehabilitation professionals in the city of San Antonio, Texas and surrounding areas are using the Nintendo Wii as a therapeutic modality, find common trends in the therapeutic usage of the Nintendo Wii by rehabilitation professionals, and determine what characteristics of the Nintendo Wii and its games rehabilitation professionals view as being important. Data will be collected in form of two surveys. The initial survey is to determine if the Nintendo Wii is being used in therapy. The second survey will be follow up questions on why the Nintendo Wii is used or not used as well as how and what patient populations are being used. From the preliminary findings of the surveys and in literature, the presenters will provide evidence on the utilization of the Nintendo Wii in rehabilitation settings with more specifics on patient population along with a list of the important characteristics found in the Nintendo Wii and its games to support rehabilitation modality use.

140 Computer Science

OPTICAL LITHOGRAPHY ON 3D SURFACES

Daniel Palmer*, Patrick Read, Dan E. Tamir, Conrad Newton, Wilhelmus J. Geerts, Texas State University-San Marcos

Only a few studies of optical lithography on non-flat substrates have been pursued. Most of these systems work on polished, very well defined, substrates. For example, Ball Semiconductor developed a system for projection lithography on polished spherical balls of 1 mm diameter. Based on a project that provides Physics students with a usable graphical user interface (GUI) to a lithography laser writer and improves the quality of a "pixel" generated by the writer, we propose a system that works on arbitrary surfaces and enables lithography on a wide variety of substrates including wings of insects and single crystalline grain of ceramic samples.

191 Computer Science

REMOTE ACCESS PROCESS FOR INTERNATIONAL PARTNERS

Demetrius Powell*, Space and Engineering Science Internship Program (SESIP), Texas Southern University, Houston, TX and Teresa McCoy, NASA-Johnson Space Center, Information Technology Security Team, Houston, TX

The focus of this project was to create and implement an automated and highly integrated website system for NASA's International Partners to gain remote access to NASA resources. Additionally, the new Homeland Security Directives (HSPD-12) had to be integrated into the authorization process. HSPD-12 is a set of directives dealing with homeland security, identification fraud, information tampering, and it is further managed by the Department of Commerce. This project included assessment of end-users needs, coordination of the NASA departments that managed the desired resources, coordination of existing databases and systems, development of streamline process, and finally the creation of the website. This website is currently being used by every International Partner of NASA.

112 Computer Science

THE EFFECTS OF EFFICIENT CPU SCHEDULING ON THE POWER CONSUMPTION OF MOTES

Jay Blanco, St. Edward's University, Austin, TX

Motes are tiny computers with wireless capabilities and environmental sensors (thermometers, microphones, light sensors, etc...) designed to be operated in remote and hard to reach locations. Since motes are operated by battery, power efficiency is a major obstacle to overcome for their widespread adoption. The motes studied in this project all used an open source operating system called TinyOS. TinyOS turns off hardware components when no tasks need to be executed. The default task scheduler for TinyOS is a simple FIFO queue with no priorities given to different types of tasks. This project altered the priority scheme of the scheduling algorithm by giving a higher scheduling priority to tasks that use more power (e.g. the radio). Testing for power efficiency consisted of running a test application with different schedulers and timing how long the motes ran. In this study, changes to the scheduling algorithm appeared to have a negligible effect on overall power consumption.

126 Computer Science

STEALTHY IP PREFIX HIJACKING: DON'T BITE OFF MORE THAN YOU CAN CHEW

Christian McArthur*, Texas A&M University and Mina S. Guirguis, Texas State University-San Marcos

Communications on the Internet traverse a number of networks, or autonomous systems (ASes), before reaching their intended destination. Routers at the edges of these ASes trade information that determines the best way to direct Internet communications between different networks. In prefix hijacking, an AS advertises routes for prefixes that are owned by another AS, and ends up hijacking traffic that is intended for the owner. While misconfiguration and/or misunderstandings of policies are the likely reasons behind the majority of those incidents, malicious incidents have also been reported (and are alarming!). Recent works have focused on malicious scenarios that aim to maximize the amount of hijacked traffic from all ASes, without considering scenarios where the attacker is aiming to avoid detection. In my presentation, I will describe a class of prefix hijacking that is stealthy in nature. The idea is to craft path(s) – of tunable lengths – that deceive only a small subset of ASes. By finely tuning the degree to which ASes are effected, the attacker can handle the amount of hijacked traffic received while the victim AS would not observe a major reduction in its incoming traffic that would raise an alarm. Demonstration of the effects of these attacks via simulations based upon real BGP Internet announcements will be discussed. Finally, I will present a defense mechanism for making it harder for stealthy prefix hijacking attacks to evade detection.

207 Computer Science

SOFTWARE DESIGN BY SPREADSHEET PROTOTYPING: AUTOCORRELATION OF CARDIAC PERIOD AS A MEASURE OF HEART RATE VARIABILITY

John A. Ward*, Department of Clinical Investigation, Brooke Army Medical Center, Fort Sam Houston, TX

Heart rate variability has been shown to vary between normal subjects and those with cardiovascular disease. Autocorrelation of cardiac period as a measure of heart rate variability was described by Zochowski in 1997. In this study, a graphical analysis of the autocorrelation algorithm was performed in an Excel spreadsheet using data from an NIH sponsored online archive of physiologic data, Physiobank (<http://www.physionet.org/physiobank/>). The algorithm was modified and programmed in Pascal. Stepwise adjustment of the spreadsheet and the Pascal program was performed until their outputs matched. On a normal test waveform the root mean square errors between the spreadsheet and the program were 0.044, 0.022, 0.015 and 0.014 for sample sizes of 10, 20, 50 and 100 cardiac periods within 100 sample buffers, respectively. Spreadsheet prototyping facilitates the development of waveform analysis software by taking advantage of the speed and graphical capability of the spreadsheet and serves as platform for verification of the output of the computer program.

240 Computer Science

KEPLER-DISCOVERY: AN OPEN SOURCE CYBER-LEARNING RESOURCE FOR AP ENVIRONMENTAL SCIENCE

Anne Ngu*, Sandra West, Texas State University-San Marcos

Kepler is a popular open source computer application used by professional researchers for collaborative analysis of scientific data and automation of scientific data and automation of scientific processes. Kepler-Discovery (KD) is a project that will allow student to access the latest scientific data and tools from scientists in the field. The software package can be installed at a high school and accessed by students and teachers from anywhere for creating, running and sharing workflows. This approach incorporates several science teaching strategies shown by meta-analysis to be particularly effective. In particular, the strategy of including an “enhanced context” (Effect Size 1.5) in the student investigations involves students collecting data from natural phenomena and available on the internet. KD also incorporates other research proven science teaching strategies, Cooperative Learning (ES 1.0) and Inquiry (ES 0.8). We will demonstrate a sample of a Kepler workflow and how this valuable resource can be made available to high school science students.

155 Conservation Ecology

AUDUBON TEXAS IMPORTANT BIRD AREAS: STATUS AND TRENDS

Andrew C. Kasner*, Audubon Texas, San Antonio, TX

Audubon's Important Bird Areas (IBA) Program seeks to identify and protect sites with important habitat for the conservation of birds at all scales of population. This paper reports on the IBA process and the inventory of IBAs in Texas. Status, trends, and threats to bird populations at select sites throughout the state are included in assessment of IBAs. Furthermore, important strides are being made to identify IBAs on private lands via partnerships with landowners and numerous potential sites around the state are in the nomination process. Finally, conservation partnerships with local chapters and other organizations, municipalities, etc. are critical to the successful protection of Important Bird Areas.

229 Conservation Ecology

EFFECTS OF CARBON DIOXIDE ON THREE SPECIES OF MILKWEED AND MONARCH BUTTERFLY LARVAE

Terri Matiella*, Janis K. Bush, Department of Biology, University of Texas at San Antonio, San Antonio, TX

The effects of three levels of carbon dioxide (subambient, ambient, and elevated) on the growth of three species of milkweed (Asclepiadaceae) and monarch butterfly larvae (*Danaus plexippus*) were examined. Plants were grown under varying carbon dioxide levels for eight weeks and various growth parameters were measured. Larvae were given a choice of either plants grown at subambient, ambient, or elevated, and preference was determined. No significant differences were found in the plant growth parameters for *Asclepias asperula* (antelope horn milkweed) or *A. tuberosa* (butterfly milkweed) across the carbon dioxide treatments. *Asclepias syriaca* (common milkweed) had a significantly greater number of branches in the elevated treatment (12) compared to the ambient (1) and subambient (3). *Asclepias syriaca* branch height was 26.3 cm in the subambient, which was not significantly different than ambient (23.9 cm), but was significantly greater than the elevated (16.5 cm). The larvae did not show preferences for leaf tissue across carbon dioxide levels, but did show a preference for species. The larvae preferred *A. asperula* or *A. syriaca* over *A. tuberosa*. Additional studies may be needed to determine if global changes in carbon dioxide will affect the interactions between milkweed and monarch butterfly.

217 Conservation Ecology

IDENTIFICATION OF TEXAS BUFONIDS USING MITOCHONDRIAL MARKERS.

Diana J. McHenry*, University of Missouri-Columbia, and Michael R. J. Forstner, Texas State University-San Marcos, TX.

Eleven species of Bufonids are found in the state of Texas. Some species are detected only when chorusing, and breeding may occur during ephemeral and unpredictable environmental conditions. Hence, many adults are observable only for short periods of time. Bufonids are available for longer as eggs, tadpoles, and toadlets, but during these life stages, species are much more difficult to discern from one another. We have developed a set of mitochondrial markers that distinguish most Texas Bufonids from one another. Relationships in the *americanus-woodhousii* clade remain difficult to tease apart using mitochondrial data alone. We also discuss field identification of toadlets for Houston toads versus Coastal Plain toads.

65 Conservation Ecology

INVESTIGATING THE IMPACT OF URBANIZATION ON ORNATE BOX TURTLES (*TERRAPENE ORNATA*)

James C. Cureton II*, Christopher P. Randle, William I. Lutterschmidt, and Raelynn Deaton; Sam Houston State University

Habitat fragmentation can have devastating effects on the persistence of a population including reducing population sizes, altering population dynamics, and reducing genetic diversity. Maintaining genetic variation within a population is important because it is an indicator of a population's potential to respond to diseases, pollution, or stochastic factors. A large-scale decline in North American box turtle populations has been attributed to urbanization and road mortality; however, there is no empirical evidence to support this assumption. Moreover, no studies have gathered baseline levels of genetic variation in natural populations. Using microsatellite markers (rapidly evolving tandem repeats in the eukaryotic genome), I will investigate levels of genetic diversity and gene flow in two natural regions and one urban-prone region of *Terrapene ornata*. I will use a paired design that will allow me to measure gene flow between populations separated by various road types (i.e. 4-lane highways, county roads, etc.). Additionally, I will collect road-mortality data to determine if road-mortality is significantly

contributing to their decline. This comprehensive study is essential to the future of this species because no empirical data has been collected on box turtle movement in urban-prone populations. If genetic measures (e.g., inbreeding level) in the urban-prone populations are similar to those of small, declining populations, then this study will be the first step in the development of a conservation plan as stated by Texas Parks and Wildlife's Comprehensive Wildlife Strategy (2005). In addition, the road-mortality data we collect can be used to develop proper management techniques.

222 Conservation Ecology

PREDATION ON ARTIFICIAL NESTS IN URBAN AND NATURAL ENVIRONMENTS

Anne-Marie Prouty* and Diane Neudorf, Sam Houston State University, Huntsville, TX.

Nest predation is the leading cause of reproductive failure in songbird species. Habitat changes, such as urbanization, may result in higher nest predation due to the loss of nesting habitat, as well as an increase in urban-adapted predators. We studied nest predation on artificial nests in two habitats in east Texas using time-lapse infrared video camera systems. One habitat was a residential neighborhood consisting of large yards with many older trees and shrubs in the city of Huntsville, Walker County, Texas, while the other was a 100 ha tract of pines and hardwood forest adjacent to the Sam Houston National Forest. We hypothesized that predator species would differ in the two habitat types and that depredation would occur at a higher rate in the urban area than in the natural area. We found a significantly higher predation rate in the urban habitat as predicted. Via video surveillance, several taxa of nest predators were identified visiting depredated nests. Knowledge of how nest predation varies according to region and habitat is important to the conservation of songbird species.

262 Conservation Ecology

SEASONAL VARIATION IN THE DETECTION OF BATRACHOCHYTRIUM DENDROBATIDIS IN A TEXAS POPULATION OF BLANCHARD'S CRICKET FROG (ACRIS CREPITANS BLANCHARDI)

James P. Gaertner*, Michele A. Gaston, Dana Spontak, Michael R.J. Forstner, Dittmar Hahn: Department of Biology, Texas State University - San Marcos, TX

A population of Blanchard's cricket frogs (*Acris crepitans blanchardi*) located at the headwaters of Barton Creek near Dripping Springs, Texas, was tested for *Batrachochytrium dendrobatidis* (Chytrid fungus) in May and July, 2008. Both sampling times differed from each other in mean temperature and total precipitation of the 14 days preceding each sampling effort with 24°C and 3.84 cm for 18 May 2008, and 30°C and < 0.2 cm for 18 July 2008, respectively. In May, nested PCR detected *B. dendrobatidis* on 83% of the toe samples of 30 individuals while none of the toes of 27 individuals collected in July tested positive for *B. dendrobatidis*. These individuals included one recapture identified by a unique toe clipping method that had tested positive for *B. dendrobatidis* in May. These results confirm seasonal variation of infection by *B. dendrobatidis* and suggest that environmental conditions such as temperature or water availability might impact infection on anurans in the wild.

72 Conservation Ecology

THE MILLENNIUM SEED BANK PROJECT: A GLOBAL PLANT CONSERVATION INITIATIVE

F.M. Oxley*, Michael L. Eason, and Minnette Marr, Lady Bird Johnson Wildflower Center at the University of Texas at Austin

The Millennium Seed Bank Project (MSBP) is a proactive, global conservation effort aimed at conserving 24,000 threatened plant species by the year 2010. Working with partners from around the world, the MSBP identifies and collects seeds of targeted species that can be used in research and restoration projects, have potential food and medicinal value, relatives that are agriculturally important, or cultural significance for native peoples. This is a comprehensive, multi-year, collaborative project that involves many countries, governmental agencies, and non-governmental organizations working together to collect and bank seeds as a hedge against potential extinction in the wild. The Lady Bird Johnson Wildflower Center is a Millennium Seed Bank Project partner with a commitment to collecting and storing the flora of Texas. To date, the Center has collected the seeds of more than 600 species across Texas.

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REINTRODUCTION EFFORTS FOR THE RIO GRANDE SILVERY MINNOW INTO THE BIG BEND REGION OF TEXAS

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The Rio Grande silvery minnow (*Hybognathus amarus*) is one of the most endangered fishes in North America and was first listed as an endangered species in 1994. Originally inhabiting the Rio Grande from Española, New Mexico to the mouth of the river, the species is currently found in approximately 5% of its former range in central New Mexico. The Recovery Plan for the species recommended that it be reintroduced into portions of its former range. After a 4-year process began in 2004, the first experimental reintroduction of the species was approved and undertaken in December 2008. More than 400,000 minnows were released at four sites in the Big Bend region. Aspects of the government approval process, the reintroduction

efforts and future monitoring plans are discussed.

P131 Conservation Ecology

EFFECT OF PRESCRIBED BURNING FOR MANAGEMENT OF THE RED-COCKADED WOODPECKER ON THE AVIAN COMMUNITY IN THE SAM HOUSTON NATIONAL FOREST.

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In the past century there has been a drastic change in vegetation due to fire suppression in the southern pine ecosystem, which has had negative impacts on many avian species. In particular, the red-cockaded woodpecker (*Picoides borealis*) was affected so severely it was placed on the endangered species list. The U.S. Forest Service actively manages red-cockaded woodpecker habitat in the Sam Houston National Forest by prescribed burning and mechanical removal of understory. We are investigating the effects of three prescribed burning regimes on the avian community. Avian species richness, diversity, and abundance will be documented in areas burned every 1 to 3 years, 3 to 5 years and in areas not burned for over 10 years, through year-round point count surveys. We will document how burning impacts the community and the significance of these habitats for resident and migrant species.

150 Environmental Science

DETERMINATION OF PESTICIDE RESIDUES IN THE AIR AROUND PESTICIDE FACTORIES

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The present study deals with the detection of pesticide residues in the ambient air around 2 factories specializing in manufacturing pesticides that were observed during preparation for this research. The pesticide factories located in Damam and Riyadh are among the locations where workers and the people working around them are exposed to the residues of pesticides and their additive chemicals. Air samples were collected 50 and 100 meters from the factories' borders using a universal sample pump of the American company SKC. Extracts of air samples collected in the XAD-2 tube were injected in a gas chromatography of nitrogen phosphorus detector and electron capture detector (GC/NPD-ECD). The results were confirmed by means of gas chromatography with mass spectrometer detection (GC/MS). The results from this research showed the concentration of 5 pesticide residues, namely Chlorpyrifos, α -Endosulfan, β -Endosulfan, Dimethoate and Diazinon, in different air samples. Some of pesticide residues detected in the air around the factories under this investigation were below the MRLs reported by WHO/Codex, OSHA and NIOSH in the air of industrial areas.

202 Environmental Science

HAIR AS AN INDICATOR OF EXPOSURE TO PESTICIDES

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Environmental toxicants such as pesticides pose a significant risk to human health. Most pesticides are persistent organic compounds, and many are ubiquitous in our environment. They are used daily in our homes, work places, and school environments. Pesticides are used extensively and are found in air, water, soil, food sources, and biological materials. Therefore, analysis of pesticides as a biomarker is relevant and is needed for assessment of exposure. Analyses of pesticides in biological samples such as blood and urine have limitations, for these methods are invasive and non-cumulative. Hair can accumulate pesticides, and, because of the ease of sampling, hair can provide a convenient biomarker for analysis of pesticides and pesticide exposure. This study consists of developing an effective and sensitive method for extracting and determining pesticides from hair using gas chromatography with electron capture detector (GC-ECD).

105 Environmental Science

OXIDATIVE STRESS IN THE SEAGRASS THALASSIA TESTUDINUM INDUCED BY LOWERED SALINITY USING SIMULATED AND NATURAL HURRICANES

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Thalassia testudinum is one of the more common seagrasses found in the Gulf of Mexico, however there is little research on quantifying stress in this species. The goal of this study was to measure oxidative stress induced by lowered salinity in *T. testudinum* plants. Oxidative stress was measured using various biochemical assays including; lipid peroxidation (TBARS), protein carbonylation (PCarb), and an enzymatic assay, catalase (CAT). Salinity treatments (35, 14 and 7 ppt) were applied to *T. testudinum* plants for 21 days in aquarium tanks. Seagrass shoots were harvested at 0, 7, 14, and 21 days and the stress quantified using the above assays. TBARS and PCarb assays indicated no increased stress with reduced salinity, however, plants in 7 ppt tanks were senescing after 21 days and this appeared to affect the CAT assay causing a drop in CAT activity. Hurricane Dolly caused widespread salinity reduction in the Lower Laguna Madre on 24 July 2008. *T. testudinum* shoots were collected on August 6 along a natural salinity gradient (10 to 33 ppt) and analyzed using the above assays. CAT assay

of the field samples indicated increased stress at lowered salinity, while the PCarb assay showed no effect. In moderately stressed plants, the TBARS assay showed an increase in lipid peroxidation but severe stress (senescence?) reduced the amount of lipid peroxides which led to a decrease in the assay. Reduced salinity stress response in seagrass is likely a combination of the severity and duration of salinity reduction.

242 Environmental Science

LOCAL ADAPTATIONS OF MARINE STREPTOMYCES FROM THE LOWER LAGUNA MADRE

Luis E. Espinoza*, Kristine L. Lowe and Anita L. Davelos Baines; University of Texas - Pan American

One hundred thirty-five Streptomyces strains were isolated from three sites (45 isolates/site) in the Lower Laguna Madre designated SB, LMT051, and ABC. ABC and LMT051 sites were close together spatially, while SB was distally located to the other sites. Strains were grown at several salt concentrations and pH values to assess their tolerance to these environmental variables. All isolates grew at 0, 15, and 30 ppt NaCl, and most grew at 40 ppt NaCl. All isolated Streptomyces grew best at pH 7.5 or 8.0. Additionally, 45 isolates (15 per site) were chosen at random for substrate utilization testing using BIOLOGTM microplates. The average number of utilized substrates and total activity (total number of substrates used by isolate) were determined. Based on measures, isolates were grouped into 4 categories: high substrate utilization and high activity (G1), low substrate utilization and high activity (G2), high substrate utilization and low activity (G3), and low substrate utilization and low activity (G4). Generally, isolates from site SB clustered in G1 and G4; isolates from LMT051 clustered in G1 and isolates from ABC clustered in G2 and G4. These isolates were also tested using an inhibitory assay to estimate if resource partitioning or competition was a survival strategy. Most inhibition occurred between SB isolates vs. isolates from LMT051 and within SB isolates. Streptomyces-specific primers were used to amplify the 16S rDNA from all isolates. PCR products were sequenced to identify species and/or strains. This research adds knowledge regarding marine Streptomyces from an environment not studied greatly.

145 Environmental Science

TRACE METAL ANALYSIS OF PRIMARY TEETH AS AN ENVIRONMENTAL INDICATOR USING INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY (ICP-MS)

Claudette Johnson*, Chelsea Harris, Christopher Stevenson, Bobby L. Wilson, Renard L. Thomas

Abstract Numerous independent studies have identified the existence of trace metals sequestered within collected teeth of adults and children. A quantification of these metals could possibly serve as an indicator of prolonged exposure to such materials due to environmental pollution and/or dietary habits. Quantified amounts of lead are of particular interest. A comparative study of the levels of trace metals with the correlated demographics and geographies of the sample sources will provide valuable information about which urban areas are affected by trace metals and/or what cultural groups are exposed more frequently to significant levels of trace metals. Deciduous and adult teeth were collected from a variety of dental office locations, cataloged, and prepared for sample analysis with the Inductively Coupled Plasma Mass Spectrometer (ICP-MS). The calculated concentrations of target trace metals are: aluminum ranged from 7.676 ug/g tooth to 653.2 ug/g tooth, titanium ranged from 5.992 mg/g tooth to 13.77 mg/g tooth, chromium ranged from 18.45 ng/g tooth to 3619 ng/g tooth, manganese ranged from 16.93 ng/g tooth to 1236 ng/g tooth, and copper ranged from 56.65 ng/g tooth to 312.6 ug/g tooth. The ranges for lead (206), lead 207, and lead (208) were 2.74 ng/g tooth to 17.19 ug/g tooth, 39.53 ng/g tooth to 16.95 ug/g tooth, and 9.471 ng/g tooth to 17.41 ug/g tooth, respectively.

220 Environmental Science

MILBY PARK COMMUNITY: POTENTIAL EXPOSURE TO ELEVATED LEVELS OF 1,3- BUTADIENE MAY CAUSE HIGHER RISKS FOR DEVELOPING ADVERSE BIOLOGICAL EFFECTS

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Statistics show that in 2004 the largest amount of 1,3-butadiene released in the U.S. occurred in the Milby Park community of Houston, Texas, with a concentration of 4 ppb (Clements et. al., 2006). Previous studies suggest that many drugs and environmental agents with this concentration can cause DNA damage (Shuga, 2007). The purpose of this research study is to better understand what biological adverse effects 1,3-butadiene might have on potentially exposed residents living in the Milby Park community between the years 2001-2006. This study uses a controlled environment to treat in vitro human lung cells with 1,3-butadiene. The cell line is exposed to doses similar to those experienced by individuals living in the Milby Park community between the years 2001- 2006 over a 24-hour period. After 24 hours of exposure, each sample will be carefully analyzed for cell viability, apoptosis and cell cycle interruption to determine if there are any occurrences of DNA damage. Any effects will be analyzed using flow cytometry. Data collected will allow researchers to determine whether or not potential exposure to elevated levels of 1,3-butadiene may have put the Milby Park community at higher risk for developing adverse effects caused by DNA damage. This research may lead to improved air quality in the Milby Park community and the development of strategies to avoid over exposure to 1,3-butadiene that could possibly cause irreversible health effects.

139 **Environmental Science****THE APPLICATION OF PULSED FIELD GEL ELECTROPHORESIS TO DETERMINE SOURCES OF FECAL CONTAMINATION IN MISSION AND ARANSAS RIVERS, TEXAS**

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Fecal contamination of water resources is a major hazard to water quality and is the most widespread source of pollutants in surface waters. Human exposure to fecal contamination of recreational waters can result in illness. Fecal contamination can force the closure of recreational waters, thus, impacting the economy. The 2004 Texas Water Quality Inventory and 303(d) list designated the tidal portions of the Mission and Aransas Rivers in southeast Texas as impaired for bacteria non-point sources and not meeting water quality standards. These waters flow into Copano Bay where important oyster harvesting beds are located, which are frequently closed due to high levels of fecal contamination. The purpose of this study was to determine the source of unknown *Escherichia coli* isolated from these waters using the DNA fingerprinting method of pulsed-field gel electrophoresis (PFGE). A known source library including *E. coli* isolates from cow, duck, human, feral hog, and horse was developed to compare unknown isolate DNA banding patterns using an algorithm. Analysis of PFGE revealed that sources of fecal pollution included human as the largest source contributor followed by duck, horse, and cow. Feral hog was not a significant contributor to fecal pollution, though a larger known source library would confirm this. The PFGE method is extremely sensitive to genetic differences and has been successful in assessing sources of fecal contamination in the Mission and Aransas Rivers, Texas.

302 **Environmental Science****THE USE OF MICROBIAL CELL TO CELL COMMUNICATION AND QUORUM SENSING FOR CONTROLLING MICROORGANISMS.**

Mahmoud Saleh*, Jim Briggs, Fawzia Abdel-Rahman and Olufisayo Jejelowo, Texas Southern University

Many plant pathogens are continuously developing resistance to commercial chemical pesticides, which may seriously hinder the management of diseases and agricultural production. Therefore, there is a continuous need for alternative agents for the management of pathogenic bacteria and fungi. Biofilm, a common mode of microbial growth, consists of colonies of microbial cells encased in self-produced, organized layers. Biofilms are highly resistant to commonly-used pesticides. Biofilm formation is initiated by diffusible signaling molecules that accumulate in the extracellular environment and are essential for quorum requirements. When a signal reaches a threshold concentration, the response regulator is activated within the local population of cells, leading to biofilm formation. Acyl homoserine lactones, cyclic peptides and the sesquiterpene farnesol are known to act as quorum sensing molecules in gram negative and gram positive bacteria and in fungi. The utilization of quorum sensing molecules for controlling the microbial population and preventing biofilm formation will be presented. The study will also show chemical structural requirements and quantitative structural activity relationships that enhance the selectivity and the potency of the target chemicals.

P184 **Environmental Science****A GEOCHEMICAL COMPARISON OF DEEP GEOLOGIC RADIOACTIVE WASTE SITES**

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A geochemical comparison of three transuranic waste sites in the United States, France, and Sweden will be discussed and compared with regard to depository host material, waste material, and methods of disposal. With an increased need for nuclear fuel and the recent retirement and disposal of nuclear weapons, proper permanent treatment of the spent transuranic waste is necessary. The WIPP site (Waste Isolation Pilot Plant) is located in southeastern New Mexico, 41.8 km (26 miles) east of Carlsbad, and utilizes thick layers of salt within the Salado Formation to contain radioactive waste. In France, the Meuse Haute-Marne in the Paris Basin has been proposed as a radioactive waste site and would utilize very thick clay layers found deep under the surface to contain the waste. Sweden is taking advantage of granite bed-rock, found 503 meters (1,650 feet) below the surface in three different cities: Osthrammar, Oskarshamn, and Tierp, in order to store transuranic waste produced by nuclear reactors.

P250 **Environmental Science****CHARACTERIZATION AND ANTIMICROBIAL ACTIVITY OF PIGMENTS PRODUCED FROM STREPTOMYCES CULTURES OF THE LOWER LAGUNA MADRE**

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Within the Domain Bacteria is the phylum Actinobacteria, which contains high G+C Gram-positive microorganisms including the genus *Streptomyces*. Significant interest has been placed on the Actinobacteria, and more specifically *Streptomyces*, due to their ability to produce about seventy percent of the world's naturally occurring antibiotics. In a previous study, *Streptomyces* taken from the Laguna Madre were observed to produce a variety of colored pigments when grown in the laboratory. The purpose of this research was to assess the chemical properties of the pigments produced by the Laguna Madre *Streptomyces* isolates using Thin Layer Chromatography (TLC) and to determine whether they exhibited antimicrobial or antibiotic properties. Results showed that the crude pigment extracts contained several organic molecules when the TLC plates were viewed with UV light or stained with bromocresol green dye. Further characterization of the extracts into specific organic groups (i.e., sugars, steroids, phenols, esters) was determined by staining the TLC plates with dyes specific for those organic groups. We are currently assessing the inhibitory properties of the pigments by spotting the extracts or plating the isolates alongside different bacterial and fungal reference strains to observe any inhibition of growth. We seek to determine if *Streptomyces* isolates from the Laguna Madre produce secondary metabolites in the form of pigments that have the ability to inhibit growth of various problematic bacteria and fungi. Given that *Streptomyces* produce secondary metabolites in nature to gain an advantage over their competitors, there is a strong likelihood that some of the Laguna Madre isolates will produce compounds that are inhibitory to other microbes.

P102 Environmental Science

INVESTIGATING HEAVY METAL TOLERANCE IN BRASSICACEAE PLANT SPECIES

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Heavy metals present in the environment can cause toxicity to plants via several mechanisms such as the disruption of cellular ion balance, substitution for natural metal centers in the catalytic sites of enzymes and the generation of reactive oxygen intermediates (ROIs). Heavy metals are toxic to most plants, but a subset of plants exists that can tolerate and even thrive in heavy metal rich environments. These are known as hyperaccumulator plant species and these plants have a variety of adaptive mechanisms to tolerate heavy metal toxicity. One possible adaptive mechanism is the increased tolerance to oxidative stress induced by the heavy metals. In this study, members of the Brassicaceae plant family will be exposed to the heavy metal nickel and their response to the resulting oxidative stress measured. Two biochemical assays that will be employed are the thiobarbituric acid reactive substances (TBARS) and the protein carbonylation (PCarb) assays which will detect the physical effects of oxidative stress via lipid peroxidation, and protein carbonylation, respectively. Additionally, assays that measure the plant's enzymatic response to the oxidative stress (OSR enzymes) will be performed to monitor the level of the activity of the OSR enzymes Superoxide Dismutase (SOD), Catalase (CAT), Glutathione Peroxidase (GPX) and Glutathione Reductase (GR). If there is a difference identified in the OSR between hyperaccumulators and non-accumulators, this difference may be exploited to be used as a guide for the genetic engineering of plants that could be used in the phytoremediation of heavy metals in the environment.

P169 Environmental Science

CHARACTERIZATION OF ORGANIC COMPOUNDS IN THE EFFLUENT OF WASTE WATER TREATMENT PLANTS

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Given the number of pharmaceuticals, steroids and other organic compounds that make their way into wastewater, there is great concern about how well wastewater treatment plants process raw sewage into effluent that is returned to the ecosystem. The importance of ensuring that wastewater is sufficiently sanitized is imperative to ensuring clean surface water. This study was conducted to detect and characterize organic compounds in the effluent of 69th street Wastewater Treatment Plant in comparison with a previous study that detected the presence of estrogen contaminants in Sims South WTP and Southwest WTP. High Performance Liquid Chromatography was used to analyze the components of the samples gathered. Based on our results, three estrogen contaminants (Estradiol, Estriol, and Ethinyl Estradiol) were detected in the effluent of 69th Street WTP at the ppb level. There were also other numerous unidentified compounds presents in the sample. The characterization of these unknown organic compounds will aid in the development of new standards to measure the cleanliness of water to minimize the adverse impact on the environment.

P280 Environmental Science

HEMATOTOXICITY OF METHACRYLONTRILE IN MALE SPRAGUE-DAWLEY RATS

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Methacrylonitrile [MeAN, $\text{CH}_2=\text{C}(\text{CH}_3)\text{CN}$] is an industrial monomer widely used in the production of plastic elastomers and coatings. It is also used in the preparation of acids, amides, amines, esters and nitriles. MeAN is highly toxic in mice, rats and rabbits by dermal, respiratory and oral routes. It liberates cyanide ions in the blood of rats, mice and rabbits, and its effects are diminished by standard therapy for cyanide poisoning. We have studied the effect of MeAN on blood of male Sprague-Dawley rats. Groups of rats (five each) were treated with 25% LD50 dose of MeAN dissolved in 0.2 ml safflower oil in one single oral dose. The control rats received only 0.2 ml safflower oil. The rats were observed for visible signs of MeAN toxicity and were sacrificed in groups of five at 0, 1, 2 and 7 days after the MeAN treatment. The hematocrit, erythrocyte count, hemoglobin content and binding of MeAN to globin molecules were determined. The hematocrit of rats treated with MeAN showed a decrease of 15-20% on days 1 and 2, which returned to normal in a week. Erythrocyte counts were reduced to 70-75% in control rats on days 1 and 2 and remained lower even after 7 days. Similarly, the hemoglobin levels of rats treated with MeAN were less than 80% of control rats. The highest binding of MeAN to globin molecules was at day 1 and decreased significantly by day 7. These data show that MeAN significantly affected the blood components of treated rats, suggesting detrimental effect on functions of blood.

P192 Environmental Science

SELECT HERBICIDES AND THEIR EFFECTS ON GROWTH, DEVELOPMENT, AND ACTIVITY LEVEL OF RANA CATESBEIANA TADPOLES

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Bullfrogs (*Rana catesbeiana*), which have a habitat that ranges across most of the continental United States, are important to many ecosystems. Recent studies of amphibian populations have shown a decline in the number of frogs found in and around bodies of water. It has been suggested that the use of herbicides in large quantities for agricultural purposes has contributed to this decline in amphibian population. To address this question, three desert-use household pre-emergent herbicides were tested at known environmental concentrations to ascertain their effects on growth, development and activity level of bullfrog tadpoles. The herbicides, each containing the active ingredients trifluralin, isoxaben, or benefin plus oryzalin, were diluted to concentrations of .05mg/L and .1mg/L, thus, forming the six treatment groups. Five bullfrog tadpoles were placed in each treatment group for two months. Tadpoles were massed weekly to determine the rate of their growth and development as well as prodded daily to test normal response to stimulus. A preliminary trial of this experiment was canceled due to fungal infection, but interesting data was still collected. For example, more tadpoles died in the experimentally stressed groups than in the control group. A new replicate of this experiment will be undertaken with an antifungal to compensate for potential fungal presence in the laboratory. We predict that the experimentally stressed tadpoles will have a slower rate of growth and development, lower activity level with a subnormal response to stimulus, and a higher death rate than the control group.

P209 Environmental Science

THE EFFECT OF OXYGENATION ON SURVIVAL OF THE FATHEAD MINNOW (PIMEPHALES PROMELAS) UPON EXPOSURE TO WEED-B-GON® MAX

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The release of commercial herbicides into the environment can have detrimental effects on aquatic life. This study analyzes the acute effects of different concentrations of the herbicide Weed-B-Gon® MAX on the fathead minnow (*Pimephales promelas*). Serial dilutions were done to determine a range of concentrations that would include the LD50 at 24, 48, and 96 hours under both aerated and non-aerated conditions. Since Weed-B-Gon® MAX is a formulation, one of the components, mecoprop-p, was used to calculate active concentration. A series of six aerated tanks was set up with concentrations of 0, 10, 20, 40, 80 and 120 ppm of mecoprop-p. These tank concentrations were duplicated under non-oxygenated conditions. The toxicity tests were run in triplicate and the death rate was determined for each condition. The mortality rates in the aerated tanks were then compared to the non-aerated tanks. Analysis of the results using a t-test showed a significant difference in 24-hour mortality rates of the fathead minnow at the intermediate concentrations of 40 and 80 ppm, $p=0.0085$ and 0.0175 , respectively. Similar results were obtained at 48 and 96 hours. This data suggests that aeration of water during an accidental release of Weed-B-Gon® MAX may ameliorate the acute lethal effects of the herbicide, depending on the concentration released.

P188 Environmental Science

THE ENVIRONMENTAL AND MORPHOLOGICAL IMPACT OF THE ATLAS MINE TAILINGS ALONG THE COLORADO RIVER NEAR MOAB, UTAH

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The Uranium Reduction Company and, later, the Atlas Minerals Corporation operated a uranium mill along the banks of the Colorado River near Moab, Utah. Waste from the mill was slurried into an open, unlined pond on the floodplain of the river until operations ceased in 1984. Today, the Atlas Corporation's uranium tailings pile contains approximately 9.5 million metric tons (10.5 million tons) of uranium mill wastes, including 1,612 million liters (426 million gallons) of highly-contaminated liquid which is seeping from the unlined site. This 53-hectare (130-acre) site is contaminating the groundwater feeding into the Colorado River with radioactive uranium and other toxins. These tailings are currently located about 210-240 meters (700-800 feet) from the Colorado River on the outside of a large meander bend. The migration pattern of this meander is a source of great debate. Current data shows the bank of the river is between 45 to 90 meters (150 to 300 feet) closer to the mill site. The geometry and position of ancient Colorado River gravels buried beneath the surface of the Moab Valley indicate that the river has shifted back and forth across the mill and tailings site in the recent geologic past. Although no contamination has been detected, the proximity of the material to the watershed has been a concern.

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GAMBUSIA SPECIOSA AS A VIABLE SPECIES: A RESOLUTION ON ITS DISTINCTION FROM GAMBUSIA AFFINIS

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Gambusia speciosa, Tex-Mex gambusia, was originally described in 1859 (Girard) from the Rio San Juan in northern Mexico. Because of its morphological similarity to *Gambusia affinis*, western mosquitofish, its validity as a distinct species has been questioned. The latest revision of the genus by Rauchenberger (1989) provisionally treated it as a distinct species pending further investigation. In the nearly twenty years since that report no work on the subject has been published. The present study seeks to resolve the issue by examining gonopodial characteristics of fish from multiple river basins in and adjacent to its believed range in west Texas and Mexico. Using computer software, pictures were taken of gonopodia and a series of morphometric measurements were made on the bony structures that form the individual fin rays of the gonopodium. These data were then analyzed by river basin and site. Although this study is not complete, provisional data indicates that *G. speciosa* is morphologically distinct confirming Rauchenberger's assessment and thus warrants treatment as a full species.

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EFFECTS OF MALE GONOPODIAL LENGTH ON FEMALE MATE CHOICE IN LIVEBEARING COERCIVE MOSQUITOFISH GAMBUSIA AFFINIS

Sarah Sendlebach*, Sam Houston State University, Elizabeth Lamb, University of Miami, Stacy Stoops and Raelynn Deaton, Sam Houston State University

Many livebearing fishes, including the mosquitofishes (Genus *Gambusia*; Family Poeciliidae) reproduce coercively. Males force females to copulate using a modified anal fin (gonopodium). Since copulations are coercive, female mate choice is not always evident. However, Langerhans et al. (2005) showed that female *G. affinis* preferred males with longer and larger (lateral area) gonopodia. Further, their data showed a trade-off between natural and sexual selection in that males with longer gonopodia, although preferred by females, were more susceptible to predation. However, the Langerhans et al. (2005) study used video imaging only for their measures of female choice. Herein, we tested the hypothesis that male gonopodial length influences female mate choice in live mosquitofish. We aimed to replicate a portion of Langerhans et al. (2005) using live fishes, rather than video images, to test if female preference for longer gonopodia holds true under more natural conditions. Additionally, we tested a wider range of GL treatments through gonopodial manipulations (shortening and extending). Surgeries resulted in six experimental gonopodial length treatments [-100%, -1/2, -1/4, -0 (no manipulation), sham, and +75%] and two female control treatments (small and large females). Behavioral trials were conducted using a dichotomous choice test with each trial including a focal female and a randomized combination of GL; (e.g. -100% vs. -25%) for all possible combinations. To date, results suggest that females do prefer males with longer gonopodia, verifying Langerhans et al. (2005). These results, along with additional data from dichotomous choice tests, will be presented.

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EFFECT OF GONOPODIAL LENGTH ON MALE MATING SUCCESS IN THE WESTERN MOSQUITOFISH

Alexandria Titlow*, Raelynn Deaton, Sarah Sendlebach, and Stacy Stoops, Sam Houston State University

In livebearing fishes (Family Poeciliidae), males have a modified anal fin (gonopodium) used to transfer sperm, a morphological character thought to be under sexual selection. The livebearing mosquitofishes (*Gambusia*) exhibit a coercive mating system, where males of all sizes force females to mate. Further, males have an elongated gonopodia (relative to some other livebearers) equipped with hooks, barbs and spines. Gonopodial morphology varies significantly both within and between species and is used for taxonomic purposes, but the extent to which structure influences male mating success is unknown. Therefore, we manipulated gonopodia on male western mosquitofish (*G. affinis*) to test the hypothesis that gonopodial length influence male mating success. We predict that males with longer gonopodia have higher mating success, and hooks, barbs and spines play an important, but indirect role in sperm transfer by increasing contact time with females. We

and hooks, bars and spines play an important, but indirect role in sperm transfer by increasing contact time with females. We manipulated male gonopodial length via shortening by -1/4, -1/2, and -100% and lengthening by +75% (plus sham and unmanipulated controls). We also removed terminal hooks and "elbows" from some gonopodia, and reduced lateral area of others, resulting in a total 9 experimental treatments. We measured male and female mating behaviors to test whether gonopodial structure increases successful copulations by males. To date, our results suggest that males with manipulated gonopodia (shortened) mate at rates equal to those of unmanipulated males. However, we do not know if these males can fertilize embryos at equal rates. We will report these data, along with behavioral results from all gonopodial manipulation treatments.

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A COMPARATIVE FIELD STUDY ON MATING BEHAVIORS ACROSS ISOLATED SPRING POPULATIONS OF THE LARGESPRING GAMBUSIA, GAMBUSIA GEISERI

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The Largespring Gambusia, *Gambusia geiseri*, is a livebearing mosquitofish that lives in cool water springs throughout central and west Texas. It was introduced across Texas for mosquito control about 80 years ago, and since that time, several disjunct populations have flourished and persist today. Because these populations have been isolated for a significant time, they provide an excellent opportunity for in situ studies on potential mechanisms of speciation, including morphological, genetic, behavioral, and/or life history divergence. Deaton et al (in prep) have shown significant genetic differentiation across six of these spring populations based on several polymorphic microsatellite loci. These findings suggest potential for further divergence in behavior, population dynamics and/or life history strategies. In this study, we investigated natural mating behaviors across three spring populations in Texas (Comal River, San Marcos River, and Anson Spring) in order to assess potential differences in reproductive behaviors, sex ratios and densities. We used a repeated measures ANOVA experimental design choosing three target groups of fishes within each habitat, observing them (snorkeling observations) every hour for 20 minutes from dawn until dusk. We asked the following questions: (1) are there significant differences in mating behavior across the populations; (2) what are the natural peak mating times for males; (3) are mating differences correlated with predation, environmental conditions, or variations in operational sex ratio (OSR) and/or densities. To date, results show that density varies across springs, but OSR does not. Further, frequency of male mating behaviors does not differ across habitats.

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A CONTEXT-DEPENDENT TROPHIC CASCADE IN A SIMPLE STREAM FOOD WEB

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According to the Fretwell-Oksanen model, in simple food chains regardless of length, top predators (k) and trophic levels $k - 2$, $k - 4$, etc. are food limited; whereas, trophic levels $k - 1$, $k - 3$, etc. are predator limited. Based on this theory, the strength of trophic cascades in 3-tier food chains should be dependent on nutrient availability. Thus, in stream ecosystems, the strength of trophic cascades could depend on community context, because some species in these systems can increase nutrient availability by regulating nutrient flux from the terrestrial landscape. We tested this hypothesis in stream mesocosms using fishes from two functional feeding guilds - a surface feeding insectivore Blackstripe Topminnow, *Fundulus notatus* and a benthic feeding insectivore Weed Shiner, *Notropis texanus*. We predicted that Weed Shiner (a top predator) would consume benthic grazing invertebrates, increasing algae via a trophic cascade, and that Blackstripe Topminnow would consume terrestrial insects, increasing nutrient availability for benthic algae. Thus, we predicted that the magnitude of the Weed Shiner effect on benthic algae would be greater in mesocosms with Blackstripe Topminnow. In general, our data supported our predictions at low (1 fish/m²) and intermediate (2 fish/m²) Weed Shiner densities. However, at the highest Weed Shiner density (4 fish/m²) there was no trophic cascade. This resulted because Weed Shiners physically disturbed the substrate at this high density, reducing benthic algae biomass. These data illustrate that the strength of trophic cascades can depend on interactive effects among taxa, and thus vary under differing community contexts.

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PINK EGGS AND SNAILS: FIELD OVIPOSITION PATTERNS OF *P. INSULARUM* THAT MAY IDENTIFY WETLANDS OR SHALLOW LAKES SUSCEPTIBLE TO INVASION

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Wetlands and shallow lakes are among the world's most threatened ecosystems (Zedler and Kercher 2005). The spread of exotic invasive species represents one of the greatest threats to wetland communities throughout Texas. Aquatic invasive mollusks are some of the most dangerous organisms to wetlands due to their high rates of reproduction and consumption. A recently identified invasive species of applesnail in Texas, *Pomacea insularum*, exhibits these alarming characteristics. As fecundity serves as the best indicator for invasive potential (Keller et al. 2006), understanding *P. insularum*'s reproductive behavior is key to predicting how *P. insularum* will spread within Texas and along the gulf coast. Identification of specific

egg laying trends in *P. insularum* will play a key role in predicting future areas of invasion. Specific characteristics within Texas wetlands and shallow lakes may facilitate the invasion process of *P. insularum* by providing females with beneficial egg laying (ovipositing) conditions. To investigate this possibility, we studied *P. insularum* oviposition behavior in an invasive population found within Armand Bayou Nature Preserve (Houston, Tx). Surveys of ovipositing sites revealed clear egg laying substrate preferences for *P. insularum*. Our results showed that *P. insularum* prefers large aquatic macrophytes as substrates for ovipositing, specifically emergent macrophytes such as *Colocasia esculenta* (i.e. Taro) and that this preference persists across seasons and years. Wetlands and shallow lakes surrounded by large emergent macrophytes likely provide preferred ovipositing sites for *P. insularum* and may possibly facilitate their invasion into new aquatic ecosystems.

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A NEW DESCRIPTIVE STUDY OF THE STRUCTURES OF THE GONOPODIUM OF THE WESTERN MOSQUITOFISH, *GAMBUSIA AFFINIS*

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One important character often used to describe a species is genitalia. In fishes and insects especially, species often are distinguished by the male intromittent organ. In mosquitofish (Genus *Gambusia*), mature males have a modified anal fin (gonopodium) equipped with hooks, elbows and serrae used for sperm transfer. This extension of the fourth and fifth ray of the anal fin has several distinct structures used to define species. While the reason is unknown, two hooks exist at the end of the gonopodium. Upon further investigation, we have found that most individuals actually possess a third terminal hook. Until now, this was an unknown character of the mosquitofish gonopodium, but with advances in microscopy, we are able to detect the third hook and other novel features. For example, the number of serrae, or spines vary from three to seven within a population, some males possess an elbow and others do not, and some males have triple or double serrae while others have single serrae. In order to survey a variety of populations for differences in the gonopodium, we collected mature males from eight populations across Texas. Length and width from 3 structures (hooks, elbows and serrae) were obtained at 900x. Any gonopodium that had extreme abnormalities was fixed so that pictures could be taken with a scanning electron microscope. We determined variation within and between populations of gonopodial structure and frequency of these novel characteristics. We are in the process of collecting additional data and results will be presented.

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AN ANALYSIS OF TIME AND ENVIRONMENTAL CONDITIONS ON PEAK MATING BEHAVIOR IN THE WESTERN MOSQUITOFISH (POECILIIDAE): IT MATTERS WHEN BUT NOT WHERE

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Livebearing fishes (Poeciliidae) are an important model system for research in sexual selection. Most experimental studies in this group are conducted under highly controlled conditions. In poeciliids, it generally is accepted that peak mating times are dawn and dusk, and that mating behaviors under controlled conditions mimic those of the natural environment. However, to our knowledge, neither of these general assumptions have been directly tested in this group. Thus, the purpose of our study is two-fold. First, we investigated mating behaviors in the western mosquitofish (*Gambusia affinis*) every hour from dawn until dusk to determine peak mating times. Second, we conducted our experiment in three different environments [highly controlled laboratory, a semi-natural greenhouse laboratory, and a natural stream (Harmon Creek, Walker Co., Texas)]. Using a repeated measures ANOVA design, we observed mating behaviors of the same male-female dyads from dawn to dusk across all three environments, using light levels and temperature as potential covariates. Although male mating never totally ceased, mating behaviors were consistent from 0730 to 1330 before declining and leveling off at 1430. We found no significant difference in mating behaviors across the three environments, suggesting that mosquitofish behave similarly in controlled conditions as in their natural environment. Further, there was no effect of either light levels or temperature on male mating behavior in our model. These findings may be important for all poeciliid biologists, assuming results hold true across species, and should be considered when conducting research involving mating behaviors of this group.

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DIRECT EFFECTS ON FEMALE FITNESS VIA MALE COERCION IN A LIVE BEARING FISH, *GAMBUSIA AFFINIS*

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We are investigating direct effects on female fitness in the western mosquitofish, *Gambusia affinis*, via male coercive mating. In *Gambusia* males use an elongated, modified anal fin (gonopodium) equipped with hooks and spines to transfer sperm to females. Therefore, we expect this structure to cause significant tissue damage to females susceptible to forced matings. We hypothesize that male coercive mating, coupled with the structure of the male gonopodium will decrease female fitness directly by increasing tissue damage around the female genital area. We have developed a methodology to measure actual physical damage to the female genital region acquired during mating using scanning electron microscopy (SEM). To

date, we have verified that tissue damage does occur via male coercion. Virgin females (those with no contact with males) had lower levels of tissue damage than nonvirgin females (those mated with males). Currently, we are in the process of determining the extent of the tissue damage caused by males, and verifying that the tissue damage actually translates to increased immune response by the females. We will quantify tissue inflammation using two standard cell culture methods for fish. We will measure lactate dehydrogenase (LDH) activity, a stable enzyme in the cytoplasm of all cells released when the plasma membrane is damaged, and transcription of heat shock proteins (HSP's), those made by the cell in response to general cellular stress. If tissue damages causes an immune response by females, this is evidence for decreased female fitness via sexual conflict in a coercive mating system.

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FISH-MEDIATED BOTTOM-UP REGULATION OF SECONDARY PRODUCTION IN STREAM ECOSYSTEMS

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We examined indirect food web interactions between fishes from two common functional feeding guilds - Blackstripe Topminnow (*Fundulus notatus*; a surface-feeding insectivore) and Weed Shiner (*Notropis texanus*; a benthic-feeding insectivore). We predicted that Blackstripe Topminnow would increase growth of Weed Shiner across a range of shiner densities by bottom-up enhancement of benthic food resources (namely algae and grazing invertebrates). As predicted, Blackstripe Topminnow consumed terrestrial insects and reduced the N:P ratio in the watercolumn through a terrestrial nutrient translocation pathway. This resulted in greater benthic invertebrate density and biomass. However, Weed Shiner consumed benthic invertebrates (chironomids), reducing invertebrate density and biomass across shiner treatments. The consumption of this increased food resource resulted in a positive effect on Weed Shiner growth at one shiner density. Specifically, at the lowest shiner density (1 fish/m²) there was no bottom-up effect of Blackstripe Topminnow on Weed Shiner growth. This likely resulted because food was not limiting to Weed Shiners at this low density. At the intermediate density (2 fish/m²), Weed Shiner growth was enhanced by Blackstripe Topminnow. We believe this resulted from differential food limitation resulting from the bottom-up effects of Blackstripe Topminnow. Finally, Weed Shiner growth was not affected by Blackstripe Topminnow at the greatest density (4 fish/m²). This likely resulted from severe food limitation at this high shiner density. Our data illustrate the bottom-up effects of the surface-feeding fish guild might be important for regulating secondary production in consumers within stream ecosystems.

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GREGARINE PARASITISM (APICOMPLEXA: EUGREGARINORIDA) IN CENTRAL TEXAS DRAGONFLIES: HOST, HABITAT, AND TEMPORAL PATTERNS

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Dragonflies frequently carry a burden of gregarine parasites, but the degree of that burden and the relationships among parasite prevalence, load, host gender, time, and environment are not well known. Previous studies report that these parasites are detrimental to a broad spectrum of insect hosts. It is estimated that more than 1 million gregarine species exist, but little is known about their broad impact because relatively few invertebrates have been surveyed for gregarines. In this study, we are surveying dragonfly species common to central Texas for gregarine parasites. Dragonflies are collected weekly using a handheld net along the shoreline of Tradinghouse Creek Reservoir and Battle Lake Reservoir, two primary sites in McLennan County. Netted specimens are taken to the lab within two hours of capture and their abdomens are separated from the thorax and stored in 70% ethanol. To quantify parasite prevalence and load, the preserved abdomens are placed ventral-side up on a Styrofoam tray and split longitudinally to expose the crops and intestines. Gregarines, which are visible through the intestinal epithelium, are counted at 60X magnification. Of the 23 dragonfly species collected thus far, 11 host gregarine parasites. Parasite prevalence increases through the flying (season April to November) in all host species at both sites. The prevalence was higher in the Battle Lake community during 2007. We also found a gender bias in parasite prevalence in two host species, *Brachymesia gravida* and *Erythemis simplicicollis* (Libellulidae). Although parasite prevalence has varied with host species, time, and habitat, parasite load has not. The mean load across all hosts is 7.5 parasites.

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HIGH INVERTEBRATE DIVERSITY IN AN EDWARDS PLATEAU (CENTRAL TEXAS) STREAM

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We assessed taxonomic richness and diversity of invertebrates in the Blanco River, an intermittent Edwards Plateau stream, and found that richness was 50 - 100% higher than other southwest U.S. streams and ranks among the richest streams in North America. Benthic and drift samples were collected seasonally for two years from mainstem, tributary, and seep sites. Total taxa was 181, including 28 mayfly genera, 25 caddisflies, and 32 beetles. Our analyses indicate heterogeneous aquatic habitats and a moderately warm climate are key to maintaining species diversity in the Blanco River Watershed. Seep-associated taxa and hyporheic species, such as the blind cave amphipod *Stygobromus russeli*, are supported by stable microhabitats in an otherwise highly variable watershed. Diverse habitats and the intermittent flow regime may also check

the invasive strength of invertebrates like the clam *Corbicula fluminea*. Edwards Plateau represents an ecotone where several biotic realms and provinces collide. Despite reports of regionally high endemicity and subterranean aquatic biodiversity, no extensive surveys of stream invertebrates have been published. Intensive sampling should be conducted in Edwards Plateau to catalogue the diversity and biogeography of aquatic invertebrates, including rare and endangered species, before aquifer draw-down drains springs and alters the flow regimes that support high invertebrate richness.

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LOCATION, LOCATION, LOCATION: LABORATORY OVIPOSITION PREFERENCES OF THE EXOTIC, INVASIVE APPLESNAIL *POMACEA INSULARUM*

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By investigating phylogeographic structure of an invasive population, ecologists can potentially determine population control methods. This technique may prove useful for combating the exotic invasive aquatic applesnail *Pomacea insularum*, recently found along the Gulf Coast. In Houston, Texas, researchers find *P. insularum* in clumped distributions around emergent structures. *P. insularum* deposits bright pink egg clutches above the water's surface on waterside objects. The snail's reliance on emergent objects for reproduction may attract them to preferred structures. To discover mechanisms underlying population distribution, we designed three lab experiments investigating what specific object qualities attract *P. insularum* (substrate material; substrate structure; exotic vs. native Texas plants). To better understand reproduction, we examined characteristics (height above water, dimensions, mass, approximate volume) and hatching efficiencies of clutches laid in experiments. We compared characteristics of lab clutches to eggs found in Houston. We found *P. insularum* preferentially oviposited on plants and ignored wood, metal or plastic ($p < 0.01$), chose round rather than flat ($p < 0.001$) but did not differentiate between tall or short structures ($p > 0.05$), and preferred exotic (*Colocasia esculenta*) to native (*Pontederia cordata*) Texas plants ($p < 0.001$). Interactions between *P. insularum* and *C. esculenta* indicate potential invasion meltdown in Houston. Clutch characteristics comparisons revealed similarities between lab and field reproduction ($p > 0.05$), validating our ability to apply our lab results to field populations. We conclude that *P. insularum* clusters around emergent plants, specifically *C. esculenta*, due to oviposition preferences for these objects. Removing egg clutches from areas dense with *C. esculenta* should slow *P. insularum* spread and damage.

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ASSESSMENT OF MERCURY BIOMAGNIFICATION IN CADDO LAKE, TEXAS/LOUISIANA

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Most studies that have examined biomagnification of mercury in freshwater food webs have focused almost exclusively on invertebrate and fish communities and have excluded non-fish vertebrates such as reptiles and mammals. Because many non-fish vertebrates are long-lived and feed near the top of the food web, mercury may biomagnify to high concentrations in their tissues. We determined the trophic positions (using stable isotopes of nitrogen and carbon) and concentrations of total mercury (using combustion atomic absorption spectrometry) in 18 species of aquatic and semi-aquatic invertebrate and vertebrate consumers from Caddo Lake, a subtropical impoundment in Texas/Louisiana. Mean trophic position ranged from two (indicative of a primary consumer) to 3.8 (indicative of a tertiary consumer) and mean mercury concentrations in muscle tissues ranged from < 100 to > 2500 ng/g dry weight. Mercury concentrations were positively correlated with trophic position indicating that biomagnification was occurring in the Caddo Lake food web. The food web magnification factor (the slope of the relationship between mean mercury concentration and trophic position) was similar to those observed in other studies. Mean mercury concentrations in tertiary consumers were four times higher than secondary consumers and some species near the top of the food web including largemouth bass (*Micropterus salmoides*), spotted gar (*Lepisosteus oculatus*), raccoons (*Procyon lotor*), and cottonmouths (*Agkistrodon piscivorus*) had concentrations of mercury high enough that their health could be negatively impacted.

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NUTRIENT IMPACTS ON AQUATIC COMMUNITIES IN SIX WADEABLE BRAZOS-BASIN STREAMS: PERIPHYTON CHEMISTRY

Cindy Contreras*, Jennifer Bronson*, Patricia Radloff and Adam Whisenant, Texas Parks and Wildlife Department
 NUTRIENT IMPACTS ON AQUATIC COMMUNITIES IN SIX WADEABLE BRAZOS-BASIN STREAMS: PERIPHYTON CHEMISTRY
 Cindy Contreras*, Jennifer Bronson*, Patricia Radloff and Adam Whisenant, Texas Parks and Wildlife Department, Austin, TX. Water quality standards in Texas contain narrative criteria for dissolved nutrients to prevent eutrophication and excessive plant growth. States are charged by EPA with developing numeric criteria to incorporate into their water quality standards. In Texas, criteria for reservoirs have been developed. Streams will be the next water body type targeted. To assist the Texas Commission on Environmental Quality in this process, six wadeable streams in the Brazos basin

were studied over a two-year period to assess nutrient status and biological assemblages. Three of the streams were selected from the Texas Blackland Prairies (ecoregion 32) and three from the East Central Texas Plains (ecoregion 33). The six streams represented a range of land uses and human influence. Fish, benthic macroinvertebrates, periphyton, mussels, water quality, habitat and flow were sampled four times at each stream. Visual observations indicated periphyton growth typical for streams in the two regions, with no unusually heavy accumulations. Periphyton samples were scraped from instream woody debris and analyzed for chlorophyll-a and ash-free dry mass. None of the streams exhibited excessive periphyton growth as defined by studies in North American and Australian streams. The one study stream dominated by domestic wastewater effluent exhibited higher chlorophyll-a and AFDM.

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ON THE POPULATION AND COMMUNITY ECOLOGY OF FISHES IN A SMALL SECOND ORDER STREAM (HARMON CREEK, WALKER CO. TX)

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We used seasonal population and natural history data for the fishes of a small second order stream (Harmon Creek, Walker Co. TX) to produce a conceptual model that predicts community assembly for fishes in this system. The Harmon Creek fish community consists of 14 species. The abundant species (Blacktail Shiner, Mosquitofish, Blackstripe Topminnow, Weed Shiner, Bullhead Minnow) vary seasonally in a predictable manner across years. For example, in the spring (i.e., March) the densities of all species are low and relatively even. The individuals comprising the populations at this time are large, mature, adults. We believe population densities and demographics at this time are governed by winter mortality and displacement from the frequent floods. By summer (July), all species increase in abundance several fold. The size structure of the populations consists of a few large adults and many small young-of-year. The relative abundances of most taxa are even, with the exception of Blackstripe Topminnow which dominates. Thus, we believe that reproduction drives community composition at this time period. By autumn (October), the community is dominated by three species (Blacktail Shiner, Blackstripe Topminnow, and Mosquitofish). We believe competition for resources drives community assembly at this time. For example, these species forage mainly on resources associated with the terrestrial environment, and because terrestrial inputs (leaf litter and insects) are the primary resources for Harmon Creek these species flourish. Our study suggests that fish communities of small head water streams are predictably regulated year after year by both abiotic and biotic events.

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REGIONAL AND LOCAL VARIATION IN FISHES OF THE BIG THICKET NATIONAL PRESERVE, TEXAS

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The Big Thicket National Preserve (BITH) in southeast Texas is a natural ecotone formed by the convergence of eastern hardwood forest, Gulf coastal plain and Midwest prairie. Although the diversity in this region is high, the BITH lies near an epicenter of an increasing human population and associated anthropogenic activities (e.g., urbanization, oil refining, etc.). As a result, the BITH will continue to face regional threats that could affect this important ecosystem in light of local conservation efforts. Because the fishes of the BITH are not well documented, we conducted a fish survey across longitudinal river segments for six drainages within the protected boundaries of this preserve. Using these data, we (1) quantified basic community metrics for the preserve and for each river (i.e., species richness, diversity and evenness); we (2) compared community structure across rivers using multivariate ordinations; and we (3) quantified effects of local microhabitat characteristics on assemblage structure within each longitudinal river segment. We found that species richness, diversity and evenness were similar across river, but there were significant differences in community structure across rivers. This indicates that each river is contributing a unique subset of species to the BITH, and, thus, is promoting species diversity within the whole preserve system. Moreover, fish assemblages differed across microhabitats within each river, suggesting that local microhabitat diversity in this preserve is essential for maintaining regional diversity in fishes. These data provide a valuable and recent baseline for monitoring and conservation efforts in the Big Thicket National Preserve, Texas.

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WETTER ISN'T BETTER: EFFECTS OF DISTURBANCE ON POMACEA INSULARUM HATCHING EFFICIENCY

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The ability to successfully reproduce in a given environment represents one of the most important determinants of an organism's invasive capability. Reproductive plasticity and fecundity play critical roles for invasive success in mollusks. *Pomacea insularum*, a large freshwater gastropod native to South America that has successfully invaded several Texas waterways through multiple introductions, puts forth great effort to oviposit each egg clutch (often containing more than 1000 eggs) well above the waterline, where it fully dries before hatching. Our experiments sought to determine the effects of water exposure to egg clutch hatching efficiency, and to compare short-term survival of disturbed vs. not disturbed hatchlings. In order to test the effects of disturbance on the hatching efficiencies of *P. insularum* egg clutches, we subjected egg clutches collected from Armand Bayou (Pasadena, TX) to water exposure at two levels of intensity: high, consisting of

full submergence, and low and three levels of frequency (low, medium, high). We found that clutches that we completely submerged for 24 hours/day did not hatch, nor did clutches that floated on water for 24 hours/day. Water exposure also significantly affected hatching efficiency at other frequencies. To test short-term survival, we pooled hatchlings hatched under disturbed (i.e. submerged for 3 hours every other day) conditions and undisturbed conditions. Results are forthcoming for this second experiment. Survival, and subsequent invasive capability do seem dependent on water exposure during egg clutch development.

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SEX RATIO AND DENSITY ALTER MALE AGGRESSION AND HARASSMENT BUT NOT MATING BEHAVIORS IN THE WESTERN MOSQUITOFISH, GAMBUSIA AFFINIS

Rachel E. Martin*, James C. Cureton, and Raelynn Deaton, Sam Houston State University, TX

Fluctuations in operational sex ratio (OSR) and density can cause sexual conflict to arise in many systems. Livebearing fishes of the genus *Gambusia* are ideal organisms for investigating sexual conflict because males of all sizes coerce (force copulate with females). In this experiment, we hypothesized that both OSR and density will influence both male mating and aggression. Specifically, we predicted that (1) males will mate with more females as OSR becomes more female-biased and density increases, and 2) male aggression will increase as the OSR becomes more male-biased and as density increases. First, using a paired design, we observed one focal male (N=40) across all densities (two and four) and all sex ratios (4:0, 3:1, 1:1, and 1:3) to assess shifts in individual male behavior. Second, using a repeated measures design, we observed focal males (N=20 males per sex ratio treatment), across all sex ratios at two different densities (two and four). When one male was mated across all treatments, the number of copulation attempts did not vary with sex ratio or density. However, males mated with more females as the number of available females increased. When different males were observed across the two densities, copulation attempts and male harassment increased as the sex ratio became more female-biased and as density increased. In both analyses, males became more aggressive as the sex ratio became more male-biased. Results suggest a tradeoff between mating and aggression in this system. This study confirms that coercive males attempt to maximize their reproductive success by mating with all available females, but their mating success may be compromised when males are forced to compete.

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WATER QUALITY OF THE TIDALLY INFLUENCED SEGMENT OF THE RIO GRANDE

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The tidal segment of the Rio Grande was studied at three stations within 80 km from the mouth of the river. The three sites monitored, El Jardin, Rio A and Rio F, were 75.9, 18.7, and 3.2 km, respectively, upstream from the Gulf of Mexico. Field data for water temperature, salinity, dissolved oxygen (DO), percent dissolved oxygen (%DO), pH, specific conductance, and flow velocity were recorded monthly at three points across the river (transects) and by depth. Seasonality was evident at all sites while tidal influence was nil at El Jardin, but increased from Rio A to Rio F. Temperature was the least variable parameter with regards to site, transects, and depth. DO, salinity, pH, and current flow were all statistically different among the three sites. Differences across river transects (3 points) were detected in %DO, salinity, specific conductance, and current flow. Depth profile differences were seen in %DO, salinity, specific conductance, and current flow. Not all sites showed differences across transects or with depth, with Rio A and Rio F more similar to each other than either to El Jardin. Water quality parameters were most dynamic at Rio F with the presence of a persistent steep halocline (salt wedge) developing between 1 and 2 m depth. Variability among sites were more prevalent than within depth profiles at a site. River transects were the least sensitive to water quality variations at all sites.

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A LONG-TERM WATER QUALITY DATASET FOR THE LOWER RIO GRANDE/RIO BRAVO

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Surface water quality data was collected monthly at two locations on the lower Rio Grande from March 1999 through December 2008. The sample sites were located to examine the effect of an urban area on the water quality of the river as such one site was at Anzalduas County Park upstream of the McAllen-Reynosa urban area while the downstream site was at the USFWS Santa Ana National Wildlife Refuge. During each sampling, water temperature, salinity, pH, dissolved oxygen and after 2006 turbidity were recorded. Water samples were collected for analysis of chlorophyll, ammonium, nitrate-nitrite and dissolved phosphate. Water temperature showed a clear seasonal trend at both sites but with high year to year variability. Salinity was low (<1 PSU) but nearly always slightly higher at the Santa Ana site compared to the Anzalduas site. Dissolved oxygen was significantly higher at Anzalduas than the Santa Ana site. Nutrient and chlorophyll levels were usually higher at Santa Ana than Anzalduas. These results indicate the input of sewage between the sample sites. Since little if any waste water treatment plant effluent reaches the Rio Grande on the U.S. side, it seems likely that Mexico is the

source.

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EFFECTS OF MALE BODY SIZE AND TEMPERATURE ON THE MATING BEHAVIOR OF THE WESTERN MOSQUITOFISH, GAMBUSIA AFFINIS

Stacy B Stoops* and Raelynn Deaton, Sam Houston State University

Temperature can have direct effects on fitness via changes in mating behaviors. Temperature is known to affect mating behavior and activity levels in a tropical population of *Gambusia holbrooki*. Therefore, we tested effects of temperature on male mating behavior in a subtropical Texas population of *G. affinis* frequently exposed to extreme thermal fluctuations. Last year, we reported no difference in male mating behaviors across a range of 5 temperatures (20-35C) in *G. affinis*. Thus, we extended our study to more temperature treatments, including both cold and hot extremes. Here, we investigated the effects of a wide range of temperatures (temperatures from 12-40C) on male mating behavior in *G. affinis*. We also tested whether male size interacts with temperature to affect male mating and/or aggressive behaviors. In two separate experiments (non-competition and competition), we tested the following predictions: (1) male mating behavior is highest at mid-range temperatures and at its lowest at extreme temperatures and (2) male size will not interact with temperature to influence male mating behavior in a competitive situation. To date, results show that male mating behavior is lowest in extreme temperatures (12 and 38). Further, male mating behavior ceases at 40C and individuals begin to die. In our competition experiment (two males with one female), relative male size was an important predictor of both male mating and male aggression, but temperature had no effect on male-male competition and did not interact with male size to further influence male mating.

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TEMPORAL PHYTOPLANKTON NUTRIENT-DEPENDENT GROWTH RESPONSES AND SEASONAL ZOOPLANKTON GRAZING ESTIMATES OF THE HIGHLAND LAKES, COLORADO RIVER, CENTRAL TEXAS

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The U.S. Geological Survey (USGS) and the Lower Colorado River Authority (LCRA) are cooperating on a study to understand plankton trophic dynamics in four reservoirs of the Highland Lakes system on the Colorado River in central Texas. Water was collected monthly for phytoplankton bioassays from 6 sites in Lake Travis (2005–06), and 5 sites in Lakes Inks, LBJ, and Marble Falls (2007–08). These lab-based experiments had four replicates each of controls, nitrogen, phosphorus, and nitrogen + phosphorus additions, and were incubated 5 to 7 days with ambient temperature and light (n=2,400). Daily in-vivo fluorescence (IVF), verified by Chl-a, was used to calculate phytoplankton growth rates using an exponential growth model. Results were analyzed using an ANOVA, and Bonferroni post-hoc treatment mean comparisons. Growth rates were lowest in controls and at mid- to up-lake sites, and were highest in nitrogen+phosphorus treatments and at near-dam sites. With all sites and months compared, phytoplankton communities responded to added nitrogen 30%, and to phosphorus 52% of the time; while co-limitation for both nutrients occurred 18%-100% during the study (p<0.05). Lake-specific seasonal zooplankton grazing experiments were performed (n=56), and significant phytoplankton loss rates indicate strong top-down control by secondary consumers.

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EFFECTS OF VEGETATION ARCHITECTURE AND STEM DENSITY ON PREDATION OF LARGEMOUTH BASS FINGERLINGS

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Hydrilla, *Hydrilla verticillata*, often exists either as immature stands of vertical stems or mature floating mats in spring and early summer when Texas Parks and Wildlife Department conducts stockings of fingerling largemouth bass, *Micropterus salmoides*. We tested the relationship of these two architectural types and stem density on fingerling predation rates using simulated hydrilla and adult largemouth bass predators in indoor tanks. Approximating these architecture types, experimental treatments of equal vertical stem distribution and unequal distribution in which 60% of the mass was at or near the water surface were tested at three stem densities: 125 (low), 250 (medium), and 500 (high) stems/m². We found architecture type (immature vs. mature) did not significantly affect predation rates at any of the three stem densities (P>0.05). Predation rates were significantly higher in both low density architecture treatments than in high density treatments (P<0.0033). Predation within the medium-density treatments did not differ significantly from high- or low-density treatments. These findings indicate that stem density regardless of architecture should guide stocking and largemouth bass fingerlings should be stocked into habitats with stem densities of at least 250 stems/m².

P53 Freshwater Science

THE DISTRIBUTION AND ECOLOGY OF TEXAS ALDERFLIES (MEGALOPTERA: SIALIDAE)

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There are 24 alderfly (*Sialis*) species in North America, five of which occur in Texas. Of the five species, two are closely-related sister species that coexist in two of the central Texas study sites. Here I present the species distributions throughout the biotic provinces of Texas, including larval records of unknown *Sialis* species. The life history data collected in 2000-2001 suggests that Texas alderflies exhibit synchronous, seasonal, univoltine life histories with a single cohort. This work also shows that life history for these primitive holometabolous insects does not differ substantially among broadly different habitats and ecological conditions. Such a narrow range of responses over such a broad range of conditions indicates that evolutionary/genetic constraints may play a more significant role in regulating aspects of life history of *Sialis* than environmental factors. Similar patterns may be characteristic of megalopterans in general compared to more recent holometabolous groups where voltinism in many taxa tends to increase in areas where water temperatures are warmer year round.

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COMPARISON OF HURRICANE IKE WITH OTHER MAJOR HURRICANES THAT HAVE STRUCK THE UPPER TEXAS AND SOUTHWESTERN LOUISIANA GULF COASTS

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Hurricane Ike was the second historically significant hurricane to strike the Gulf Coast along the Texas-Louisiana border within three years. Ike's storm surge was much larger than that expected from a Saffir-Simpson Scale Category 2 hurricane. The storm surge was in part enhanced by Ike's wind field size, angle of approach toward the coastline, and speed of movement as it approached the coastline. Compared to other strong hurricanes that have hit this area within the past 150 years. Ike's erosional and damaging effects on the coastline and infrastructure was spectacular considering its Category 2 rating. A visual analysis of the Upper Texas and Southwestern Louisiana coastlines before and after Ike and how Ike's damage to the coastline compares to damage caused by Rita and notable storms that have struck this area during the Nineteenth and Twentieth centuries will be exhibited and discussed, placing Hurricane Ike into a proper historical perspective.

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EFFECTS OF HURRICANE IKE FROM BOLIVAR PENINSULA TO SURFSIDE: A PHOTO TRANSECT ALONG THE TEXAS COASTLINE

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Galveston was the 4th largest city in Texas in 1900 when it was devastated by a major hurricane. The city responded by building a seawall and other protective features such as groins, jetties and eventually sand-filled "geo-tubes". We examine the effectiveness of such structures against Hurricane Ike in September 2008 along an east/west transect from Bolivar Peninsula to Surfside. Though Ike was only a Category 2 storm, it was very large. The eye made landfall near Galveston Bay with a surge of about 15'. As predicted by the "upper right quadrant" rule, the worst damage was east of the eye: entire communities on Bolivar Peninsula, mostly lacking in protective structures, were completely destroyed. In Galveston, most piers and restaurants in front of the 17' high seawall were destroyed, whereas buildings on top of the seawall were relatively undamaged by waves. Behind the seawall, where the ground slopes to just above the bay, hundreds of buildings were damaged by flooding from a "back bay surge". Immediately west of the seawall end, erosion was extensive. Slightly farther west, newer ocean-front homes on high pilings and protected by geo-tubes suffered only moderate washout. Storm effects in that area were minimal after a few hundred feet inland. Forty miles west, in Surfside, several older ocean-front homes were destroyed by waves, but the storm effects were significantly diminished. We conclude that a stronger storm with a higher surge and an eye-landfall just west of Galveston, would potentially cause far greater damage to the city.

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EROSION AND SEDIMENTATION PATTERNS PRODUCED BY HURRICANE IKE ALONG THE TEXAS COAST

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Hurricane Ike made landfall east of Galveston, Texas in September 2008 devastating Bolivar Peninsula, parts of Galveston Island, and the eastern portion of the Brazos River Delta. The most intensive destruction and erosion occurred east of the eye on the central portion of Bolivar Peninsula. Less erosion occurred west of the eye at San Luis Pass and on the Brazos River Delta. Certain areas or bands were damaged more than others. Rollover Fish Pass on Bolivar Peninsula suffered the greatest amount of damage whereas the areas of San Luis Pass and the Brazos River Delta received little damage. The sedimentary effects of Hurricane Ike included the following: shifted the beach landward, removed the dune complex, developed a low

angle beach face, cut channels through the beach, exposed the black clay that underlay the beach, produced a small erosion scarp at the transition between the foreshore and the backshore and deposited a washover sand sheet that thinned shoreward. This sand sheet has a wedge-shaped geometry and consists of a series of coalescing fans. Parts of the marsh behind the beach received a layer of mud that filled channels and topographic depressions, and covered vegetation in places with a sheet of mud.

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HOW TO ENHANCE PROPERTY DESTRUCTION BY HURRICANES BY INSTALLING GEOTUBES ON ERODING BEACHES--THE SAGA OF HURRICANE IKE AT GILCHRIST, TEXAS

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A Geotube® is a temporary seawall or "sand sock". It absorbs wave energy and reduces flooding from minor storm surges of moderate meteorological events, such as cold-front passages or thunderstorms. Geotubes perform best in areas of beach accretion or stability. However, in beach-erosion areas, such as the upper Texas coast, Geotubes hasten beach erosion and increase damaging effects of hurricane storm surges. Geotubes were placed on both sides of Rollover Pass, an artificial cut in Bolivar Peninsula. They quickly reduced beach width and steepened the offshore profile. This steepening was caused by the Geotubes reflecting wave energy downward and offshore, causing sand removal offshore and water deepening. Without the gently sloping, normal beach profile, large waves could then strike the Geotubes during a tropical storm or hurricane storm surge. When the storm surge is above the height of the Geotube (typically 6-8 ft.), large storm waves pass over the Geotube, without it absorbing much wave energy, and hit structures behind it. The abrupt shallowing at the Geotubes can cause the waves to break on them rather than offshore, propelling fast-moving water directly onto beach houses, concrete slabs, etc. close behind them. This occurred during Hurricane Ike (2008), with a 20-foot storm surge, when all (>200) structures, except for one newly constructed home on high piers, were destroyed in Gilchrist between Highway 87 and the Geotubes. Also, because the Geotubes were breached, storm-surge backflow was concentrated at gaps cut in them, eroding channels several feet deep into beach sand and underlying compacted bay mud. Geotubes placed on Bolivar Peninsula gave residents a false sense of security and enhanced destruction by Hurricane Ike's waves. West of the area where Geotubes were placed, a much higher percentage of beach houses and slabs survived Hurricane Ike because there were no Geotubes to enhance destructive effects along a normal, gently-sloping beach.

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HURRICANE IKE AND THE RISE & FALL OF CAPLEN, TEXAS

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Caplen, Texas lies on Bolivar Peninsula 15 km west of High Island. Named tropical storms make landfall on the coast between High Island and Freeport an average of every eight years. Caplen was primarily grazing land in the late 1800's and hurricanes in 1900 and 1915 discouraged new development there. By 1931, 15 houses stood between the coastal road and the beach. In 1952, nearly 150 houses lay along the beach east of the Caplen Oil Field with another dozen on the Intracoastal Waterway. The Rollover Fish Pass dredging in 1955 made Caplen the easternmost community on man-made Bolivar Island. House-counts on the 1943 and 1962 Frozen Pt. topographic maps shows an increase from 23 to 89, but two dozen houses disappeared, many destroyed in 1961 by Hurricane Carla. The 1974 Caplen USGS topographic map shows 62 houses added over 22 years. Thirty of those were missing from the easternmost 1.2 km of beach on the 1994 Caplen map. The 1994 Frozen Pt. and Caplen maps show a total of 320 houses at Caplen based on 1987 air photos. Beginning in 1996, several expensive anti-erosion projects were conducted there including sand nourishment, and hay bale and geotube installation. By 2005, high tides often reached the geotubes suggesting their negative impact on the beach profile. On September 13, 2008, Hurricane Ike's storm surge destroyed all but three houses in Caplen and verified that coastal anti-erosion projects may accelerate erosion, are ineffective in the long-term, and are not cost-effective.

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POST-HURRICANE IKE EROSION STUDY ALONG THE UPPER TEXAS GULF COAST BETWEEN SABINE PASS AND HIGH ISLAND

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Erosion of the upper Texas Gulf Coast, between High Island and Sabine Pass, has been a significant problem for residents attempting to maintain the now-abandoned stretch of Texas State Highway 87 between these two towns. Occasionally, the idea of restoring this highway is revived. While studying the effects of Hurricane Ike on the Texas coastline, this area was used to estimate erosional effects since the 1980s, as well as during the preceding 50 years. Erosion along the upper Texas coast is caused primarily by three natural processes: (1) subsidence (sinking of the land caused by the compaction of sediment layers beneath the land surface, especially clay particles), (2) sea level rise (caused by global temperature rise, increasing glacial ice melting and expansion of sea water volume), and (3) storms and tropical cyclones (which erode the shoreline via energy from wind-generated waves and storm surges). Analysis of topographic maps produced over the past

half century indicates coastal elevation has noticeably decreased. Beach width also has been greatly reduced as the shoreline transgresses into the marsh. Beach transgression and subsidence has allowed for easier salt water infiltration into the marsh during storms and tropical cyclones, killing marsh grasses, which results in marsh sediment erosion and the subsequent forming of small ponds and lakes adjacent to the coastline. Hurricanes Rita and Ike have helped greatly to advance this erosion, but most erosion occurs gradually due to everyday processes. Thus, plans to replace Highway 87 near the beach should continue to be rejected.

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THE EFFECTS OF ROLLOVER PASS ON THE BOLIVAR PENINSULA DURING HURRICANE IKE

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Rollover Pass was built under the direction of the Texas Game and Fish Commission during 1955 to improve oxygen levels and salinity in East Bay through the influx of fresh seawater from the Gulf of Mexico. After an intensive study, the Commission (now part of the Texas Parks and Wildlife Department) concluded that Rollover Pass has no effect on East Bay oxygen levels. However, Rollover Pass is good at stealing sediment moving via the dominant longshore current to beaches west of the area, and depositing this sediment behind the Pass into Rollover Bay. Nature is trying to fill-in Rollover Pass and Bay, yet the area is routinely dredged, with sediment being dumped along the beach east of Rollover Pass. This sediment is then eroded and transported back into Rollover Bay. Thus, beach erosion is hastened along the west side of Rollover Pass. The Pass also further destabilizes the area during hurricane storm surges, acting as a funnel and allowing for the storm surge to pass through easily. Compared to the rest of the area, retreating storm surge water has a larger volume and velocity resulting in a higher discharge that increases the destruction of the areas adjacent to the Pass. Although Rollover Pass is not owned by the State of Texas any more, it limits the effect of costly beach nourishment projects along beaches east of Rollover Pass (sometimes funded by the state and/or federal government) and destabilizes the area during storm surges. Closing the Pass would greatly enhance coastal stability.

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TECHNIQUES FOR RECOVERING MICRO-MAMMAL REMAINS FROM LOW YIELDING UINTA C FACIES

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Fossil micro-mammal localities are often missed using small test samples. In 2007, a 900 kg (1 ton) test sample was collected from clays at the Uinta C, Uinta Formation, WU-26 "Pond site" in Utah's Uinta Basin, which yielded numerous micro-mammal teeth (Westgate and others, 2008). In 2008, 4500 kg (5 tons) of both red and green mudstones were collected. The samples were reduced to 90 kg in the Green River (98% primary reduction) using 0.5 mm mesh screen-bags. Two-thirds of the river-washed sample (41 kg red clay; 24 kg green clay) was reprocessed in the Lamar University Paleontology Lab. Pre-tests of varsol vs H2O2 as clay dispersants were conducted. Varsol was chosen as the preferred clay dispersing agent with visually better results and a 76% vs. 58% weight reduction. After varsol treatment the red clay was reduced to 1.7 kg (96% secondary reduction) and the green clay to 5.3 kg (78% secondary reduction with a large pebble fraction). Primary and secondary processing generated a 99.9+% sample-weight reduction. Sample fractions from sieves with 0.6->1.6 mm mesh were inspected using binocular microscopes. Thirty-five mammal pre-molars and molars identifiable at the generic or species level were recovered. These include 25 cheek teeth from mostly mouse-size rodents (1-2 mm APL), and 10 marsupial, insectivore, carnivore, horse and artiodactyl teeth. Virtually all micro-mammal teeth came from the green clays. The 35-tooth sample weighs about 1 gm and is one three-millionth of the original 3000 kg reprocessed sample, giving a specimen yield of 0.00003%.

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SURFACE AND GROUNDWATER INTERACTIONS VIA STREAM BANK SEDIMENTS: POTENTIAL SINKS AND SOURCES OF PHOSPHORUS IN A EUTROPHIC HEADWATER STREAM

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To determine contributions of P from streambank sediments along a second-order, eutrophic stream in North-Central Texas, shallow groundwater well pairs, about 5-m deep, were installed at three locations. Well cores collected when the wells were dug were analyzed for P, and groundwater levels were monitored for about two years. Water levels in wells furthest upstream indicated a losing stream at all times, while wells further downstream showed a gaining stream except during flow reversals associated with storm events. Total-P concentrations from well core sediments ranged from 54-254 mg/kg and were typically high at the top of banks, decreased downward until redoximorphic features were encountered at which point P concentrations increased notably to near or above surface levels. Very little extractable P was seen in sediment cores from the two upstream well sets; however, the furthest downstream showed extractable P throughout with the highest value of 21 mg/kg near the bottom of well. Groundwater levels were often high at the most downstream location due to pooling of stream water from a downstream reservoir. This pooling allowed fewer wetting and drying cycles that may have allowed more sediment P to remain in extractable forms. Because the overall stream reach is more often losing than gaining, these sediments act more as a

sink than a source of P in the interaction of surface water with groundwater. Erosion of alluvium could increase P transfer, particularly from lower portions of the streambank, where some stream P is being stored.

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THE LOWER TERTIARY TRANSPRESSIVE COAHUILAN REVOLUTION OF THE SABINAS BASIN, IN NORTHERN MEXICO

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For many years the tectonics of the Sabinas basin has been attributed to the compressive effects of the late Cretaceous Laramide orogeny; however there are very strong geologic evidences that the folding of the structures in the Sabinas basin, as well as in the Chihuahua folded belt, was a consequence of transpressive forces that took place in the lower Tertiary (Eocene) during the movement of the Texas-Coahuila block toward the northwest. This movement was related with the aperture of the Gulf of Mexico. The previously identified La Babia and San Marcos faults, outcropping in northern Mexico, acted as regional megashears, responsible of this movement. Seismic data of the producing fields in the Sabinas basin and surface geology in the area of Cuatro Ciénegas Valley, in the central portion of the state of Coahuila, provide important evidence that transpressive forces were responsible for the folding of the subsurface anticlinal traps and the surface structures outcropping in the basin.

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HYPOGENE DIAGENESIS IN THE CASTILE FORMATION OF FAR WEST TEXAS

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The evaporite rocks of the Castile Formation that fill the Delaware Basin in southeastern New Mexico and far west Texas have been extensively modified by hypogene processes since their Lopingian deposition. Intrastratal dissolution of halite has produced widespread brecciation in the form of laterally extensive blanket breccias and vertically exaggerated breccia pipes, as a result of solution in a mixed convection system. Ascending fluids delivered from the underlying Bell Canyon Formation have produced complex hypogene caves in the western Delaware Basin, where density convection has enabled undersaturated fluids to be continuously delivered to the solution front. Hydrocarbons migrating updip through the Bell Canyon Formation have provided necessary organics for sulfate reduction within the sulfates of the Castile Formation, resulting in evaporite calcitization and the production of hydrogen sulfide, which is readily oxidized into native sulfur. Numerous selenite masses are found scattered throughout the region, which appear to be genetically related to both evaporite calcitization and the development of hypogene caves. Isotope analyses of sulfates and carbonates suggest that diagenesis in the Castile Formation is the result of mixing of fluids, including hydrocarbon-rich basinal waters, hydrothermal waters, and meteoric waters. Currently, hypogene diagenetic patterns within the Castile Formation are being heavily overprinted by epigene processes as surface denudation continues to remove overburden and surficial strata throughout the Delaware Basin.

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HYPOGENE SPELEOGENESIS WITHIN ELLENBURGER CARBONATES OF CENTRAL TEXAS

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Ordovician Ellenburger carbonates near the Colorado River in Burnett, Lampasas and San Saba Counties, Texas, exhibit complex diagenetic histories associated with fluid migration and regional speleogenetic evolution. Numerous caves developed in the Ellenburger Formation contain solutional features indicative of dissolution within a confined or semi-confined system, including complete hypogene morphometric suites of risers, half-tubes, ceiling channels and outlet cupolas. Many caves show characteristics of epigene origins or epigene overprinting of hypogene origins; however, this is expected in any karst systems that have been breached and exposed to surficial processes. Vuggy and cavernous porosity is often filled or partially lined with massive, calcite spar that commonly shows evidence of at least one additional episode of dissolution. Water chemistry of springs within the region suggests deep fluid circulation flow paths, including a component of sulfuric acid which provides increased aggressivity for ascending fluids. Current research is focusing on interpreting the speleogenetic evolution of this region, with an emphasis on ascending solutional fluids possibly associated with the potentiometric low created by persistent down cutting of the Colorado River locally.

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LOCAL ASCENDING FLUIDS: SPELEOGENESIS IN THE CRETACEOUS CARBONATES OF SOUTH TEXAS

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Throughout south Texas, extensive karst development occurs in Cretaceous carbonates, including caves formed in the Edwards and Glen Rose Formations in the following counties: Edwards, Kimble, Kinney, Real, Sutton and Uvalde. Most of these caves are no longer hydrologically active with respect to significant groundwater flow, but instead represent largely relict karst features; however, minor secondary precipitation associated with shallow vadose fluid migration is active locally. Caves in this region often consist of large, isolated chambers and/or complex maze sections, suggestive of dissolution within a confined or semi-confined hypogene setting, independent of near-surface, epigene processes. Morphologic features within

individual caves suggest dissolution involving sluggish flow within a mixed-convection regime, involving components of both forced and free convection. Limited surface drainages, lack of incised, solutional insurgences and clustered occurrences of intense cave development all suggest that karst development is not related to the modern geomorphic landscape. Current studies on south Texas karst indicate a complex fluid history, where the bulk of solutional porosity resulted from hypogene processes that have been overprinted by epigene processes. Studies of the speleogenetic evolution of south Texas provide intriguing comparisons for hydrologically active systems elsewhere.

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ON MAGMATITES FROM THE CARBONATITIC MAGNET COVE IGNEOUS COMPLEX, CENTRAL ARKANSAS.

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The Magnet Cove Igneous Complex (MCIC) of the Mid-Cretaceous Arkansas Alkali Magmatic Province provides numerous opportunities to study comprehensive geological aspects of a carbonatite volcano at a subvolcanic level, 1-2 km below the general landscape surface 94 Ma ago. Geological, mineralogical, petrographic and geochemical characterization of rock types can now be achieved using methods of field geology, polarization microscopy, X-ray diffraction/Rietveld and geochemistry. Major to rare rock types recently characterized (TAS-diagram, APF-triangle) include (1) phanerites, i.e., jacupirangite, ijolites, nephelinolite, nepheline-monzosyenite, various nepheline-syenites; (2) aphanites, i.e., lamprophyres, nephelinites, phonolitic nephelinites, tephriphonolite, several phonolites. Effects of hydrothermal alteration and mineral formation vary in intensity and extent yet cause significant petrographic difficulties. Petrologic and geotectonic questions still remain to be addressed in detail. A comparison with carbonatite complexes in Colorado, Scandinavia and Eastern Africa shows structural, compositional and formational similarities.

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OVERVIEW OF RECENT MOUNTAIN-BUILDING EVENTS IN THE BIG BEND REGION, WEST TEXAS AND NORTHERN MEXICO

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The terrain of the Big Bend region, as well as locations of many ore bodies, hot springs, and the Rio Grande River, mostly result from two mountain-building events: Basin and Range extension that continues today, but also Laramide contraction that ended 50 million years ago. Both events continued for tens of millions of years, producing complex arrangements of folds and faults throughout broad, overlapping zones extending from southern Mexico into Canada. Laramide contraction and Basin and Range extension are caused, at least in part, by changing plate interactions along the western margin of the North American plate. Panoramic photographs illustrate two particularly well-exposed structures in Big Bend National Park: the Dog Canyon overturned syncline, a Laramide fold crosscut by a Laramide thrust, and the Canoe syncline, caused by Basin and Range normal faulting. Work to date, which includes our recent mapping in the Dog Canyon-Dagger Mountain area and the southeastern Marathon uplift, emphasizes several points: a) Big Bend Laramide structures include thick-skinned basement uplifts and coeval thin-skinned thrust belts, b) map-scale and outcrop-scale folds formed during Basin and Range extension as well as during Laramide contraction, c) active faults are confined to the Rio Grande River area and the eastern Sierra del Carmen, and d) several fault zones moved repeatedly during Laramide contraction and Basin and Range extension. Strike-slip components resulted when pre-existing structures were not orthogonal to extension or compression direction. Our Journal of Borderland Studies paper at www.borderlandstudies.net contains tectonic maps, panoramic photographs, explanations, and many references.

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PARAGENETIC SEQUENCE AND GLACIATION EFFECTS OF THE OPHIOLITE COMPLEX AND SURROUNDING AREA OF GROS MORNE NATIONAL PARK, CANADA

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Gros Morne National Park is located in eastern Canada, on the western side of the island of Newfoundland and is part of the Appalachian Mountain range. The park encompasses three different bedrock terrains: a Precambrian crystalline block (Long-range Mountains), sedimentary deposits (uplands and coastal lowlands), and basic and ultra-basic sheets (Table Mountain); all overprinted by glacial processes. Table Mountain is located in the southern-most region of the park and contains an ophiolite complex from the closing of the Iapetus Ocean. A petrographic study was done on the peridotite of this complex to gain an understanding of the petrology and intriguing geologic history. Research on the glacial patterns and petrographic data will be used to better understand the formation and evolution of the area.

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THE CONTROVERSIAL ORIGIN OF THE DAGGER MOUNTAIN ANTICLINE, BIG BEND NATIONAL PARK, TEXAS

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Dagger Mountain, in Sierra del Carmen, northern Big Bend National Park, contains a large doubly-plunging anticline; many surfaces are dip slopes. The fold exposes the Santa Elena Limestone, Del Rio Clay, Buda Limestone, Boquillas Formation, and numerous small mafic intrusions of probable Tertiary age. Two possible causes of the Dagger Mountain anticline have been proposed by others: a) regional ENE Laramide compression producing a fault propagation fold above a blind thrust, or b) local forceful laccolith emplacement doming overlying strata. Detailed, 1:10,000-scale geologic mapping combined with data from Moustafa (1988) reveal the anticline contains an axial plane oriented at 333 83SW and a fold axis of 151 1, similar to Laramide folds throughout Sierra del Carmen. The west flank displays map-scale kink folds. One contains a 330 50SW axial plane and a 69° interlimb angle. Outcrop-scale folds in the Boquillas Formation adjacent to mafic dikes and sills are parallel folds that have a consistent 340 90NW axial plane orientation; their fold axes average 340 28 and interlimb angles average 64.5°. Consistent outcrop-scale fold orientations indicate mafic plutons were passively emplaced and that outcrop-scale folds and the Dagger Mountain anticline formed in the same deformation phase. High-angle Basin and Range faults that cross-cut the Dagger Mountain anticline have a strike of approximately 327.

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THE CRANIAL MORPHOLOGY OF THE LOWER PERMIAN REPTILE CAPTORHINUS AGUTI

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Captorhinus aguti, a eureptile from the Lower Permian of Texas and Oklahoma, is a well known taxon critical to understanding the evolutionary relationships among the major lineages of reptiles. X-ray computed tomography of an exceptionally preserved skull of Captorhinus aguti, collected from the fissure fill deposits of Fort Sill, Oklahoma, revealed new morphological features of this species. Because most of the skull elements are well articulated, detailed three-dimensional reconstructions of the relationships and orientations of articulations and sutures are now available. The elements of the right mandible are preserved in articulation, allowing the reconstruction of an endocast of the Meckelian canal and its associated vessels. The septomaxilla is more complex than previous reconstructions have shown. The lateral side is dominated by the septomaxillary canal, which is the anterior extension of the lacrimal duct and exits into the nasal capsule. For the first time a largely complete sphenethmoid can be studied. The sphenethmoid is goblet-shaped in cross-section and is dorsally broader than previously assumed. The dorsal side of the palate is well preserved and accessible with this non-destructive method. These new discoveries in the skull morphology of Captorhinus aguti contribute important morphological characters for phylogenetic hypotheses of the relationships within captorhinids. This is especially valuable because this species is the most common captorhinid included in prior phylogenetic analyses.

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DETAILED MAPPING OF EASTERNMOST LARAMIDE STRUCTURES, SOUTHEASTERN MARATHON UPLIFT, WEST TEXAS.

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A detailed, 1:10,000-scale geologic map of a thirty km² region within the Slaughter Ranch, West Texas, shows three outcrop-scale and map-scale deformation phases. The Slaughter Ranch, approximately 50 km northeast of Persimmon Gap in Big Bend National Park, is within the eastern margin of Laramide deformation which includes the southeastern Marathon uplift. The first deformation event (D1) formed outcrop- and map-scale folds and a penetrative axial-planar foliation within pre-Permian rock units (Caballos Novaculite and Tesnus Formation) during the Ouachita orogeny. D1 axial plane orientations are ~N84E 20SE. The second deformation event (D2) formed map-scale folds within Cretaceous and older rocks during the Laramide orogeny. Cretaceous map units overlying an angular unconformity include a basal Glen Rose siliciclastic member, Glen Rose Limestone, Maxon Sandstone, Telephone Canyon Fm., Del Carmen Limestone, Sue Peaks Fm., and Santa Elena Limestone. Cretaceous units fit Big Bend strata descriptions by Maxwell and others (1967), except for the unusually thick Maxon Sandstone (169 m thickness). A D2 anticline, locally overturned and adjacent to an overturned syncline, extends outside the map area ~10 kilometers. D2 axial plane orientations are ~N48W 22SW. The third deformation event (D3) formed outcrop- and map-scale folds, some overturned. A map-scale D3 anticline appears to overprint the lengthy D2 anticline. D3 axial planes are oriented N34W 69SW. Relative timing relations between D2 and D3 folds are poorly documented and could be reversed. D3 folds correlate with the single phase of Laramide folds widespread in Sierra del Carmen and throughout in the Big Bend region.

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GEOMORPHIC CHANGES TO THE GALVESTON REGION AS A RESULT OF HURRICANE IKE: GIS-BASED ASSESSMENT OF COASTAL EVOLUTION

Alexcia Gray*, Kevin W. Stafford, Geology Department, Stephen F. Austin State University, Nacogdoches, TX

As human populations increase along coastlines, more emphasis is being placed on environmental protection, impact assessment and geomorphic evolution in coastal regions. Coastlines the world over play an important role in the economy of a nation but their location and geology makes them vulnerable to natural disasters. South Texas is no exception. Hurricanes invariably wreak havoc in the Gulf of Mexico on a yearly basis. Various methods are emerging to aid in the modeling of shoreline process, specifically with the use of remote sensing and GIS-based data analysis. By comparing satellite imagery before and after storm events we can see how much the shorelines are changing in response to catastrophic events, in order to develop better models for coastal processes. In this study, we investigate Galveston Bay and the surrounding area through analysis of imagery data before and after Hurricane Ike, which severely modified the Texas coastline in September 2008. Coastal landforms, including barrier islands, spits, bars and dunes are mapped, along with urban development, to show the changes in coastal geomorphology as a result of the catastrophic impact of one of the most destructive hurricanes to ever impact the Texas coast in recorded history.

P64 Geosciences

NEW DINOSAUR DISCOVERIES FROM OCAMPO, COAHUILA, MEXICO

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The first field team to discover dinosaur remains in northwest Coahuila state, México, belonged to the National Institute of Statistics, Geography and Informatics (INEGI for its acronym in Spanish) in 1996, and they were who contacted and took us to the fossiliferous sites in 2007. All the localities are in the municipality of Ocampo, northern Coahuila. In the locality of Las Jicoteas, of Late Cretaceous age, the dinosaur material found during 2007 and 2008 consist of osteoderms, vertebrae, distal and proximal portions of the limbs, and portions of the ribs, attributed to the genus *Edmontonia* sp. Also we found remains belonging to the families Tyrannosauridae, and several individuals of the Hadrosauridae. In the same site we found fossils of associated fauna, including gar fish scales, turtle osteoderms of the Trionychidae family. In another locality called La Salada (Late Cretaceous, Campanian), had been found teeth from Tyrannosauridae, and several individuals of the Hadrosauridae that goes from two meters juveniles to adults. Also from this locality comes evidence of the giant alligatoridae *Deinosuchus riograndensis*. From the locality know as "El Bosque" had been found several tree trunks and stumps probably of Maastrichtan age, and among them had been found some very weathered hadrosaur remains.

P182 Geosciences

THE GEOCHEMISTRY OF SODA DAM IN THE JEMEZ MOUNTAINS, SANTA FE NATIONAL FOREST, NEW MEXICO

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The Jemez Mountains in northern New Mexico form the southernmost tip of the Rocky Mountains. This area consists of scenic vistas and remnants of past volcanic activity such as hot springs, sulfur vents and the Valles Caldera National Preserve. The area is also transected by numerous faults associated with orogenic events and volcanic activity. Soda Dam is found along Highway 4 in the Jemez Mountains and is a very large mineral deposit of carbonate rock. Deep faults serve as the conduit for heated water from below the surface to flow upwards and precipitate. Most of the precipitate consists of calcium carbonate with small amounts of other minerals and elements that have been deposited over time giving Soda Dam its unique color variation. The temperature range of 100°F to 160°F keeps minerals dissolved until deposition can occur at the surface and the acidic nature of the water indicates formation of hydrosulfuric acid. This very unusual formation develops and disintegrates at the same time due to the chemical processes occurring at Soda Dam.

P255 Geosciences

THE TRIALS AND TRIBULATIONS (AND FINAL SUCCESS) OF SITING EARTHSCOPE SEISMIC STATIONS IN EAST AND SE TEXAS

Trishell Joffrion*, Joseph M. Kruger, Ashley Henslee, Lamar University, Beaumont, TX

In the Summer of 2008, Lamar University was selected as one of several institutions by the Incorporated Research Institutes for Seismology (IRIS) to determine where in Texas to place earthquake seismic stations associated with the EarthScope Transportable Array program. These stations are scheduled to be installed in 2009 to 2010, and will record seismic waves of earthquakes from around the world for 2 years or more after installation. The job of the Lamar team was to determine exactly where 20 seismic stations were to be sited in east and southeast Texas based on a preferred grid with a 70 km spacing between each station. Requirements for each site included placement of the site within 7 km of the preferred location if possible, out to 15 km away from the preferred location if necessary. Other requirements included landowner permission, cell phone reception, a low seismic noise environment away from wells, pipelines, highways, secondary roads, airports and flight paths, etc., out of a floodplain, away from trees, and with enough open exposure for GPS reception and solar panel charging. Needless to say, meeting all these requirements was a challenge in east and southeast Texas. This

presentation illustrates how all (or at least most of) the challenges were eventually met using GIS and GPS tools for preliminary to final site evaluation, combined with a lot of salesmanship and (literally) sweat equity in the form of numerous hours in the field. In the Summer of 2008, Lamar University was selected as one of several institutions by the Incorporated Research Institutes for Seismology (IRIS) to determine where in Texas to place earthquake seismic stations associated with the EarthScope Transportable Array program. These stations are scheduled to be installed in 2009 to 2010, and will record seismic waves of earthquakes from around the world for 2 years or more after installation. The job of the Lamar team was to determine exactly where 20 seismic stations were to be sited in east and southeast Texas based on a preferred grid with a 70 km spacing between each station. Requirements for each site included placement of the site within 7 km of the preferred location if possible, out to 15 km away from the preferred location if necessary. Other requirements included landowner permission, cell phone reception, a low seismic noise environment away from wells, pipelines, highways, secondary roads, airports and flight paths, etc., out of a floodplain, away from trees, and with enough open exposure for GPS reception and solar panel charging. Needless to say, meeting all these requirements was a challenge in east and southeast Texas. This presentation illustrates how all (or at least most of) the challenges were eventually met using GIS and GPS tools for preliminary to final site evaluation, combined with a lot of salesmanship and (literally) sweat equity in the form of numerous hours in the field.

P208 Geosciences

UTILIZING GEOPHYSICAL METHODS FOR ASSESSMENT AND CHARACTERIZATION OF SEEPAGE FROM THE IRRIGATION CANALS IN EL PASO LOWER VALLEY, TEXAS

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In the El Paso County Water Improvement District No. 1, several canals form a part of the irrigation delivery network used to deliver water for agricultural irrigation. Annually, billions of gallons of water are lost through seepage along sections of the network. To salvage water by reducing seepage losses, we need to understand patterns of seepage losses. Electrical resistivity techniques can be applied to identify sections of canal where soil is more permeable resulting high seepage losses. In order generate electrical resistivity soil profiles during the non-irrigation seasons, several half mile sections were selected along canals with varying seepage rates. We used a multiple channel resistivity meter (The "Ohm Mapper") which allows a vertical resistivity profile to be collected using a single current transmission. Though the results presented are preliminary, they will serve multiple purposes. First, by comparing our results with other seepage test results, a relationship between seepage rate and soil profile can be developed. This will allow the identification of priority sections, where high seepage losses exist and will identify the potential for water conservation through canal lining. Second, the research findings could be used to produce geological profiles and other information needed for developing guidelines for design of canal lining to improve water delivery efficiency, especially during drought. Finally, the method is transferable to other areas of the state and will have a positive impact on the environment and the overall quality of life.

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THE SPATIAL AND SEASONAL DISTRIBUTION OF SAND SEATROUT BETWEEN INSHORE AND OFFSHORE HABITATS OF TEXAS, WITH NOTES ON THEIR MATURITY.

Dusty McDonald* and Britt Bumguardner, Perry R. Bass Marine Fisheries Research Station, Palacios, TX

Sand seatrout (*Cynoscion arenarius*) are found within the inshore bays and offshore areas within the Gulf of Mexico, especially in the state of Texas. However, information is limited on their distribution and maturation, particularly in relation to offshore passes. To investigate sand seatrout distribution, we analyzed twenty years of bay and offshore trawl data collected by the Coastal Fisheries Division of TPWD. Sand seatrout maturation was investigated using fish collected from January 2005 to December 2006 in gillnet and trawl samples. We compared monthly gonadosomatic indices (GSI) of both sexes and analyzed the most advanced gonad oocytes of mature females (>140mm TL). Previous reproductive work on sand seatrout had been limited spatially and consisted of macroscopic inspection of ovaries. Our distribution analysis showed a higher abundance of sand seatrout offshore than inshore and indicated sand seatrout prefer offshore areas and inshore bays associated with a pass. We also found that sand seatrout abundance had an inverse relationship with salinity and water depth offshore. Our maturation analyses revealed a higher GSI level for both males and females offshore throughout the spawning season and indicated distinct differences in oocytes stages between sand seatrout collected inshore and offshore. These data highlight the seasonal, spatial and maturity differences in sand seatrout and relate these differences to the hydrological and geological features found along the Texas coastline.

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MERCURY CONCENTRATIONS IN RED SNAPPER (*LUTJANUS CAMPECHANUS*) FROM THE NORTHERN GULF OF MEXICO

Brianne L. Kiester*, Matthew M. Chumchal, Texas Christian University, Fort Worth, TX, Kevin M. Boswell, Michelle Zapp, James H. Cowan Jr., Louisiana State University, Baton Rouge, LA, and R. J. David Wells, Texas A&M University at Galveston, Galveston, TX

The Gulf of Mexico (Gulf) supports some of the most productive fisheries in the world. Two thousand metric tonnes of red snapper (*Lutjanus campechanus*) are harvested annually, making red snapper the most valuable commercial and recreational reef fish in the Gulf. Despite the importance of red snapper as a food fish, few studies have examined the level of Hg contamination in this species. Red snapper collected by recreational fishermen off the coasts of Texas (n = 121), Louisiana (n = 295), and Alabama (n = 264) were sampled during 2007 and 2008. We analyzed total mercury concentrations in epaxial muscle tissues using combustion atomic absorption spectrometry. Mercury concentrations in red snapper tissues were positively correlated with fish total length (TL). Approximately 96% of legal-sized fish (USA federal length limit = 406 mm TL) had mercury concentrations below the United States Environmental Protection Agency's (USEPA) limit for the protection of human health (300 ng/g ww). The majority of fish with mercury concentrations exceeding USEPA limits were collected off the coast of Alabama. Specifically, 8% of legal-sized fish collected off the coast of Alabama exceeded the USEPA limit. No fish collected off the coast of Texas and < 1% of the fish collected off the coast of Louisiana exceeded USEPA limits. Although most of the individuals we examined would pose a limited risk to consumers, results from our study suggest regional differences in Hg concentrations within the northern Gulf, with the highest Hg concentrations found off the Alabama coast. Future studies should determine if other species exhibit spatial variation in mercury concentration and explore potential mechanisms responsible for this pattern.

84 Marine Science

GENETIC STRUCTURE IN TARPON (*MEGALOPS ATLANTICUS*) – PATTERNS ARISING FROM ANALYSES OF ALLOZYMES, MITOCHONDRIAL DNA, AND MICROSATELLITES.

Rocky Ward*, West Texas A&M University, Canyon, Texas and Ivonne R. Blandon, Texas Parks & Wildlife Department, Corpus Christi, Texas.

Until the middle of the 20th Century tarpon supported a valuable recreational fishery in Texas waters. Reasons for the collapse may have included over-fishing, habitat alterations, or some combination of factors. In the late 1990s Texas Parks & Wildlife Department supported research designed to further understanding of tarpon in the western Gulf of Mexico and to developing a management plan for recovering the recreational fishery in Texas waters. Much of this research was aimed at understanding the population structure of the species in the Gulf and across its distribution. In collaboration with fishery scientists in other states, Mexico, Central America, the Caribbean, and Africa samples were collected and analyzed using allozymes, mtDNA, and microsatellite DNA. In this paper we examine patterns in population structure of tarpon that arise from the overall data.

P153 Marine Science

A GENETIC ASSESSMENT OF CURRENT MANAGEMENT STRATEGIES FOR SPOTTED SEATROUT IN TEXAS

Joel Anderson* and William Karel, Texas Parks and Wildlife

The spotted seatrout (*Cynoscion nebulosus*) is one of the most intensively managed finfishes in the Gulf of Mexico, due primarily to its importance as a sportfish species throughout its range. As a result, genetic divergence and patterns of gene flow have previously been assessed among designated populations of spotted seatrout, using various types of genetic markers, in an attempt to provide meaningful data for delineation of management units. However genetic data can be influenced both by contemporary gene flow and historical demography, and these processes can often result in similar genetic signatures. In this study, a nested clade analysis (NCA) was used to disentangle the effects of historical and contemporary processes on the distribution of mitochondrial DNA (mtDNA) sequence haplotypes in the western Gulf. The NCA was coupled with traditional F-statistics and a mantel-matrix procedure in order to compare the results of multiple analytical frameworks. Overall, genetic divergence among populations was low but significant ($F_{ct} = 0.016$, $P = 0.046$), and was highest between populations that were far apart geographically. Correlation between genetic divergence and geographic distance was supported by a significant mantel matrix correlation coefficient ($r = 0.717$, $P = 0.01$), as well as two nested clades which had distributions that correlated significantly with latitude. All three statistical procedures suggest that the genetic structure of spotted seatrout in the western Gulf of Mexico can best be described by continuous change, and isolation-by-distance, rather than discrete populations. These results are examined in the context of current management strategies for spotted seatrout on the Texas Gulf coast.

P156 Marine Science

BAHIA GRANDE WATER QUALITY, 2005-2008.

Priscilla Saenz*, Barbara Garza, Javier Reynoso, Dora Cedillo, Antonio Villarreal, Christian Garcia, Ruben Trevino, Erin Bieberbach, Hudson DeYoe and Thomas Whelan, University of Texas-Pan American. Edinburg, TX.

The Bahia Grande is a 6,500-acre basin located within the Laguna Atascosa National Wildlife Refuge in southern Cameron County, Texas. This area is part of the Bahia Grande Restoration Project, which is a US Fish & Wildlife Service effort to restore the Bahia Grande to pre-1930s condition by re-establishing tidal exchange with marine waters of the Brownsville Ship Channel. One objective of our study is to monitor basin water quality changes quarterly during restoration. Field data (temperature, salinity, conductivity, pH, depth) was first collected and sampling occurred in August 2005, one month after the resumption of tidal exchange and quarterly through October 2008. During each trip, water samples were collected at 9 sites in the basin and were analyzed for water column chlorophyll a, nitrate-nitrite, soluble phosphate, ammonium and total suspended solids. Sediment samples were collected and analyzed for benthic microalgal chlorophyll a levels. Comparing August 2005-2008, average basin salinity was highest in 2006 (>70 ppt) while salinity in 2005, 2007 and 2008 was about equal (50 ppt). In 2006-08, water column chlorophyll was generally low (<50 micrograms/L) except from August 2007 (ca.70 micrograms/L) to April 2008 (ca.150 micrograms/L). Sediment chlorophyll increased through 2006 and early 2007 to peak in March 2007 and subsequently decline through the rest of 2007 and 2008. It appears that in 2007 reduced salinity perhaps with other factors led to the development of the first significant plankton community and algal bloom in the basin that persisted until the summer of 2008.

P134 Marine Science

DISTRIBUTION AND ABUNDANCE OF A BRAIN-ENCYSTING PARASITE IN KILLIFISH OF THE LOWER LAGUNA MADRE, SOUTH TEXAS

Ashley Longoria*, Brian L. Fredensborg, University of Texas-Pan American

Parasites are ubiquitous organisms in soft-bottom intertidal ecosystems. The most abundant parasites are often trematodes (flukes) that greatly impact the animal community by affecting host survival, reproduction and behavior. The trematode *Euhaplorchis* sp. was recently observed encysting on the brain of the long-nose killifish, *Fundulus similis* in the mangal of Lower Laguna Madre, South Texas. To examine the distribution and abundance of this species, we surveyed the parasite fauna of *F. similis* and the related species, *Cyprinodon variegatus* in Lower Laguna Madre in December 2008. Both of these fishes are abundant members of the animal community of the Texas mangal where they serve as an important food source of several bird species. The two species were caught adjacent to a stand of *Avicennia germinans* (black mangrove) on South Padre Island using a bag seine hauled parallel to the shoreline. They were subsequently dissected in the laboratory to identify and count the number of parasites present. Our results showed that *Euhaplorchis* sp. infected just under 90 % of *F. similis* and infection levels ranged from 0 - 437 metacercariae per fish. The number of *Euhaplorchis* metacercariae increased linearly with host length indicating a constant recruitment rate of infective stages throughout the life span of the host. No *Euhaplorchis* sp. was observed in *C. variegatus* suggesting a high host specificity of that parasite. The wide distribution of *Euhaplorchis* sp. indicates an important role of this parasite in the mangal community of Laguna Madre which will be the subject of future studies.

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P122 Marine Science

MERCURY CONCENTRATIONS IN SPORT FISHES IN SOUTH TEXAS BAYS

Christopher Bost*, Texas Lutheran University, Seguin, TX, Greg Stunz, Texas A&M University, Corpus Christi, TX, Ben Hale, Truman State University, Kirksville, MO and Eugene Billiot, Texas A&M University, Corpus Christi, TX

Consumption of fish containing high levels of mercury may cause physiological and neurological damage in both infants and adults. Both men and women who consume high levels of methylmercury experience symptoms such as reduction of eyesight, irregular gait, and other negative impacts upon cognitive function. Furthermore, children of mothers who had consumed high levels during pregnancy show permanent neurological impairment. The objective of this preliminary study was to quantify the total mercury concentrations in four recreationally and economically important fish species: spotted seatrout (*Cynoscion nebulosus*), red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*) and

southern flounder (*Paralichthys lethostigma*) in South Texas estuaries of Aransas Bay, Corpus Christi Bay and Upper Laguna Madre. We tested for total mercury in the epaxial tissue of these fishes using Cold Vapor Atomic Absorption Spectroscopy (CVAAS). Levels of mercury contamination in local fish populations were between 0.050 and 0.158 parts per million, which do not appear to pose a health concern for consuming fish from the coastal bend bays and estuaries. However, future studies need to be conducted on a larger spatial scale including more samples as well as examining other toxic contaminants that bioaccumulate in fishes, such as polychlorinated biphenyls (PCB's), in south Texas bays.

P135 Marine Science

PARASITE TRANSMISSION IN A SOUTH TEXAS ESTUARY: SALINITY CHANGE FACILITATES A SHIFT IN THE PRODUCTION OF PARASITE INFECTIVE STAGES

Milena Melo* and Brian L. Fredensborg, University of Texas, Pan American

Trematodes (flukes) are ubiquitous parasites in aquatic ecosystems where they play an important role in the structure of animal communities. Larval stages multiply in snail hosts and a free-swimming stage (cercaria) seek out and infect a second intermediate host (crabs, fishes or birds). Except for temperature there is a lack of information on the effect of environmental factors on the transmission of infective stages. In this experiment, we investigated the effect of three salinities (20, 35 and 50 ppt) on the production of trematode cercariae from snail intermediate host, *Cerithidea pliculosa*. More than 600 snails were collected from two mangrove locations on South Padre Island, Texas in October 2008. Snails containing larval stages of the three species: *Philophthalmidae* sp., *Mesostaphanus* sp., or *Himasthla rhigedana* were included in the experiment. Experimental snails were individually placed in 125 ml containers with sediment and 20, 35 or 50 ppt sea water, and the number of infective stages was counted daily for seven consecutive days. In *Philophthalmidae* sp. the highest mean daily production of cercariae were obtained at 35 ppt. In contrast, *Mesostaphanus* sp. produced the highest amount of cercariae in 20 ppt while no difference in cercarial production was observed in *Himasthla rhigedana* between 20 and 35 ppt. Our results demonstrate that salinity affects the production of trematode infective stages, and that the preferred salinity varied among parasite species. Estuarine habitats may therefore experience periodical shifts in the species composition of trematode infective stages related to changes in terrestrial run-off following heavy rainfall.

P152 Marine Science

THE EFFECTS OF WINTER SEVERITY ON THREE LIFE STAGES OF SPOTTED SEATROUT (*CYNOSCION NEBULOSUS*)

Dusty McDonald*, Britt Bumguardner, TPWD- Perry R. Bass Marine Fisheries Research Station, Palacios, TX, and Mark Fisher, TPWD-Rockport Marine Lab

Three size classes of spotted seatrout, *Cynoscion nebulosus*, were exposed to a steady temperature drop (0.33°C per hour), similar to a winter freeze, in order to determine the dynamic critical thermal minimum. In addition, we sought to determine if any size dependence in relation to cold tolerance exists in this species. Our experimental fish first began displaying signs of stress at 6.3°C and displayed loss of equilibrium occurring at 6.1°C. No differences existed between size classes with pre-lethal biotic responses ($P = 0.45$ for signs of stress; $P = 0.49$ for loss of equilibrium). The adult fish, ranging from 276-333mm in total length (TL), had a median lethal temperature (LT50) of 1.8°C, the young adult fish, ranging from 117-149mm in TL, had a LT50 of 1.9°C, and the juvenile fish, ranging from 33-79mm in TL, had a LT50 of 3.0°C. These results suggest that positive size dependence is occurring by using lethality as criteria ($P < 0.01$) between juvenile and young adult-sized spotted seatrout. However, no significant difference existed between adult and young adult-sized fish for lethality.

P133 Marine Science

THE POTENTIAL EFFECT OF PARASITISM ON CHLOROPHYLL-A ABUNDANCE ON A MUDFLAT IN LAGUNA MADRE, SOUTH TEXAS

Carolina Servin*, Hudson DeYoe and Brian L. Fredensborg, University of Texas-Pan American, TX

Benthic diatoms greatly contribute to the high primary productivity of intertidal mudflats. The dominant grazer of benthic diatoms on mudflats in the Gulf of Mexico is the plicate horn snail, *Cerithidea pliculosa*. *C. pliculosa* serves as host to a suite of castrating parasites (flukes) that have been demonstrated to reduce snail populations elsewhere. Trematode infection may also change snail host feeding behavior reducing the grazing efficiency of snails. It is unclear if changes to snail density and behavior may incur a cascading effect on the abundance of primary producers. We investigated the effect of snail density on the abundance of chlorophyll-a in sediment collected from a mudflat in the Laguna Madre, South Texas. The method of chlorophyll-a extraction and quantification was first tested through diluted standardized sediment samples. Those dilutions required detailed observations of the sediment for impurities that could interfere with the absorbance of chlorophyll-a. Subsequently, we examined the effect of four different snail densities on chlorophyll-a abundance in freshly collected sediment in 50 ml PVC dishes over a 48 hour period. As expected increasing snail density significantly and negatively affected chlorophyll-a abundance. Interestingly, the highest snail density did not reduce chlorophyll-a levels below the level of the control group suggesting a negative effect of snail density on the feeding activity of snails. These

initial studies suggest a potential role of parasitism on primary producer abundance via a control of grazer density. Field studies will be conducted to verify the observed pattern in the lab. Benthic diatoms greatly contribute to the high primary productivity of intertidal mudflats. The dominant grazer of benthic diatoms on mudflats in the Gulf of Mexico is the plicate horn snail, *Cerithidea pliculosa*. *C. pliculosa* serves as host to a suite of castrating parasites (flukes) that have been demonstrated to reduce snail populations elsewhere. Trematode infection may also change snail host feeding behavior reducing the grazing efficiency of snails. It is unclear if changes to snail density and behavior may incur a cascading effect on the abundance of primary producers. We investigated the effect of snail density on the abundance of chlorophyll-a in sediment collected from a mudflat in the Laguna Madre, South Texas. The method of chlorophyll-a extraction and quantification was first tested through diluted standardized sediment samples. Those dilutions required detailed observations of the sediment for impurities that could interfere with the absorbance of chlorophyll-a. Subsequently, we examined the effect of four different snail densities on chlorophyll-a abundance in freshly collected sediment in 50 ml PVC dishes over a 48 hour period. As expected increasing snail density significantly and negatively affected chlorophyll-a abundance. Interestingly, the highest snail density did not reduce chlorophyll-a levels below the level of the control group suggesting a negative effect of snail density on the feeding activity of snails. These initial studies suggest a potential role of parasitism on primary producer abundance via a control of grazer density. Field studies will be conducted to verify the observed pattern in the lab.

P157 **Marine Science**

USE OF PAM FLUOROMETRY TO DETECT STRESS IN THE SEAGRASS THALASSIA TESTUDINUM.

Ammie Ortiz*, Maria Silva, Natalie Mejia, Michael Persans and Hudson DeYoe, Center for Subtropical Studies and Department of Biology, University of Texas-Pan American, Edinburg, TX

Non-optimal salinities stress marine organisms. Lowered salinity in coastal marine systems can occur due to direct precipitation and/or freshwater runoff. We are interested in detecting photosystem stress in seagrasses using a Pulse Amplitude Modulated (PAM) fluorometer which measures quantum yield of PSII. The seagrass *Thalassia testudinum* was subjected to three salinities (7, 14 and 35 ppt) employing aquarium tanks for 14 days. After 7 days, reduced quantum yield was detectable at lowered salinities while at 14 days the seagrass in all tanks were stressed but the reason is unclear. Midway into the tank study, rains from Hurricane Dolly significantly depressed salinities (as low as 5 ppt) in the Lower Laguna Madre. We initiated a field component to our study due to this event. Two and four weeks after the storm (8/6 and 8/23), we collected samples of the seagrass *T. testudinum* at four locations along a salinity gradient (ABC (highest salinity), DB67, W14, and WPT19 (lowest most variable salinity)) and measured quantum yield. After two weeks, a significant increase in quantum yield was detected at one site (W14) while there was a significant decrease at another reduced salinity site (WPT19). By the second collection, salinity had increased at the impacted sites but was still below normal. At this time, there was no difference in quantum yield amongst the four sites indicating that the effect of reduced salinity on photosystem II of *Thalassia* is short-lived.

76 **Mathematics**

ANOTHER APPROACH TO SOLVING $A=MP$ FOR TRIANGLES

Elsie M. Campbell*, Angelo State University, and Dionne T. Bailey*, Angelo State University, jointly

The problem of finding all integer-sided triangles whose area A and perimeter P are numerically equal appears as far back as 1865. Although differing in details, all early solutions required a good deal of trial and error. Not surprisingly, the generalization of solving $A=mP$ for integers $m \geq 2$ wasn't considered well into the last century. We will present another approach which gives a relatively simple characterization of all solutions and essentially relies only on the easy manipulation of a single Diophantine equation.

223 **Mathematics**

THE CONTROL OF AN INVERTED PENDULUM USING CHAOS THEORY

Katherine Bateman* and Michael Frye, University of the Incarnate Word, San Antonio, TX

Can an inverted pendulum be controlled by a chaotic controller? This presentation examines that question using a mathematical solution using chaos theory and Lyapunov stability theory. The research explores the mathematical control of a second order nonlinear differential equation of an inverted pendulum using open loop chaotic control and closed loop linear feedback. A controller based on chaos theory was developed and simulated using MATLAB to invert the pendulum. Stability is theoretically proven using Lyapunov theory. This presentation will examine the control technique of using chaos theory for an inverted pendulum and present the simulated results. This research has practical implications for the scientific community at large. First, there are still questions needing to be investigated in the area of chaos and using chaos to control a system. Furthermore, an inverted pendulum models such behavior as the flight dynamics of a hovering helicopter or vertical take-off aircraft. At large the average person is surrounded by chaotic systems that have a direct affect on his or her life, for example, the weather. Also at some malls, the police ride Segways and the problem with riding a Segway which behaves as an inverted pendulum. For both the Segway usage and the inverted pendulum the goal is to keep the mechanism at a 90 degree position.

265 **Mathematics****WAVELET MATRIX COMPLETION METHODS AND THEIR EFFECTS IN IMAGE COMPRESSION**

Henry F. Schreiner III*, Massooma Pirbhai, and Roger E. Zarnowski, Angelo State University, San Angelo, TX.

Wavelets are mathematical functions that separate data into different frequency components. They have advantages over traditional Fourier analysis in analyzing physical situations where the signal contains discontinuities and sharp spikes. Wavelets are local transforms that can be used in either lossy or lossless compression systems, as, for example, in the JPEG2000 format. When a digital image is created, the data must be transformed, quantized, and encoded before it is stored on a computer. It is in the first stage that wavelet transforms can be utilized. These types of transforms are developed using different types of filters. The simplest type of transform is the Haar wavelet, which was proposed by Alfred Haar in 1909. Unfortunately, it is not continuous and therefore not differentiable. However, the Haar wavelet is only a special case of Daubechies wavelets. Named after Ingrid Daubechies, these wavelets are an infinite collection of orthogonal wavelet sets, each of which defines a discrete wavelet transform. High order Daubechies wavelets are differentiable, but are more computationally intensive. A problem arises when applying long finite filters to a finite sequence. There are several ways to construct the convolution matrix. One way is to periodically extend the data and wrap the filter when creating the filter bank. We ran comparisons of proposed solutions, including this more common wrapped boundary method and also a symmetric extension method, looking at different vectors and images, and making entropy or peak signal-to-noise ratio (PSNR) comparisons. Artifacts vary depending on the nature of the data.

282 **Mathematics****APPLICATION OF MATRIX COMPLETION METHODS TO PARTIAL IMAGE RECONSTRUCTION**

Massooma Pirbhai*, Henry F. Schreiner III, and Roger E. Zarnowski, Angelo State University, San Angelo, TX

Matrix completion methods allow us to change the way wavelet transforms handle the edges of an image. The most common method is to "wrap" the rows of the wavelet matrix, which mixes data from opposite boundaries. Matrix completion avoids this problem. An application of the matrix completion methods is in partial image reconstruction. For example, a very large MRI scan may be transformed using wavelet methods to reduce the file size. Since a complete scan reconstruction takes time and computer resources, a low resolution portion can be viewed quickly without the higher detail from a full reconstruction. This allows us to mark and reconstruct a small region of interest, like a possible tumor site. The common wrapping method makes this difficult because the region of interest has been inappropriately distributed over the regions of the transformed scan. Our project focused on implementing partial image reconstruction using the "matrix completed" D4 and D6 transforms. We also compared the results with other methods to see which one was more effective and efficient for this particular application.

227 **Mathematics****OPTIMIZATION OF NONLINEAR FUNCTIONS USING PSO**

Luis Alonso* and Michael Frye, Univeristy of the Incarnate Word, San Antonio, TX

Particle Swarm Optimization (PSO) is still a relatively new technique basing its results on the so-called "swarms" of particles looking for a solution. This is to be compared to a swarm of bees looking for flowers. A particle is no more than a particular point in the given domain of a problem. Each point in a given solution space will either produce desirable results when put through a given algorithm or will start to deviate from a predetermined solution range. This technique compares individual particle solutions to the best solution out of the group as a whole. Crucial to development is relating all of a given algorithm's outputs to one single number. The given algorithm will have a "fitness function" in PSO parlance. The output of the fitness function provides guidance to all of the individual particles in the swarm. PSO is performed through multiple iterations thereby allowing PSO to govern itself through this fitness function. In this particular case the PSO algorithm itself is being evaluated via the Rosenbrock Function. This function is being used as a litmus test for the PSO. The objective of the test is to see if the PSO can converge to the previously known global minimum of (1, 1). Rosenbrock is a difficult benchmark for optimizers due to a high population of local minima. Verifying that PSO can search the Rosenbrock Function and return the correct answer lends confidence to future use of this algorithm.

296 **Mathematics****EMPIRICAL LIKELIHOOD SPIROMETRY REFERENCE VALUES.**

Nancy Glenn*, Center for Bionanotechnology and Environmental Research, Texas Southern University

The American Lung Association advocates regular pulmonary testing to allow for early detection and timely treatment of lung diseases such as cancer, chronic bronchitis and asthma. Spirometry tests, the most commonly used pulmonary function test, generate reference values that are based on linear equations. These equations typically employ linear regression forms that rely heavily on parametric assumptions which are often violated; this may ultimately lead to misdiagnoses. We instead use empirical likelihood confidence intervals to establish normal ranges for spirometry reference values. Empirical likelihood's major advantages are that it relaxes normality and other distributional assumptions; it has many of the same asymptotic properties as the parametric likelihood; it employs the most popular method for deriving statistical estimators, maximum likelihood; and it extends to confidence regions. Research confirms that ethnicity has a major impact on pulmonary function reference values. Several studies provide spirometry reference values for European Americans and African Americans. However, Hispanic American pulmonary function has been understudied even though this population comprises the largest minority population in the United States. We use the empirical likelihood approach to establish normal spirometry reference value ranges for Hispanic Americans. This approach extends to other ethnicities as well.

82 Physics

DIFFERENTIAL PHOTOMETRY: A MEASUREMENT OF LIGHT CURVES FOR ASTEROIDS & VARIABLE STARS

Dwayne Caldwell, Brookhaven College & Matthew Davis*, Hardin-Simmons University

Charge-coupled devices (CCDs) are sophisticated digital cameras used by astronomers. CCDs exhibit a linear response. The images they produce represent nearly-ideal computational and mathematical data. CCD images taken of the Main Belt asteroid 771 Libera with a 10" Schmidt-Cassegrain telescope were analyzed using differential photometry. The light curve of the asteroid was measured; that is, the relative variation in its brightness as a function of time. Additional CCD images taken of two δ Scuti variable stars, XX Cyg and YZ Boo, using a 12.5" aperture telescope, were also analyzed using differential photometry to measure their light curves. These measurements permit the determination of rotation rates, and in the case of asteroids an understanding of their geometrical shape.

81 Physics

LIBYA TOTAL SOLAR ECLIPSE 2006: A REPEAT OF THE EDDINGTON-EINSTEIN EXPERIMENT

James D. Martin* & Ashley D. Delgado, Hardin-Simmons University

In 1919 Sir Arthur Eddington led an expedition to Principe, an island off the coast of West Africa, to photograph a total solar eclipse. His findings showed Einstein's theory of general relativity predicted the bending of light around the Sun better than Sir Isaac Newton's equations of the 18th Century. Eddington's findings catapulted Albert Einstein to the most well-known physicist of the 20th Century. In 2006, a team of astronomers trekked to Libya to try and duplicate the experiment using modern optics and digital astrophotography. The expected results are stars that appear in the sky near the Sun have an apparent shift away from the Sun's center. However, the expected deviation was smaller than the margin of error introduced during the preliminary analysis of the data. This paper details the methodologies used, and the shortcomings encountered along with ideas for future analysis of the data. More sophisticated analytical methods are now being employed to extract more accurate information.

149 Science Education

CAN CLASSROOM INTERACTION WITH SCIENTISTS POSITIVELY INFLUENCE SCIENCE MAJORS TO CONSIDER A RESEARCH CAREER?

St. Edward's University, Austin, TX

St. Edward's University is a primarily undergraduate institution where students majoring in biology and biochemistry overwhelmingly intend to enter medicine or dentistry. Many students have limited exposure to research since this is not a public activity and the pace of science does not lend itself to television dramatization. The hypothesis is that when students relate personally with scientists they will be more likely to consider a research career. During the semester seven diverse scientists addressed a microbiology class in person, via videoconference or videotape. Students were asked if they were more likely to consider a research career via anonymous online survey and also identified the two scientists with whom they most related. After this experience, 86% of the students were more likely to consider research while 14% were not with males and females responding similarly. In choosing the two scientists with whom they most related every student chose at least one scientist of their own gender. Students were twice as likely to relate with a scientist who spoke in class compared with those they met via videoconference or videotape. The Caucasian and Hispanic students chose one speaker of the same ethnicity 37% of the time, both speakers of their own ethnicity 26%, and both speakers of an ethnicity different than themselves 37% of the time. The conclusion is that students are positively influenced to pursue scientific research through personal interaction with scientists and that gender and personal interaction are most important in student identification with a scientific role model.

86 Science Education

CORRELATED SCIENCE & MATH: A NEW MODEL FOR SCIENCE & MATH TEACHER TRAINING

Sandra West*, Texas State University, San Marcos, TX and Sandra Browning, University of Houston - Clear Lake, Clear Lake, TX

Correlated Science & Math: A New Model for Science and Math Teacher Training Correlated Science & Math (CSM) is a new model of linking science and math instruction. Integrating science and math typically means science teachers using math as a tool or math teachers using a science as an application of a math concept. The CSM model is clearly defined where the concepts in each discipline are taught with four fundamental goals: (1) teach for conceptual understanding and (2) use the discipline's proper language; (3) use the natural links between the disciplines; and (4) identify parallel ideas. Both science-led and math-led CSM lessons and courses have been developed and taught. Differences and similarities between courses (syllabi and lessons) will be presented.

125 Science Education

CORRELATED SPACE SCIENCE, GEOLOGY & MATH PROGRAM EVALUATION

This study is based on the new model of linking science and math called Correlated Science & Math (CSM) in two science led courses, Correlated Geology & Math and Correlated Space Science & Math was taught in a two week (70 hours) summer session and five academic year sessions. This study took place during the summer and fall of 2008. The cohort, 10 in-service grades 5-8 math and science teacher teams, had at least one team member with less than 20 hours of math or science content. Teachers were given a pretest prior to training and a posttest after training. A paired t-test was used to determine if teachers increased their content knowledge of math, space science and geology. Preliminary results show teachers (1) increased their content knowledge ($p < .05$) (2) adopted an integrated approach, not the CSM model (3) adopted the inquiry model for their demonstration lesson. Further analysis will include student performance on pre/posttests, state test scores, student work and classroom observations.

196 Science Education

DEMOGRAPHIC AND ACADEMIC FACTORS RELATED TO STUDENT PERFORMANCE AND SUCCESS IN ENTRY-LEVEL BIOLOGY, CHEMISTRY, AND PHYSICS COURSES

Mamta Singh* and Sandra West, Texas State University, San Marcos, TX

This study investigated students' performance and success in college biology, chemistry, and physics entry-level courses. Six variables—gender, ethnicity, high school GPA, high school science, school choice, and work hours were used as independent variables and course final performance as a dependent variable. The sample comprised of voluntary student participants of entry-level science courses (biology (N=490); chemistry (N=377); physics (N=125)). The study attempted to explore two research questions: 1) What were the variables of performance in entry-level biology, chemistry, and physics? and 2) What were the predictors of success in entry-level biology, chemistry, and physics? Multiple regression models and logistic regression models were used to address the above two research questions. The results suggested that high school GPA had a strong association with students' performance in entry-level science courses. Additionally, high school GPA and high school chemistry were the predictor variables for students' success in entry-level biology and chemistry courses. Similarly, students' performance and success in entry-level physics courses were influenced by high school GPA and high school physics course respectively. A further study with a longitudinal and quasi-experimental research design is recommended to assess students' performance and success entry-level science courses.

146 Science Education

GETTING COMMUNITY COLLEGE STUDENTS INVOLVED IN RESEARCH

C. Frederick Jury *, Nelson Rich and Cameron Neal, Collin College, Plano, TX

This presentation will describe the creation, operation, evolution and results of an effort to design a program for mentoring Math and Science students in research at a two-year college. The program enhances collaboration among faculty and provides interested students with opportunities to participate in research and a variety of scholarly activities. Program benefits include providing a springboard for further interest and participation in research upon transfer.

167 Science Education

GEOCHEMISTRY OF THE SOUTHWEST PART ONE: CHEMISTRY IN THE GREAT OUTDOORS

Alyx S. Frantzen *, Department of Chemistry and Melinda G. Shaw, Department of Geology, Stephen F. Austin State University, Nacogdoches, Texas

Field courses provide students with a unique opportunity to study scientific processes in an outdoor setting. These courses are commonly used in geology, but rarely in chemistry. Often students are intimidated by the field of chemistry, thinking it is purely academic and restricted to the laboratory. The challenge faced by the instructors is to take a basic principle and apply it in a natural setting, away from the laboratory and lecture hall. Geochemistry of the Southwest offers students a two week, intensive field trip through four states visiting and studying sites with a distinct connection between chemistry and geology. Teaching chemistry away from the classroom and laboratory offers unique challenges for both the instructors and the

students. Since every part of the learning experience occurs away from technological advances, students must concentrate on the results of chemical processes that occur and their influence on the geology of the area. Instructors must take care when planning the trip to ensure that the sites visited adequately represent the principle or process they are trying to reinforce and that the material is accessible to students that have completed introductory chemistry courses.

287 Science Education

GEOCHEMISTRY OF THE SOUTHWEST PART TWO: GEOLOGY AND CHEMISTRY, TOGETHER AGAIN

Melinda G. Shaw *, Department of Geology and Alyx S. Frantzen, Department of Chemistry, Stephen F. Austin State University, Nacogdoches, Texas.

Geology is a discipline that easily lends itself to being taught and appreciated in an outdoor setting. Most geology students take chemistry as part of their undergraduate degree but seldom appreciate the relationship between the two sciences; geology occurs in the great outdoors and chemistry in the laboratory. This program addresses some of the challenges faced by instructors by adopting an inter-disciplinary approach to understanding basic chemical processes and applying those processes to a geologic setting. Geochemistry of the Southwest offers students a two week, intensive field trip through four states visiting and studying sites with a distinct connection between these two disciplines. Teaching geology and chemistry together allows students to understand not only how a particular terrain evolved, but also the chemical processes that influence this unique geologic setting. This program and its effects on student success and attitudes are factors to consider during implementation; instructors must take care when planning the trip to ensure that the sites visited adequately represents the relationship between the two disciplines and that the material is accessible to students that have completed introductory chemistry and geology courses.

80 Science Education

INTERNATIONAL ASTRONOMICAL SEARCH COLLABORATION: HANDS-ON ASTRONOMY RESEARCH PROGRAMS FOR HIGH SCHOOL & COLLEGES

J. Patrick Miller, Hardin-Simmons University

The International Astronomical Search Collaboration (IASC = "Isaac") is centered at Hardin-Simmons University. Its programs include online, hands-on astronomical discoveries for high schools and colleges. Using real-time images from the Astronomical Research Institute (Charleston, IL) students from 130 schools in 11 countries make original discoveries of Main Belt asteroids. They also make virtual impactor observations reported to the NASA Jet Propulsion Laboratory (Pasadena, CA) as part of the NASA Near-Earth Asteroid (NEA) Project, and make hundreds of positional observations of NEAs. IASC also features a 3-week summer institute in astronomy held at the Lawrence Berkeley National Laboratory (UC Berkeley), in which 18 Texas high school science teachers from six Educational Service Centers learn hands-on astronomy for use in their classrooms and labs. The institute is coordinated through the Region 14 Education Service Center and funded by a grant from the Texas Regional Collaboratives (UT Austin). IASC participates in the NASA Widefield Infrared Explorer Survey educational and public outreach program, servicing 100 schools across the United States in IR science and asteroid discovery. Its Main Belt asteroid discovery program is an activity in support of the International Year of Astronomy 2009. This presentation will provide an overview of the program and its effectiveness.

128 Science Education

INVESTING WISELY: EDUCATION AS A MEANS TO FUND SEA TURTLE CONSERVATION ON SOUTH PADRE ISLAND

Anna Frankel*, Southwestern University, Georgetown, TX and Jeff George, Sea Turtle, Inc., South Padre Island, TX

Informal science education represents a noteworthy aspect of marine conservation work at Sea Turtle, Inc. (STI). This presentation will describe the efforts of educating the public in conservation, its effects on patron donations, and uses of these funds. During daily tours, educational programs cover the mission and history of STI, basic sea turtle physiology, migratory patterns, diet and rehabilitation of sick and injured animals at the facility. According to visitor exit surveys (Spring 2006-January 2007), more than 90% of respondents reported an increased likelihood in leaving a donation in addition to their entrance fee when they had participated in an educational tour. With this substantial increase in revenue, STI sponsors sea turtle education and conservation programs in Mexico, Costa Rica and Sri Lanka. These programs directly protect nesting sea turtles and hatchlings all over the world by employing and training locals in techniques used at STI. Donations also provide funds to care for turtles living in the facility that cannot be released back into the wild. With the financial support of the public, STI has been able to support the increase of Kemp's Ridley nests on South Padre Island. The past five years have witnessed a dramatic increase in nests from 9 to 52 nests on South Padre and from 6,000 to over 17,000 nests in Tepehuajesand Rancho Nuevo, Mexico. Therefore, STI advocates that education plays an imperative role in funding opportunities that considerably help further marine conservation.

252 Science Education

LEAST SQUARES OPTIMIZATION OF LINEAR SPECTRAL SUPERPOSITION FOR QUANTITATION OF MIXTURES.

Benny E. Arney, Jr.*, Sam Houston State University

In many areas of industrial analysis and quality control the need for immediate "real time" monitoring of material streams is almost standard. The problem of monitoring the concentration of multiple components simultaneously is one that generally stumps most undergraduates and many graduate students. Application of the linear least squares directly to digitized spectrophotometric data provides a simple route to instantaneous quantitation of multiple components from a single spectrum of the mixture. The development of least squares for spectral application and an example of an undergraduate laboratory experiment applying the method to the analysis of a mixed metal solution will be presented.

99 Science Education

PREDICTORS OF STUDENT SUCCESS IN A HUMAN ANATOMY COURSE FOR NON-MAJORS

R. Russell Wilke* and Christie L. Adkins, Angelo State University

This preliminary study was conducted in response to administrative inquiries about the success rate of students enrolled in a sophomore level, human anatomy course at a small regional university. This service course caters to a wide variety of academic majors and students at all levels of classification. Because attrition ranges from 25-45% depending on the semester, the goal of the research was to identify risk factors that impede student success in order to develop strategies to increase retention and promote achievement. Three lecture sections with 110 students each (n=320) were used in the initial analysis. Factors analyzed included students' SAT/ACT composite scores, academic classifications (by number of hours completed), majors, attendance records, and grade point averages. Various statistical analyses determined students who were true freshman with 0-12 hrs of academic credit and with ACT/SAT composite scores less than 16 and 700 respectively were the ones most likely to fail. Implications of the findings will be discussed.

98 Science Education

PROGRAM EVALUATION OF A CORRELATED PHYSICS, CHEMISTRY AND MATH TRAINING PROJECT

Lisa Gloyna, and Melissa Ponce*, Texas State University, San Marcos, TX

Program Evaluation of a Correlated Physics, Chemistry and Math Training Project This study evaluates a Correlated Science and Math (CSM) professional development project. The study spanned two years and included three cohorts of science and math teachers, three summer sessions, and Academic Year (AY) training sessions. The three summer sessions included physics and chemistry-led CSM courses. Two math-led CSM courses were concurrently taught during the second and third sessions. The data show more significant gains in science content than in math content. The data indicate that science teachers had more significant gains in content knowledge than math teachers. Teachers used more integrated science and math in their teaching practice. The only measure of student learning for this study was with TAKS scores which are inconclusive.

129 Science Education

THE EFFECT OF LEARNING STYLES ON COGNITION AND SATISFACTION IN ONLINE BIOLOGY LABORATORIES FOR NON-SCIENCE MAJOR UNDERGRADUATES

Patricia Ritschel-Trifilo, Hardin-Simmons University, Abilene Texas, and Capella University, Minneapolis, MN

Learning is a biological process involving horizontal and vertical synapse formations in the brain resulting in established neuronal pathways. Each learner has a unique biological makeup resulting in personally-selected approaches to acquire, understand, and perceive information, which constitutes their learning styles. Learners have a dominant and several subdominant learning styles (established neuronal pathways) they use to explore new material. This study investigates the effect of learning styles on cognition in an online biology laboratory for non-science major undergraduates. Participants in the control group, without knowledge of learning styles, each chose a random combination of instructional strategies to explore the subject of fermentation and enzymes. Each participant in the experimental group was tested to determine dominant and subdominant learning styles, and was then instructed to follow a specific pathway, using these styles, through the instructional materials to explore the topic. Results of the study show a statistically significant improvement in cognition when instructional strategies are matched to dominant and subdominant learning styles compared to instructional strategies unmatched to learning styles. Learners expressed a higher level of satisfaction with the instruction and greater ease of learning when the instructional strategies matched learning styles. Research results suggest that if the selected instructional style in an online laboratory presenting new, unfamiliar material to learners does not match the learners' style the learner is forced to use a pathway with little neuronal connectivity resulting in poor cognition and understanding, and dissatisfaction with the instruction. Learning is a biological process involving horizontal and vertical synapse formations in the brain resulting in established neuronal pathways. Each learner has a unique biological makeup resulting in personally-selected approaches to acquire, understand, and perceive information, which constitutes their learning styles. Learners have a dominant and several subdominant learning styles (established neuronal pathways) they use to explore new material. This study investigates the effect of learning styles on cognition in an online biology laboratory for non-science major undergraduates.

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197 Science Education

THE EFFECTS OF CLICKER FEEDBACK ON STUDENT SUCCESS

Brittany Heath*, Connie Russell, and J. Kelly McCoy, Angelo State University

Student response systems ("Clickers") are designed to improve the overall classroom experience by increasing participation which should lead to an increase in interactivity. Researchers suggest that the precise, real-time feedback the students receive should improve their classroom experience by improving their understanding to the subject matter. The claim made by the clicker companies as well as by many researchers is that this feedback is of great interest to the students and may serve as a significant motivating factor in terms of creating interest in the topic. This study used a quasi-experimental design to correlate effects of clicker feedback on student success in answering multiple choice content questions. We were specifically targeting the feedback the students obtain when using clickers. Our hypothesis was that the use of clickers will increase student learning because their use provides students with instant feedback. To test this we evaluated four sections of an introductory biology class (N=180) for majors so that the only difference between the control and experimental group is the presence or absence of clickers. Additionally, students' demographic information (e.g. sex, ethnic origin) was included in the assessment to determine if these types of characteristics have an impact on students' response to clickers. Lastly, since the literature reports that students rate clickers higher when instructors have more experience with them, an opinion poll was given at the end of the semester to assess students' feelings and instructor effect. This presentation will report preliminary results of the study.

299 Science Education

WEB ASSISTED INSTRUCTION USING THE AGILE MIND

Demerios Kazakos*, Center for Bionanotechnology and Environmental Research, Texas Southern University

The challenge of attracting elementary and high school students to the sciences, is an eternal challenge to educators and to the growth and productivity of an educated workforce in the United States. Texas Southern University, as a minority serving institution located in an urban environment, has to face such challenges to a higher degree. However, it is within the strategic mission of TSU and NASA to attract and retain students in the stem fields. The state of Texas has wisely decided to provide financial assistance towards several initiatives that enhance the effectiveness of K-12 teachers, using web assisted instruction. Agile Mind is such a web assisted instructional system that is currently under a pilot implementation in several Universities and K-12 schools. Texas Southern University started implementing the use of the Agile Mind in the training of teachers, in Mathematics and Biology. The speaker will discuss the resulting experience of its use, and the future plans for enhancing the effectiveness of teachers using web assisted methods.

83 Systematics and Evolutionary Biology

FURTHER OBSERVATIONS ON THE NESTING BIOLOGY OF TRYPOXYLON SPECIES (HYMENOPTERA: CRABRONIDAE) IN TRINIDAD, WEST INDIES

Allan W. Hook*, St. Edward's University, Austin, TX

Additional results were obtained in 2008 on the nesting biology of three species of Trypoxylon (*manni*, *maidli*, *nitidum*) in Trinidad. *Trypoxylon manni* and *maidli* construct aerial mud nests that are often communal, and nest reutilization was documented for *T. maidli*. Prey and parasites were also obtained or associated with both species. A few Mantispidae (Neuroptera) were reared from *T. manni* nests, an unusual association that has never been reported before. *Trypoxylon nitidum* nests in preexisting cavities and males guard the nest while the female is away.

181 Systematics and Evolutionary Biology

TAXONOMIC AND DISTRIBUTIONAL ICHTHYOFAUNA STUDY OF THE SELECTED AREAS IN THE NORTH OF THE ZACATECAS STATE, MEXICO.

Fernando Solís-Carlos*, Maria de Lourdes Lozano-Vilano y Maria Elena García-Ramírez. Universidad Autonoma de Nuevo León.

The Mexican state of Zacatecas is mostly arid with an annual precipitation of about 510 mm thus its aquatic ecosystems are very vulnerable. This region has few studied fish fauna. The goal is to make an ichthyological inventory and ecological and zoogeographical analyses in the north of Zacatecas. This project was done in the north of the state and included three hydrographical basins: Nazas - Aguanaval, Lerma - Santiago and Presidio - San Pedro. We made 36 collections in 30 localities, in a period of three years using Chinchorro 3m nets, Agallera nets and electrofishing. We found 23 species in 18 genera belonging to 9 families. Nine species are exotic: *Mendia jordani*, *Lepomis cyanellus*, *L. gulosus*, *L. macrochirus*, *Micropterus salmoides*, *Oreochromis aureus*, *O. mossambicus*, *Cyprinus carpio*, *Gambusia senilis*; 11 are native and 3 undetermined. By zoogeographical origin 16 are Nearctic, 5 Neotropical and 2 are transitional; by ecological affinity 17 are primary, 5 secondary and 1 peripheral. According to NOM-059-ECOL-2001, 5 species are threatened: *Catostomus nebuliferus*, *Cyprinella garmani*, *Etheostoma pottsii*, *Gambusia senilis*, and *Gila conspersa*. New state records include: *Goodea atripinnis* (native) and *Gambusia senilis*, *Lepomis cyanellus*, *Oreochromis aureus*, *O. mossambicus*, *Cyprinus carpio* and *Mendia jordani* (introduced). Other species recorded include: *Notropis cf. nazas*, *Codoma cf. ornatum* and *Gambusia spp.*

173 Systematics and Evolutionary Biology

SYSTEMATICS OF THE ELECTRIC RAYS (TORPEDINIFORMES: BATOIDEA)

Kerin M. Claeson*, Department of Geological Sciences, The Jackson School of Geosciences, The University of Texas at Austin

Torpediniformes, the electric rays, are a monophyletic group of cartilaginous fishes. Eleven valid genera within the Torpediniformes are distributed among four subfamilies (Torpedininae – 1 genus, Hypninae – 1 genus, Narcininae – 5 genera, and Narkinae, 4 - genera). The interrelationships of these genera, however, are unknown except for their groupings into subfamilies. A total of 48 fetal and juvenile specimens, representing ten of the 11 torpediniform genera, were examined for this study. Focus was on external and skeletal morphology. A combination of clearing and double-staining, x-radiography, and computed tomography was used to investigate skeletal morphology. New data were discretized, scored, and combined with previously published species diagnoses to create a matrix of 62 characters, which was subjected to a preliminary parsimony analysis. Two most parsimonious trees were recovered, and both maintain the four previously subfamilies. A strict consensus tree suggests the following new relationships. Within Narcininae, the genera *Narcine* and *Discopyge* are considered sister taxa. They form a polytomy with the remaining narcinine genera, *Diplobatis* and *Benthobatis*. The strict consensus also reveals the following hierarchical structure within Narkinae: *Electrolux* + (*Heteronarce* + (*Narke* + (*Typhlonarke* + *Temera*))). This topology supports the hypothesis that *Heteronarce* is only superficially similar to the narcinine genus *Narcine* but is not most closely related to *Electrolux*. Further taxonomic and ontogenetic sampling is underway to add support to this hypothesis of torpediniform interrelationships.

50 Systematics and Evolutionary Biology

ASYMMETRIES IN INVESTMENT AND SCALING OF REPRODUCTIVE PARAMETERS BETWEEN GENERATIONS IN A CYNIPID EXPRESSING HETEROGONY

Glen R. Hood*, Cristina Campbell, and James R. Ott, Texas State University-San Marcos, TX

Belonocnema treatae exhibits cyclical parthenogenesis (heterogony) on its host plant, *Quercus fusiformis*. Temporally segregated sexual and asexual generations develop in galls located on roots and leaves respectively. We examined immediate correlates of body size in each generation: uni-locular leaf gall diameter for the asexual generation, and number of siblings in multi-locular root galls of the sexual generation. We then determined the relationship between body size and potential fecundity via dissection for females of each generation. These data allowed us to test whether a) fecundity can be predicted based on gall characteristics (gall diameter for the asexual generation and number of sibling within galls in the sexual generation and b) the body size - fecundity relationship scales equivalently between generations. Results of this research are used to predict the direction of life cycle evolution of this and potentially other insect species expressing heterogony.

113 Systematics and Evolutionary Biology

THE ROLE OF HOST PLANT FIDELITY IN THE EVOLUTION OF REPRODUCTIVE ISOLATION

Michelle Downey*, Texas State University, San Marcos, TX

Variation in traits related to resource use, such as host plant use in phytophagous insects, may provide the circumstances under which disruptive selection takes place. Herbivorous insect populations which undergo a host shift to a different plant resource may experience new selective pressures that, if overcome, can lead to adaptation on the new host and host race formation. These host races have been described as incipient species. The current study investigates the role of ecological factors to the process of reproductive isolation among populations of the juniper hairstreak butterfly, *Mitoura gryneus* in Texas. *Mitoura* are closely associated with their particular host plants (Cupressaceae) and exhibit host plant fidelity: males lek and mating occurs on host trees, and females oviposit and larvae develop exclusively on the hosts. Evidence of specialization to the host plants, in the form of female oviposition preference and larval performance, is experimentally evaluated. In addition, population genetic analyses are used to examine patterns of geographic genetic variation. If host plant

fidelity and assortative mating leads to reproductive isolation according to host plant, *Mitoura* populations using alternate hosts will have significantly greater genetic differentiation than populations using the same host. The *Mitoura* system, in which host-associated populations occur both allopatrically and sympatrically, provides a powerful opportunity to examine the role of ecological factors as drivers of reproductive isolation and population differentiation.

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NATURAL AND SEXUAL SELECTION IN POISON DART FROGS

Tara Maginnis*, St. Edward's University, Austin, TX, Molly Cummings, Martine Maan, and Mary Ramsey, The University of Texas, Austin, TX

Natural and sexual selection are often studied as two mutually exclusive mechanisms of evolutionary change, yet phenotypes are often the product of both mechanisms. Poison dart frogs, with their vibrant aposematic coloration, are a classic example of a naturally selected phenotype to avoid being eaten by predators. However, in some species, there is also strong female choice for aspects of male coloration. Thus, poison dart frogs are an ideal system to explore the nature of interactions between natural and sexual selection, and how their visual trait signals differ between populations and/or environments. In addition to behavior and ecology experiments, we are exploring variation in the gene expression of light sensitive pigments (opsins) in all the different poison dart frog morphs; variation in opsin sensitivity may be a mechanism of divergence contributing to the phenotypic variation we see in poison dart frogs.

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PEACEFUL PARTHENOGENS? SOCIAL BEHAVIOR OF MARMORKREBS, A PARTHENOGENETIC CRAYFISH

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Decapod crustaceans, particularly crayfish and clawed lobster, frequently form dominance hierarchies through aggressive interactions. Animals of similar size will often fight, with the winner becoming dominant and the loser becoming subordinate. Winning or losing triggers behavioral and neurophysiological changes. For example, dominant crayfish will turn towards an unexpected touch whereas subordinate individuals will turn away from unexpected touch. We are examining behaviors associated with social status in the parthenogenetic marbled crayfish known as Marmorkrebs (*Procambarus* sp.). Preliminary observations in the lab and anecdotes from pet owners suggest that Marmorkrebs show aggressive behavior, but that they are less aggressive than other crayfish and it is not clear if they form stable dominance relationships. We test the hypothesis that Marmorkrebs are less aggressive than other crayfish by comparing their responses to non-social unexpected stimuli to sexually reproducing crayfish species, *Procambarus clarkii* housed in similar conditions. If Marmorkrebs are less aggressive and do not form stable dominance hierarchies, they are predicted to show more variable and/or more subordinate-like responses to standardized stimuli.

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MOLECULAR PHYLOGEOGRAPHY OF SOUTHEAST ASIAN PERCHING BIRDS (PASSERIFORMES) BASED ON COI BARCODE.

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The DNA barcoding initiative endeavors to create a complete database of the 650 bp cytochrome oxidase 1 for all birds (COI or *cox1*) for accurate identification and phylogeographic studies. The gene region appears to be sufficiently variable to identifying new and cryptic species and can be easily amplified using primers that anneal to conserved flanking regions. Our initial efforts to sequence the gene for Oriental perching birds (Passeriformes) have been difficult. We designed new sets of primers using the web-based Primer3 and Geneious Pro. Two pairs of primers out of six primers provided excellent and unambiguous PCR products. An initial phylogenetic analysis of 30 species of Philippine taxa suggested several surprising results. The enigmatic Philippine Ibon *Hypocryptadius cinnamomeus*, traditionally placed within the white-eye family, is sister to *Emberizidae*, suggesting the non-monophyly of *Zosteropidae*. Robust phylogenies supported the sister grouping of *Passeroidea* with the Old World insect eaters within *Passerida* and the monophyly of *Corvida* with Australo-Papuan origin. Sequence analysis also revealed relatively high DNA sequence divergence values among conspecifics, suggesting that the rate of speciation are much faster in small tropical islands relative to mainland forms.

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TAXONOMIC STATUS OF THE DAVIS MOUNTAINS COTTONTAIL, *SYLVILAGUS ROBUSTUS* (LAGOMORPHA: LEPORIDAE) REVEALED BY AMPLIFIED FRAGMENT LENGTH POLYMORPHISM

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The Eastern Cottontail, *Sylvilagus floridanus*, is the most common and geographically widespread of all North American rabbits. In the Trans-Pecos region of Texas lives the Davis Mountains Cottontail, *Sylvilagus robustus*. This cottontail has an unclear taxonomy, and is thought by some to be a subspecies of *S. floridanus* instead of a separate species. Previous morphological data supports *S. robustus* as a species; however, mitochondrial DNA (mtDNA) data suggest otherwise. The objective of this study was to examine nuclear data using a DNA fingerprinting technique, amplified fragment length polymorphism (AFLP), to test the hypothesis that *S. robustus* is a species separate from *S. floridanus*. We analyzed 228 fragments from 15 *S. robustus* individuals from the Davis and Chisos Mountains and 12 *S. floridanus*. Results from a principle coordinate analysis show two separate clusters. Significant bootstrap support in both a neighbor-joining and parsimony analyses suggest *S. robustus* is genetically distinct from *S. floridanus*. There were 104 parsimony informative loci, of which five were fixed differences between the two species. Together, these data support *S. robustus* as separate species.

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A GEOGRAPHIC INFORMATION SYSTEMS (GIS) ANALYSIS OF THE MODERN DISTRIBUTIONS OF SOUTHERN AFRICAN OTOMYS (RODENTIA: OTOMYINAE) WITH IMPLICATIONS FOR PLIO-PLEISTOCENE PALEOENVIRONMENTAL RECONSTRUCTION

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Six extant species of *Otomys*, a rodent taxon widely distributed throughout southern Africa, are generally recognized. These modern species are routinely reported from Plio-Pleistocene paleontological and archaeological sites in the region. As some modern members of the genus are often associated with water, fossil otomyines are commonly viewed as indicative of wet conditions or permanent water sources. This analysis uses GIS methodology to assess the validity of *Otomys* as an indicator of water, and to refine reported modern environmental tolerances. Variability and overlap in dental characters make species level identification based on dentition difficult. As such, identifications at the genus level avoid misdiagnosis and distorted paleoenvironmental signatures. By allowing the analysis of spatial components, Geographic Information Systems (GIS) based analyses are currently emerging as a powerful tool in paleoenvironmental reconstruction. GIS models, for example, allow for the prediction of past environments by analyzing the tolerances of modern taxa that have persisted relatively unchanged throughout the Plio-Pleistocene. The tolerance ranges of modern taxa may be applied to fossil bearing localities where these taxa are known to have occurred in the past. Here modern distributions from 270 localities are geo-referenced along with associated substrate type, mean annual precipitation and annual temperature ranges. Additionally, distance from major rivers, lakes and dams is calculated with 93% falling within 10km of a water source, 73% falling within 5km and only 29% falling within 1km. Preliminary results suggest caution must be exercised when *Otomys* is relied upon as the sole indicator of a nearby water source.

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MOLECULAR IDENTIFICATION OF SMALL MAMMALS FROM THE KOANAKA HILLS (NQCUMTSA HILLS) REGION, NGAMILAND, BOTSWANA

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Quantifying a region's biodiversity depends upon the ability to discern between individual species composing local communities. Although fundamental in nature, this task is often more difficult than it seems, especially for groups containing cryptic species, such as mammals of the orders Soricomorpha, Chiroptera, and Rodentia and also for where species keys for local fauna are either lacking or not well-defined. However, the advent of molecular techniques has provided biologists with tools for discerning morphologically indistinct animals for biodiversity assessments. We sequenced the first 400 base pairs of the cytochrome-b gene to genetically identify small mammals collected during a mammalian survey of the Koanaka Hills (Nqcumtsa Hills) region of Botswana. Application of molecular techniques for mammals collected during this trip was critical due to the fact that we documented taxa known to contain cryptic species (e.g. *Crocidura*, *Aethomys*, and *Micaelemys*) and species with very similar morphologies (e.g. *Tatera* spp). Based on field identifications we recognized 18 genera representing 19 species of rodents, shrews, and bats. Tentative identifications made in the field were compared to molecular data in order to assess field identification accuracy. Based on the molecular data, it appears that this is a unique assemblage of mammals.

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CRANIAL ANATOMY AND ONTOGENY IN PANTYLUS CORDATUS BASED ON HIGH RESOLUTION X-RAY COMPUTED TOMOGRAPHY

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Much of the ambiguity surrounding the phylogenetic position of the early tetrapod group Microsauria arises from incomplete knowledge of detailed anatomy and ontogeny. High Resolution Computed Tomography (HRCT) advances the study of fossil taxa by accessing new or previously unobtainable sources of data. Five individuals of *Pantylus cordatus*, including two juveniles, were CT scanned in order to gain a better understanding of skull morphology and growth in microsaurians. Examination of internal cranial anatomy reveals complex, interdigitating articulations between rostral and palatal elements, while those of the cheek region are associated by broad, overlapping contacts. Both juveniles already possess a full complement of dermal bones as well as a partially ossified braincase. The smallest specimen lacks ossified otic capsules and septomaxillae, providing the first information on cranial ossification sequence in microsaurians. External suture appearance increases in complexity with size, but contacts between bones show little ontogenetic variation. Dermal sculpture is stronger in larger specimens but there are no major changes in dentition type or spatial patterning of teeth through ontogeny. In the absence of significantly earlier stages of development, I suggest that *Pantylus* was a direct developer that did not undergo drastic changes in anatomy, feeding, or habitat during growth, unlike many temnospondyls and lissamphibians.

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A DIGITAL ENDOCAST OF *PROCYON LOTOR*

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The Northern raccoon is one of the most common mammals in North America, but the skull and endocast have yet to be described in any great detail. A digital endocast was extracted using high-resolution computed tomography and is described here. The surface area of the endocranial cast is 8915.4 mm² and the endocranial volume is 43558.7 mm³. The encephalization quotient for *Procyon lotor*, derived using the endocranial volume and average body weight for the species, is 1.241. The endocast reflects much of the soft anatomy of the brain, including casts of gyri, sulci, cranial nerve canals, and some vasculature. While some differences are presented, the endocast of *Procyon lotor* is consistent with many patterns observed within Carnivora and Procyonidae. The olfactory bulbs are relatively large, and are separated from the cerebral cast by the rostrally elongated frontal and porean gyri in the raccoon. The vermis, paramedian lobes, and both hemispheres of the cerebellum are also visible. The parafloccular lobe, however, is absent from the endocast, which is a derived condition within Procyonidae. Endocasts of the right and left inner ears were also extracted. While the two ears are symmetrically oriented, they do exhibit some asymmetries in size and construction. The volume of the left ear is 39.4 mm³; the volume of the right ear is 44.1 mm³. Also, the crura of the lateral and posterior semicircular canals of the right ear appear to share a common opening with the vestibule; this condition is not seen in the left inner ear.

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COLOR VARIATION AND ITS POSSIBLE ROLES IN SAND CRABS

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Sand crabs in the genus *Lepidopa* living in the beaches of southern Texas can have either a gray or white carapace. In previous taxonomic descriptions, they are identified as *L. benedicti* but no mention of their obvious color variation has been made. It is not clear what functions these differences in color may have, considering that sand crabs spend most of their time completely submerged in sand. The color differences are not due to sexual dimorphism, because colors are evenly distributed between males and females. Gray crabs are more common and bigger than white crabs, suggesting that gray carapace color may have an advantage over white. One possible advantage to having a dark carapace is that being darker on the dorsal surface may function as "countershading" when animals are swimming to hide from predators. If so, sand crabs should swim right side up to benefit from the countershading effect. We found that sand crabs were swam upside down about 92% of the time they swam, which is inconsistent with the countershading hypothesis.

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COMPARATIVE ETHOLOGY OF THREE SPECIES OF BICRYTES SAND WASPS IN CENTRAL TEXAS

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Three species of *Bicyrtes* were studied in May and early June of 2008 in Pedernales Falls State Park, Texas. Data was obtained on digging, provisioning, orientation, nest architecture, parasites, and number and prey type. Thirteen nests were excavated and measured; cell weights (total prey weight) and weights of individual prey were also recorded. Cell weights were compared to wasp size (pinned specimens) and *B. quadrifasciatus*, the largest of the three species, had the highest cell weights. *Bicyrtes quadrifasciatus* provisioned with four species of coreids and five species of pentatomids; *B. ventralis* took four species of pentatomids and *B. fodiens* preyed on a single, small species of Pentatomidae. In nest digging, *B. ventralis* and *B. fodiens* positioned their abdomens at a greater angle than *B. quadrifasciatus*. *Bicyrtes quadrifasciatus* constructed the longest main burrows and *B. fodiens* was the only one found making a multicellular nest. *Bicyrtes ventralis* and *B. quadrifasciatus* were found to be both mass and delayed mass provisioners while *B. fodiens* only mass provisioned. *Bicyrtes quadrifasciatus* were present throughout the study period while *B. ventralis* was most active in mid May, and *B. fodiens* did not appear until early June.

P87 Systematics and Evolutionary Biology**DIFFERENTIATION BETWEEN MITOCHONDRIAL DNA OF TEXAS LESSER SIRENS**

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The taxonomic status of the lesser siren in the Rio Grande Valley of Texas is in dispute. The Rio Grande lesser siren is variously considered to be *Siren intermedia texana*, a geographically disjunct subspecies of the lesser siren, or *Siren texana*, a separate species. In this study we use direct sequencing of PCR products amplified using primers for cytochrome B and NADH dehydrogenase 4 designed specifically from *Siren intermedia* sequences, and universal primers for the 12S rRNA and 16S rRNA genes. Two samples were examined, one from Cameron County, Texas representing the Rio Grande lesser siren, and one from Anderson County, Texas representing the western lesser siren. We provide analyses of both within sample genetic variability and between sample genetic differentiation.

P345 Systematics and Evolutionary Biology**LEG REGENERATION TRADEOFFS IN THE SOUTHERN WALKING STICK, ANISOMORPHA BUPRESTOIDES**

Christopher R. Redmond*, Tara L. Maginnis, St. Edward's University, Austin, TX

Appendage regeneration is novel way to study resource allocation tradeoffs, as organisms capable of regeneration produce a structure not once, but twice. In phasmids, leg regeneration is quite common, yet it is currently unknown how pervasive or how variant appendage regeneration tradeoffs are within the order. In this study, appendage regeneration tradeoffs were examined in the southern two-striped walking stick *Anisomorpha buprestoides* (Stoll). This species has a relatively long life history for its small size, shows strong sexual dimorphism, and has a suite of morphological traits to explore resource allocation tradeoffs. When compared with other studies on phasmid leg regeneration tradeoffs, the results suggest that the manifested tradeoff is rather consistent among morphologies, regardless of life history.

P55 Systematics and Evolutionary Biology**FURTHER STUDIES OF EXOPROSOPA ALBICOLLARIS (DIPTERA: BOMBYLIIDAE) A PARASITE OF BEMBEVINUS NEGLECTUS (HYMENOPTERA: CRABRONIDAE): ACTIVITY PATTERNS, FLY LONGEVITY, AND TESTS OF FACTORS INFLUENCING RATES OF OVIPOSITION.**

Martha Gonzalez* and Allan Hook, St Edward's University, Austin, TX

Exoprosopa albicollaris, a parasitic bee fly of the sand wasp *Bembecinus neglectus*, was studied 12 May-5 June, 2008, at Perdenales Falls State Park. Fly persistence in the study site was determined by marking nineteen individuals. Marked flies averaged 5.3 days (range 1-16 days) in the study site. Additional work attempted to determine if the bee fly oviposition rates/choices were influenced by hole (entrance) size. This was tested by artificially constructing large entrance holes adjacent to small entrance holes. Six trials were conducted with paired large and small holes. For the six trials conducted (30 May - 4 June) small entrance holes ranged from 1-1.5cm in diameter, and large entrance holes ranged from 3-5.5cm in diameter. Large entrance holes averaged 4 eggs per bout while small entrance holes averaged 3 eggs per bout. Only two of six trials conducted showed that flies preferred to toss their eggs down larger holes. Suggestions will be offered to improve tests of factors influencing oviposition choices in this parasitic fly.

P246 Systematics and Evolutionary Biology**RATES AND PATTERNS OF MITOCHONDRIAL COI DNA CHANGE IN ASPERGILLUS FOUND IN MANNED SPACE STATIONS**

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Microbial life forms are hypothesized to suffer from relatively faster rates of mutation in space due to microgravity and ionizing radiation. We propose to measure and test the relative rates to which certain genes evolve under extraterrestrial conditions. The 648 bp segment of the mitochondrial cytochrome oxidase 1 (COI or *cox1*) will be used to study the phylogenetic position and pattern of sequence divergence of the most common fungal taxa in manned space stations, such as *Aspergillus*. COI is used extensively to barcode all life forms on Earth, and efforts are underway to develop portable molecular probes based on COI for use in monitoring microbial growth in manned space stations. However, the universality of the gene is questioned by reports of the prevalence of mobile introns across many fungal groups. We shall sequence the COI of at least 20 strains of earthbound *Aspergillus*, and at least one sample from NASA space station. From sequence comparison, including those published sequences from Genbank, we shall identify the pervasiveness of introns across the gene, and across the taxonomic genera and evaluate whether identified introns provide unambiguous evidence of monophyly of specific strain. Also, we shall measure sequence divergence of 'space' *Aspergillus* relative to Earth-based conspecifics and look for evidence of positive, neutral, and/or negative selection.

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THE INFLUENCE OF THERMAL ECOLOGY VIA SURFACE TEMPERATURE ON THE NEST DIGGING AND PROVISIONING BEHAVIOR OF THE SAND WASP BEMBEVINUS NEGLECTUS (CRABRONIDAE: BEMBEVINAE) AT PEDERNALES FALLS STATE PARK IN BLANCO COUNTY, TEXAS

Brittany J. Gillard* and Allan W. Hook, St. Edward's University, Austin, TX

Bembecinus neglectus nest in hot, sandy areas where surface temperatures can reach 65 degrees C. *Bembecinus neglectus* females spend time on the sand, nest digging and provisioning, thus they can be exposed to lethal temperatures. Because wasps are ectotherms they are reliant on ambient temperatures and behavioral mechanisms to control body temperature. The relationship between the amount of time *B. neglectus* females spend on the sand, digging and provisioning, and the temperature of the sand was studied at Pedernales Falls State Park in Blanco County, Texas. This study predicted that as sand temperatures increased, the wasps would spend less time in contact with the sand. Regression analysis showed there to be a highly significant negative correlation between the time spent on the sand (digging and provisioning) and the temperature of the sand. Nest digging and provisioning activity of *B. neglectus* females was significantly influenced by the surface temperatures of the sand.

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ASSESSMENT OF THE ALLELOPATHIC POTENTIAL OF JUNIPERUS ASHEI ON GERMINATION AND GROWTH OF BOUTELOUA CURTIPENDULA

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Potential allelopathic compounds of *Juniperus ashei* (Ashe juniper) and their effect on a native grass was determined in laboratory and field studies. Solid-phase microextraction and gas chromatography/mass spectrometry was used to determine if monoterpenes known to be in the essential oils of *J. ashei* are released in leaf and litter leachate, or volatilized from leaf tissue. Camphor, bornyl acetate, and limonene were found in leaf and fresh litter leachates of *J. ashei*. Camphor was the most common, potentially allelopathic compound found in *J. ashei* leaf and litter leachate, and in volatiles from leaf tissue. The effects of leaf and litter tissue on the germination of *Bouteloua curtipendula* (side-oats grama) was tested using the 'sandwich agar method'. The highest germination of *B. curtipendula* (29.6%) occurred in the control, which was significantly higher than fresh litter (13.2%) and degraded litter (16.2%). The lowest germination (6.2%) occurred with *J. ashei* leaves. In the field experiment, aboveground dry mass of *B. curtipendula* was evaluated in relation to location within the canopy and intercanopy of *J. ashei* when light and water were held constant across locations. Aboveground dry mass of *B. curtipendula* was significantly greater in the intercanopies of *J. ashei* (163.7 g m²) compared to the dry mass in the understory (44.8 g m²) and dripline (44.5 g m²), suggesting some negative influence by *J. ashei*. Chemical analyses indicate that monoterpenes are released through leaching and volatilization from *J. ashei*, and germination and field studies suggests that these compounds inhibit *B. curtipendula*.

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AMPHIBIAN, REPTILE, AND SMALL MAMMAL INVENTORY OF PALMETTO STATE PARK AND THE OTTINE WETLANDS WITH COMMENTS ON HISTORICAL DATA

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Survey data collected to describe characteristics of animal assemblages are important in developing management plans. Mammal, reptile, and amphibian sampling began in January 2008 at Palmetto State Park and the adjacent Ottine wetlands, Gonzales County, Texas to produce a current species inventory and estimates of species diversity and evenness. We compared the current data to results of a survey done in 1958. A total of 486 animals (217 rodents, 207 amphibians, 62 reptiles) have been captured or observed representing 41 species (10 mammals, 7 amphibians, 24 reptiles). Data suggests that community composition has changed over the past 50 years shifting to a greater abundance of species that are suited to urbanization and heavy agricultural use. There appears to be a substantial loss of amphibian richness with only 7 species detected compared to 15 species detected as recently as the 1950s. Reasons for changes in herpetile and mammalian assemblages, including extirpation and rarity of a number of species, historically present in the area can most likely be attributed to: heavy agricultural use, increased ground water use, invasive exotic species, and a series of severe droughts.

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THE WESTERN COTTONMOUTH (AGKISTRODON PISCIVORUS LEUCOSTOMA) IN WEST-CENTRAL TEXAS: THE DEMOGRAPHY AND VENOM COLLECTION IN A PERIPHERAL POPULATION

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The western cottonmouth (*Agkistrodon piscivorus leucostoma*) is a semiaquatic pitviper found in the southeastern United States. The population studied in this project represents the entire population at the western limit of the snake's range. Through this mark-recapture project, 44 individuals were caught at least once and there have been 82 total captures. At the study site where collection was done there are two geographically disconnected areas. The first area is Cold Creek with a sample river distance of 1.1 km. The second area is Anson Spring, with a sample area along the river of 0.8 km. Of the 44 snakes collected on the ranch, none were caught in both areas. Demographic data collection, including place of collection, sex ratio, population size, and morphological measurements were taken at each capture. Mann-Whitney U-tests were done to statistically test for differences in the data between the two study sites as well as on the sexes to determine if sexual dimorphism was present. The sex ratio on Cold Creek is 9 males to 16 females and on Anson Spring it is 11 males to 8 females. The Schnabel Method was used to estimate the population size on the ranch and it resulted in an estimation of 55 individuals. Venom samples were also collected from each snake and variation between individuals will be analyzed. In conjunction with the demographic data, the venom research may prove useful in determining the differences in this peripheral population with other populations in the continuous range of *A. p. leucostoma*.

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TWO ARE BETTER THAN ONE: IMPROVED FUNNEL TRAP DESIGN

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The objective of this study was to investigate the effectiveness of two common drift fence traps, pitfalls and single funnels, in comparison with a new one-way double funnel design. We expected this new trap design to decrease the escape rate over standard trapping techniques and therefore increase drift fence sampling efficiency. Five 15 m linear drift fence arrays, constructed of aluminum flashing, were located within a 25 acre Guadalupe County property in central Texas. Each array was run with a one-way double funnel for the full 34 days. Pitfall traps were run for the first 19 days and were then switched out for single funnel traps for the remaining 15 days. The one-way double funnels caught significantly more individuals than single funnel traps for all categories. When compared with pitfall traps, one-way double funnels caught significantly more reptiles and total vertebrates. Our results indicated that one-way double funnels offer an improved trapping technique especially when compared with typical single funnel traps.

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DETECTION OF BATRACHOCHYTRIUM DENDROBATIDIS IN AMPHIBIANS FROM THE FOREST FLOOR TO THE UPPER CANOPY OF AN ECUADORIAN AMAZON LOWLAND RAINFOREST

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Eighty-six individuals from 31 species of amphibians were collected from the forest floor, the shrub/sub-canopy (0-4 m) and mid- to upper canopy (4-38 m) of a Neotropical lowland rainforest near the Tiputini Biodiversity Station (TBS) - Universidad San Francisco de Quito in the Upper Amazon Basin of eastern Ecuador, and analyzed for *Batrachochytrium dendrobatidis* using a nested PCR protocol. *B. dendrobatidis* was detected on 17 of the 86 individuals (20%), with positive samples collected from each of the vertical strata. Infection was found to be significantly higher in the fossorial/floor and canopy groups, showing 25% and 33% of individuals infected, respectively, than in the shrub/sub-canopy group with only one individual (3%) infected. Thus, *B. dendrobatidis* was non-randomly distributed along the vertical axis, suggesting that microhabitat conditions in the different strata can potentially have an influence in host-pathogen dynamics. To our knowledge this is the first examination of *Bd* infection in amphibians found in the forest canopy and the first record of a symptomatic anuran infected with *Bd* in lowland tropical rainforests of the Upper Amazon Basin.

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POPULATION DYNAMICS OF AN ARTIFICIAL PARASITOID COMMUNITY ASSOCIATED WITH IMPORTED FIRE ANTS

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We review classical biological control efforts for management of the red imported fire ant in south Texas. Artificial communities of up to three species of decapitating flies have been successfully established in several sites and the population dynamics and dispersal documented. We discuss our observations within a regional and long-term context.

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CHANGES IN SMALL MAMMALIAN POPULATIONS FOLLOWING A PRESCRIBED BURN

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The influence of fire on biotic communities has received much attention during recent years especially with the increased use of prescribed burns. Fire has been shown to alter various features of grassland and surrounding communities that may impact habitats required by various species of small mammals. The effects of fire on soil and vegetation are relatively well documented, however, the effects on small mammals are not well known for many communities, especially those within the south Texas rangeland. This paper reports the effects of a prescribed burn imposed on maintained grasslands within an operating cattle and hunting ranch in south Texas (Frio County, Texas). Small mammal communities were sampled over a one year period (March, 2005 - February, 2006) using Sherman live traps. The secondary study sites (brushland and riparian) were sampled during one, three night trapping session (July, 2006). A total of 56 individuals of six different rodent species were captured in 4,200 trap nights throughout the duration of the study period. Population irruptions occurred in the grassland, in July, 2005 for *Sigmodon hispidus* (hispid cotton rat) and in September, 2005 for *Chaetodipus hispidus* (hispid pocket mouse) showing a positive relation to not only time, but also vegetative re-growth.

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THE REPTILES OF THE KOANAKA HILLS, NGAMILAND, BOTSWANA

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The Koanaka Hills locality, located in western Ngamiland, Botswana, is a Plio-Pleistocene cave deposit. While the deposit has produced numerous reptile fossils, a lack of comparative osteological material from the region has hampered taxonomic diagnosis, particularly below the level of family. In addition, the lack of a published account of the modern reptiles from the area prevents documenting how the reptile fauna has changed over the last 2 million years. As such, a collecting trip to the Koanaka Hills was undertaken from the 19th to 30th of June 2008. Despite trapping in the winter dry season, this trip resulted in the collection of 38 specimens of nine species belonging to seven different squamate families. Three families are represented by a single species each: Agamidae (*Agama aculeata*), Chamaeleonidae (*Chamaeleo dilepis*), and Gekkonidae (*Chondrodactylus turneri*). The Lacertidae, however, is represented by three species: *Ichnotropis capensis*, *I. squamulosa*, and *Pedioplanis namaquensis*. The Scincidae is represented by *Trachylepis varia* and *T. wahlbergii*, and the Viperidae by *Bitis arietans*. Our data was supplemented by a small, previously unreported Transvaal Museum collection from the Koanaka Hills, made in 1965. This collection was comprised of 10 specimens, including one additional species, the lacertid *Heliobolus lugubris*. Furthermore, collections made in adjacent areas provide the basis for a list of the reptiles expected, but not yet documented, at the Koanaka Hills locality. All but one of the modern families (Viperidae) was identified in the fossil material from the locality.

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DEN-SITE SELECTION IN THE AMERICAN HOG-NOSED SKUNK, *CONEPATUS LEUCONOTUS*

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Once considered to be one of the most common skunks in Texas, *Conepatus leuconotus*, the American hog-nosed skunk, has since suffered regional extirpations and population declines. This negative trend, as well as a severe lack of information regarding the basic biology of this species, is cause for concern. Using radio telemetry, we are studying home range and den site requirements, seasonal and diurnal activity patterns, and population demographics of *C. leuconotus*. Our study site is located on the Knickerbocker and Dove Creek Ranches in Tom Green and Irion Counties, fifteen miles west of San Angelo, Texas. To date, we have captured a total of seventeen hog-nosed skunks, thirteen of which are radio-collared and tracked regularly. Radio-collared individuals are located one to three times a week. A total of 94 den sites have been located. There have been 35 instances of a den being repeatedly used and six instances of a den being used by two different hog-nosed skunks on separate occasions. A randomly chosen subset of the dens discovered through radio-tracking are being examined. Vegetation within a ten meter radius of the den is analyzed, and measurements are taken on den depth and entrances. Distance to nearest water source and road are also recorded. A location fifty meters away from the den at a random bearing is subjected to the same analysis. Differences between den sites and random locations will be examined to detect den site requirements and/or preferences.

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RELATING MOURNING AND WHITE-WINGED DOVE DENSITY ESTIMATES TO SOUTH TEXAS HABITAT TYPES

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We compared density estimates of white-winged (*Zenaida asiatica*) and mourning doves (*Z. macroura*) in south Texas to the 1992 and 2001 National Land Classification Database (NLCD) categories. Our objective was to determine which, if any, category (or categories) from either of the NLCD classification schemes could be used to predict species occurrence. Our study was conducted between 15 May and 15 August of 2007 and 2008. We used point transect methodology and Program DISTANCE to determine density estimates of white-winged and mourning doves at 236 points encompassing 744 observations. Land classification categories were quantified using geographic information systems (GIS). Each point and a 350 m buffer were projected on NLCD maps. We then used GIS to determine proportions of each land classification category within the buffer area. Multivariate analysis was used to test if estimated density was influenced by land classification categorical type. Our results indicate that white-winged dove occurrence in south Texas can be predicted using the 2001 NLCD categorization scheme; densities were strongly influenced by areas categorized as deciduous forest and developed medium intensity/transportation using the 2001 NCLD. Habitat categories from the 1992 NCLD did not explain white-winged density estimates, nor did either NCLD show a relationship to mourning dove density.

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SEED DISPERSAL BY AMERICAN BLACK BEARS (*URSUS AMERICANUS*) IN BIG BEND NATIONAL PARK, TEXAS

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Seed dispersal by carnivores is an important, but often over-looked and poorly studied plant-animal mutualism. We are currently conducting a study of seed dispersal by black bears in Big Bend National Park, Texas. Black bears are potentially important seed dispersers in the Trans-Pecos region of Texas, because bears consume large quantities of fruit. Seeds from the ingested fruit may be retained for up to 24 hours before defecation, during which time bears can move long distances. During 2008 we recovered seeds of Texas Persimmon (*Diospyros texana*), Evergreen Sumac (*Rhus virens*), Prickley Pear (*Opuntia* spp.), and Mesquite (*Prosopis glandulosa*) from bear scats. Germination trials are being conducted to compare germination rates and percentage of seeds collected from bear scats with those that have not passed through a bear's digestive tract.

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EVALUATION OF DISKING TO PROMOTE COTTONWOOD GERMINATION IN THE ROLLING PLAINS OF TEXAS

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Mature cottonwood galleries are an important habitat component of riparian areas in the southwestern United States. Historic overbank flooding of rivers provided the wet, exposed soil necessary for cottonwood germination. Decline of cottonwoods is thought to be associated with the damming of rivers and concomitant changes in the hydrologic cycle. Simulated flooding events and drawdowns of water impoundments have been used to promote cottonwood germination, but these techniques require the use of expensive water control structures which are not feasible in many areas. We evaluated the use of disking to create bare, exposed soil as a technique to promote cottonwood germination given adequate rainfall. We established 28 5 m x 10 m plots adjacent to a mature cottonwood stand on the South Pease River on the Matador Wildlife Management Area. At the onset of cottonwood seed fall (mid-late May) we alternately disked half of the plots in 2006, 2007, and 2008. We surveyed the plots for the number of seedlings surviving in October. No cottonwood seedlings were present in 2006 and 2008. In 2007, 16 cottonwood seedlings survived to October. Two of the seedlings were in a disked plot, whereas 14 were in a small disturbed area (pocket gopher activity) in a control plot. March-August rainfall was 23.7, 53.6, and 30.3 cm for 2006, 2007, and 2008, respectively. In 2007 we also observed widespread germination in nearby dozer tracks. However, no seedlings survived the 2008 summer. We conclude that soil disturbance alone has limited potential to promote cottonwood regeneration at this site.

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A SURVEY OF ECTOPARASITES OF SMALL MAMMALS FROM NICARAGUA

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Four rodent and one bat species collected from the Mombacho Volcano Reserve near Grenada, Nicaragua were surveyed for acarine ectoparasites. This collection of small mammals consisted of *Artibeus toltecus*, *Liomys salvini*, *Oligoryzomys fulvescens*, *Peromyscus mexicanus*, and *Sigmodon hispidus*. Acari were recovered via the brushing technique, mounted in PVA medium, and identified using keys and primary literature. The prevalence and mean intensity for each parasite species was determined. Results found *Eubrachyla elaps jamesoni* to be the most prevalent ectoparasite recovered, followed by *Laelaps castroi*, *Steptola elaps heteromys tapachulensis*, and *Periglischrus iheringi*. It is assumed all are new host locality records due to a lack for prior work in this region. An examination of the status of *S. h. tapachulensis* was conducted to determine if this subspecies should be elevated to species designation.

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POPULATION STRUCTURE OF URBAN GREAT-TAILED GRACKLES (*QUISCALUS MEXICANUS*) AT WINTER ROOST SITES

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Great-tailed grackles (*Quiscalus mexicanus*) are currently expanding their range in the United States. This range expansion is thought to be related to human-induced habitat changes and urbanization. Great-tailed grackles form large roosting flocks in winter that break off into smaller flocks during the breeding season, often in close proximity with humans. Because they typically winter and breed in the same areas, many cities in Texas make a considerable investment managing great-tailed grackle flocks. The ultimate objective of this project is to develop an Integrated Pest Management (IPM) plan for controlling great-tailed grackle populations in urban areas. However, to begin with, baseline data needs to be collected on the biology and habits of this species in an urban setting. In 2008 and 2009 preliminary data were collected from winter roosting flocks at several urban locations in northeast Texas. Roost characteristics, population size, sex ratio, and flock activity patterns were monitored. Results of the data analyses are presented.

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THE RATTLE - A NON-INVASIVE SOURCE OF DNA FOR PHYLOGEOGRAPHIC STUDIES OF RATTLESNAKES (GENUS *CROTALUS*).

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Rattlesnakes of the genera *Crotalus* and *Sistrurus* represent important management challenges. Some species have restricted distributions, while others have declining population numbers, face habitat degradation, and are targeted by directed harvest. Scientific management of at-risk species requires detailed information on ecology, life history, distribution, and population structure. Our laboratory is in the process of gathering data on this last subject - genetic population structure. One of the preliminary studies in this research was to identify a non-invasive source of DNA from individual rattlesnakes. We demonstrate the usefulness of rattle segments as a source of DNA, compare genomic DNA yields with yields from muscle, the yields of distal and proximal segments, and the yields of rattles preserved dry with rattles preserved in ethanol. Finally, we demonstrate the usefulness of rattle-derived DNA in PCR amplifications of microsatellite DNA fragments.

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VARIATION IN THE OWL PELLETS FROM KOANAKA HILLS, BOTSWANA AND ITS IMPLICATIONS FOR REGIONAL PALEOENVIRONMENTAL RECONSTRUCTION

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Recent cave excavations at the Koanaka Hills of the Ngamiland Province, Botswana have yielded a large assemblage of small mammal fossils dating between 2 million to 390,000 years old. Depositional setting and preservation suggest the material was originally collected by a barn owl (*Tyto alba*). Additionally, modern barn owl pellets have been collected from two caves located on Koanaka South (the southern most region of the Koanaka Hills) and trapping has been conducted in three surrounding areas. These areas include a rocky outcrop, a dry lake bed, and an active water hole, all within 15 km of the caves. A comparison between the fossil and modern faunas will yield data on how the environment of the Koanaka Hills has changed throughout the Pleistocene. Additionally, comparisons of remains contained in the pellets to the trapping record will help identify any potential taphonomic biases that exist as well as provide information on the hunting patterns and ranges of barn owls in the area. Thus far, a preliminary analysis of 40 pellets has yielded high frequencies of the Gerbillinae (gerbils) and the Murinae (rats and mice) specimens, which, given the arid environment of Botswana, is consistent with the expected results. Also, elements attributed to the Soricidae (shrews) and the Bathyergidae (mole-rats) have been recovered. All taxa recovered from modern owl pellets are also found in the fossil assemblage, and correlate most closely with the fauna trapped on the modern rocky outcrop.

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A HISTORY OF THE USE OF PHOTOGRAPHY IN SCIENCE

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The desire to permanently capture images from light can be traced back several millennia. The Renaissance and the Industrial Revolution brought about the scientific thought and technology necessary to produce the first cameras in the early 1800s. Use of this technology to record visual documents for scientific study has its beginnings in the decade after the production of the first actual camera image by Niépce in the mid-1820s. Development of differing methods to capture images from light flourished for the next two decades, with the first images captured for scientific study being published in the late 1830s. Methods continued to improve, producing higher quality images more economically, followed by the first cameras capable of being used outside of the studio in the 1840s. Simultaneously, the use of specialty cameras to record panoramic and stereoscopic images and images through microscopes and telescopes became common. By the late, nineteenth century, cameras had become smaller, less expensive and easier to use. With the advent of modern technology (aeronautical and space

flight, computers, deployment of satellites, etc.) and continued development of more highly sophisticated cameras and scientific equipment, cameras became used in all facets of science to record and document phenomena and experimental observations and procedures. In the late twentieth century as environmental issues became of increasing importance, use of the analytical method of repeat photography became common. This technique of photographing previously photographed views, famously used to rephotograph nineteenth century survey photographs of the American West, became a popular tool to study landscape use and change.