108th Annual Meeting of the North Carolina Academy of Science

March 25-26, 2011

Elon University
Elon, NC

North Carolina Academy of Science
Since 1902

ELON UNIVERSITY

Welcome

Welcome to the 108th Annual Meeting of the North Carolina Academy of Science hosted by Elon University With over 125 presentations across a broad range of scientific disciplines, this meeting is sure to offer topics of interest to everyone

The meeting opens with a poster session in McKinnon Hall which is located in the Moseley Center on Friday night. A three piece jazz combo will provide background music while you stroll, read posters, enjoy a variety of hot and cold hors d'oeuvres and engage in lively discussion. Following the poster session, undergraduate and graduate students are invited to the Fat Frogg Bar and Grill just down the street for an informal social gathering from 7.30 to 10:00 PM.

Saturday begins with a continental breakfast in the Koury Business Center Lobby which will be available until after the break between the morning oral presentation sessions. Due to the large number of presentations we will have 7 concurrent sessions located on all 3 floors of the Koury Business Center Throughout the day, you are invited to visit the vendors, exhibits, and refreshments located in the first floor office suite of the Koury Business Center. Please take some time to visit with our honored guests from the North Carolina Student Academy of Science who will be at their posters between 10 and 11 AM in the vending/exhibition area.

Our keynote speaker, Dr Anthony Atala, M.D , is the Director of the Wake Forest Institute for Regenerative Medicine, and the W.H Boyce Professor and Chair of the Department of Urology at Wake Forest University He is a practicing surgeon and a researcher in the area of regenerative medicine. His presentation will be delivered in McKinnon Hall at the Moseley Center

Lunch boxes will be available after Dr Atala's address back at the Koury Business Center You are invited to eat outside around the fountain if the weather is nice or to find a comfortable space in the Koury Business Center if it is not.

After lunch, three concurrent workshops will be delivered: Synthetic Biology, The Green Growth Toolbox, and the Graduate School Workshop/ Panel Discussion Following the workshops will be the final four concurrent oral presentation sessions. We round out the afternoon with the annual business meetings of NCAS and CANCAS The meeting concludes on Saturday evening where it began in McKinnon Hall in the Moseley Center with the annual banquet and awards ceremony

If you have any questions or needs during the meeting, please look for Elon University faculty, staff, and students with ribbons on their badges indicating they are assisting the local arrangements committee. They will help in any way they can.

NCAS 2011 Local Arrangements Committee

Michael Kingston, Professor of Biology and Environmental Studies
Linda Niedziela, Associate Professor of Biology
Yuko Miyamoto, Assistant Professor of Biology
Jeffrey Coker, Assistant Professor of Biology
Janet MacFall, Associate Professor of Environmental Studies and Biology

NCAS 2011 Annual Meeting Summary Schedule

Friday March 25th, 2011

1:00-2:00 Finance Committee Meeting (Koury Business Center, Rm 300—KOBC 300)
2:00-5:00 Board Meeting (KOBC 300)
5:00-6:00 Registration and poster setup (McKinnon Hall, Moseley Center)
5:30-6:00 Poster judges meeting (Moseley Center 215)
6:00-6:15 Welcome remarks from Dr Karen Guzman, President of the North Carolina Academy of Science (McKinnon Hall, Moseley Center)
6:00-7 30 Poster Session and Reception with heavy hors d'oeuvres (McKinnon Hall, Moseley Center)
7:30-10:00 Informal Social for undergraduate and graduate students at the The Fat Frog (directions included in this program on pp. 17 and 18)

Saturday March 26th, 2011

7:30-8:30 Registration, Continental Breakfast, and Exhibits/Vendors setup (First floor Lobby area, Koury Business Center--KOBC) (building sketches on pp. 6-8 of program)
7:30-3:00 Powerpoint Preview/Practice Room (KOBC 348)
8:30 Student Academy Poster setup (First Floor Office Suite, KOBC)
8:00-5:00 Exhibits from Meeting Sponsors and Vendors (First Floor Office Suite, Koury Business Center)
8:00-8:30 Judges and Session Chair Meetings (KOBC 145)
8:30-9:45 Sessions for oral presentations
- Ecology I (KOBC 208)
- Molecular Biology and Biochemistry (KOBC 112)
- Zoology I (KOBC 242)
- Botany I (KOBC 244)
- Microbiology (KOBC 306)
- Physics, Chemistry, and Math (KOBC 310)
- Health Sciences (KOBC 145)

9:45-10:00 Break
10:00-11:00 Student Academy Poster Presentations (First Floor Office Suite, KOBC)
10:00-11 15 Sessions for oral presentations
- Molecular Biology (KOBC 112)
- Environmental Science (KOBC 208)
- Developmental Biology (KOBC 306)
- Zoology II (KOBC 242)
- Botany II (KOBC 244)
- Chemistry and Biochemistry (KOBC 310)
- Zoology III (KOBC 145)

11:30-11:45 Welcoming remarks by Dr Steven House, Provost and Vice President for Academic Affairs, Elon University and Dr Karen Guzman, President of North Carolina Academy of Science.(McKinnon Hall, Moseley Center)
Introduction of the keynote speaker by Dr Michael Kingston, Chair of the Local Arrangements Committee
11:45 -12:45 Keynote speaker Dr Anthony Atala, M.D , Director of the Wake Forest Institute for Regenerative Medicine at Wake Forest University, "Regenerative Medicine New Approaches to Healthcare." (McKinnon Hall, Moseley Ctr)

1:00-1:30	Box Lunches (Koury Business Center Lobby) Judges meetings for the awards over lunch (KOBC 145)
1:45-3:15	Synthetic Biology Educators Workshop, Dr Malcolm Campbell (LaRose Digital Theater, KOBC 101)
1:45-3:15	Green Growth Toolbox. Incorporating Wildlife Habitat into Land Use Planning Workshop (KOBC 242)
1:45-3:15	Graduate School Workshop (KOBC 346)
3:30-4:15	Sessions for oral presentations Physiology and Molecular Biology II (KOBC 112) Behavior and Learning (KOBC 145) Ecology II (KOBC 208) Math, Physics, and Environmental Science (KOBC 310)
4:30-5:30	NCAS Business Meeting (LaRose Digital Theater, KOBC101)
4:30-5:30	CANCAS Business Meeting (KOBC 346)
5:30-6:00	CANCAS Officer Awards Meeting (KOBC 145A)
6:00-8:00	Banquet with award ceremony and closing (McKinnon Hall, Moseley Center)
8:00-8:30	NCAS Board of Directors meeting (Moseley Center 215)

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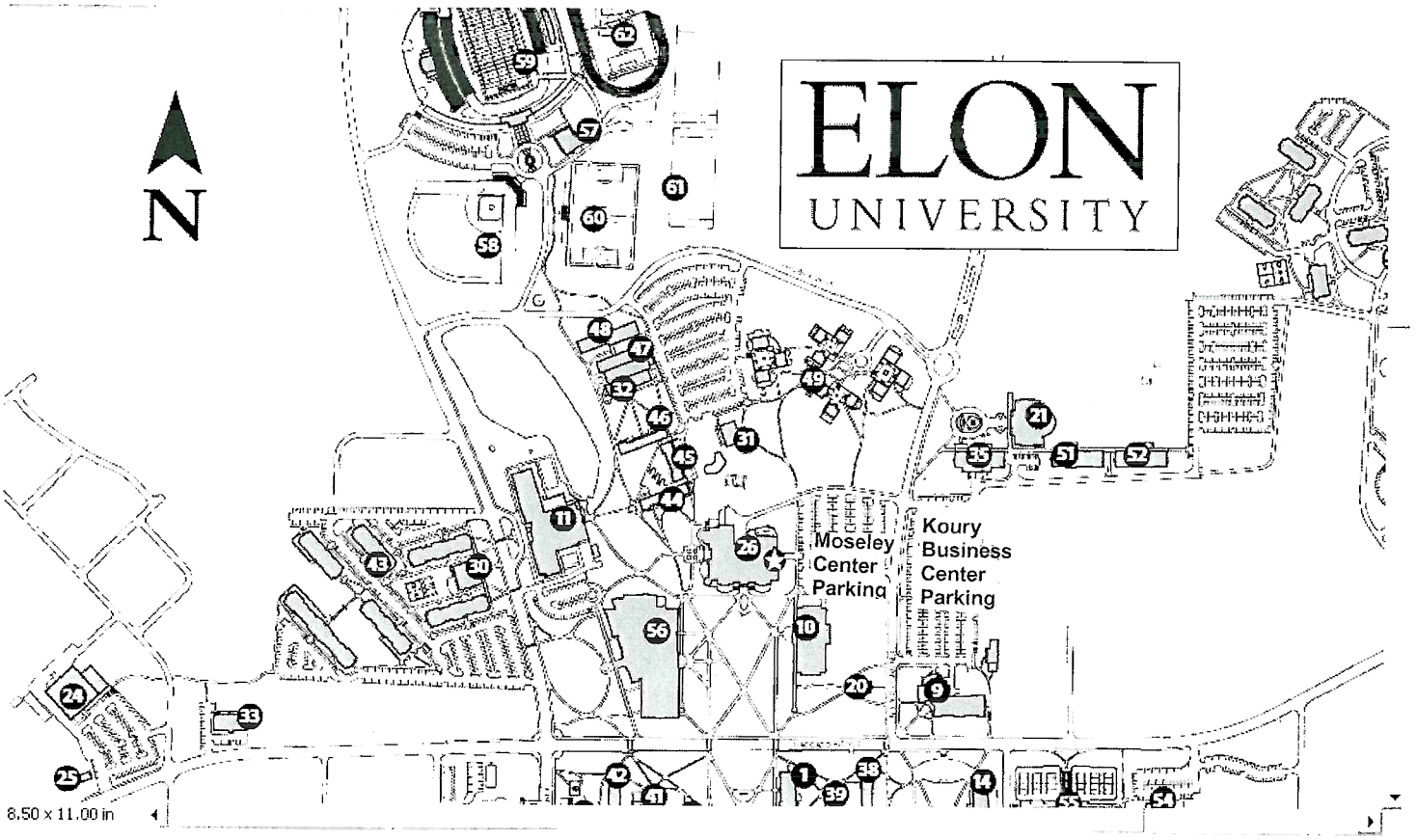
Fisher Scientific

Campus Map



Moseley Center Bldg # 26
Koury Business Center Bldg #21

Administrative & Academic Buildings

1 Powell – *Office of Admissions*
2 Duke
3 Alamance
4 Mooney – *School of Education*
5 Long
6 Whitley Auditorium
7 Carlton – *Isabella Cannon Centre for International Studies*
8 McEwen – *School of Communications*
9 Dalton L. McMichael Sr. Science Center
Hampl Engineering Workshop
Greenhouse
10 Carol Grotnes Belk Library
11 Center for the Arts
McCrary Theatre
Yeager Recital Hall
12 Isabella Cannon International Studies Pavilion
13 Ella Darden and Elmon Lee Gray Pavilion
14 William Henry Belk Pavilion
15 Luvene Holmes and Royall H. Spence Jr. Pavilion
16 William R. Kenan Jr. Honors Pavilion
17 Martha S. and Carl H. Lindner III Hall
Elon College, The College of Arts and Sciences
18 Vera Richardson Truitt Center for Religious and Spiritual Life
19 Powell House
20 Financial Planning
21 Ernest A. Koury Sr. Business Center
Martha and Spencer Love School of Business
22 Truitt – *University Relations*
23 Johnston Hall
Alumni Center
Parent Programs
University Advancement
24 Arts West
25 Faculty/Staff Wellness Center

Support Facilities

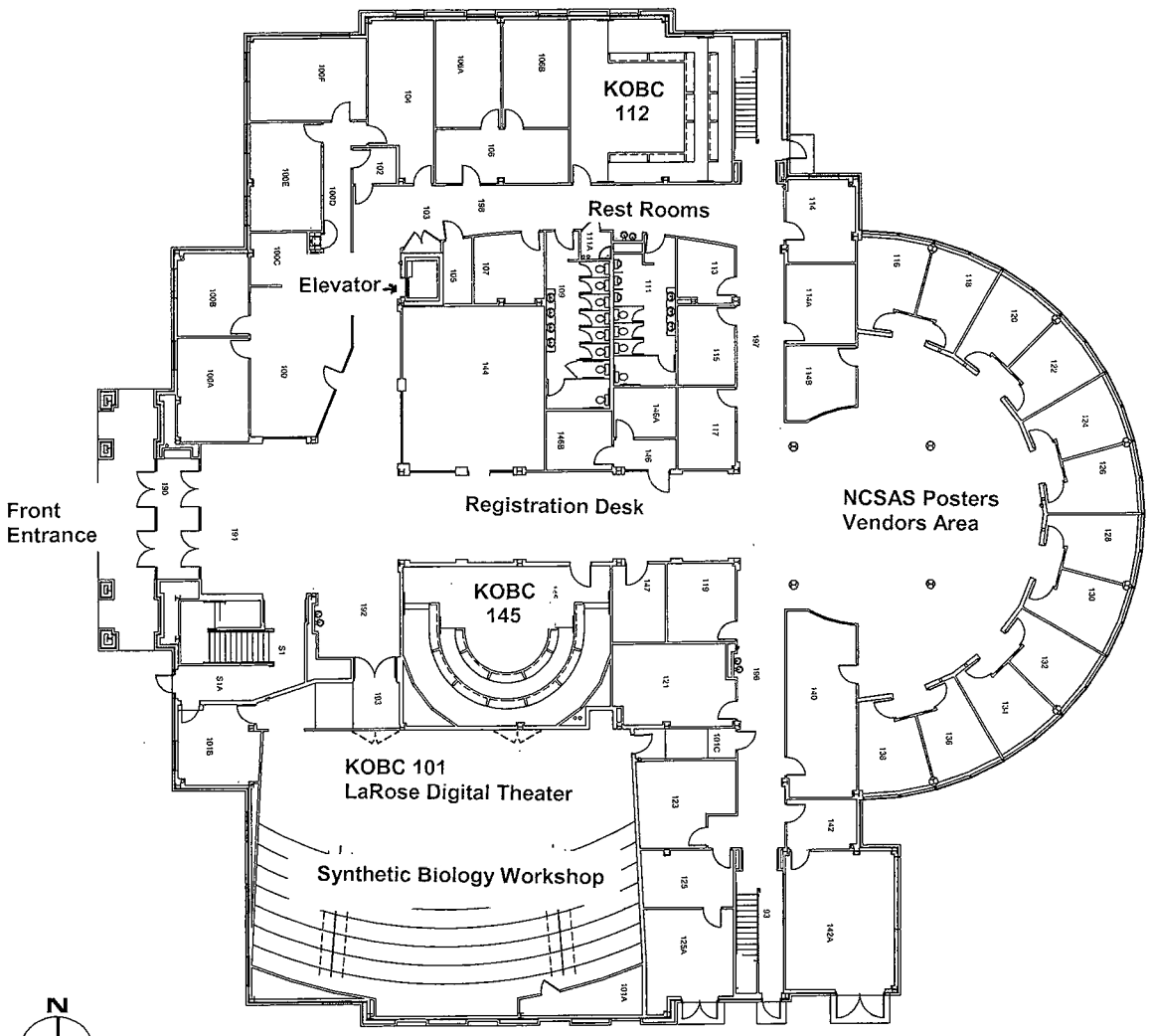
26 Moseley Center
Admissions Welcome Center – Admissions visitors start here. ✪
27 McEwen Dining Hall
Varsity Sports Grille
28 Downtown Elon
29 Campus Technology Support
30 Caroline D. McCoy Commons
Campus Safety and Police
31 R.N. Ellington Health and Counseling Center
32 Harden Dining Hall
33 Business Services
34 Holt Chapel
35 The Colonnades Dining Hall
36 Holland House – *Newman Center*

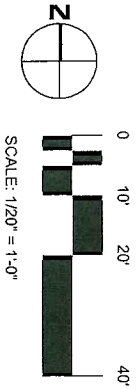
Residence Halls

37 Hook, Brannock and Barney Halls
38 Carolina Hall
39 Smith Hall
40 West Hall
41 Virginia Hall
42 Sloan Hall
43 The Oaks
44 Chandler Hall
45 Colclough Hall
46 Maynard Hall
47 Moffitt Hall
48 Staley Hall
49 Loy Center
Greek Houses
50 Danieley Center
51 The Colonnades - A
52 The Colonnades - B

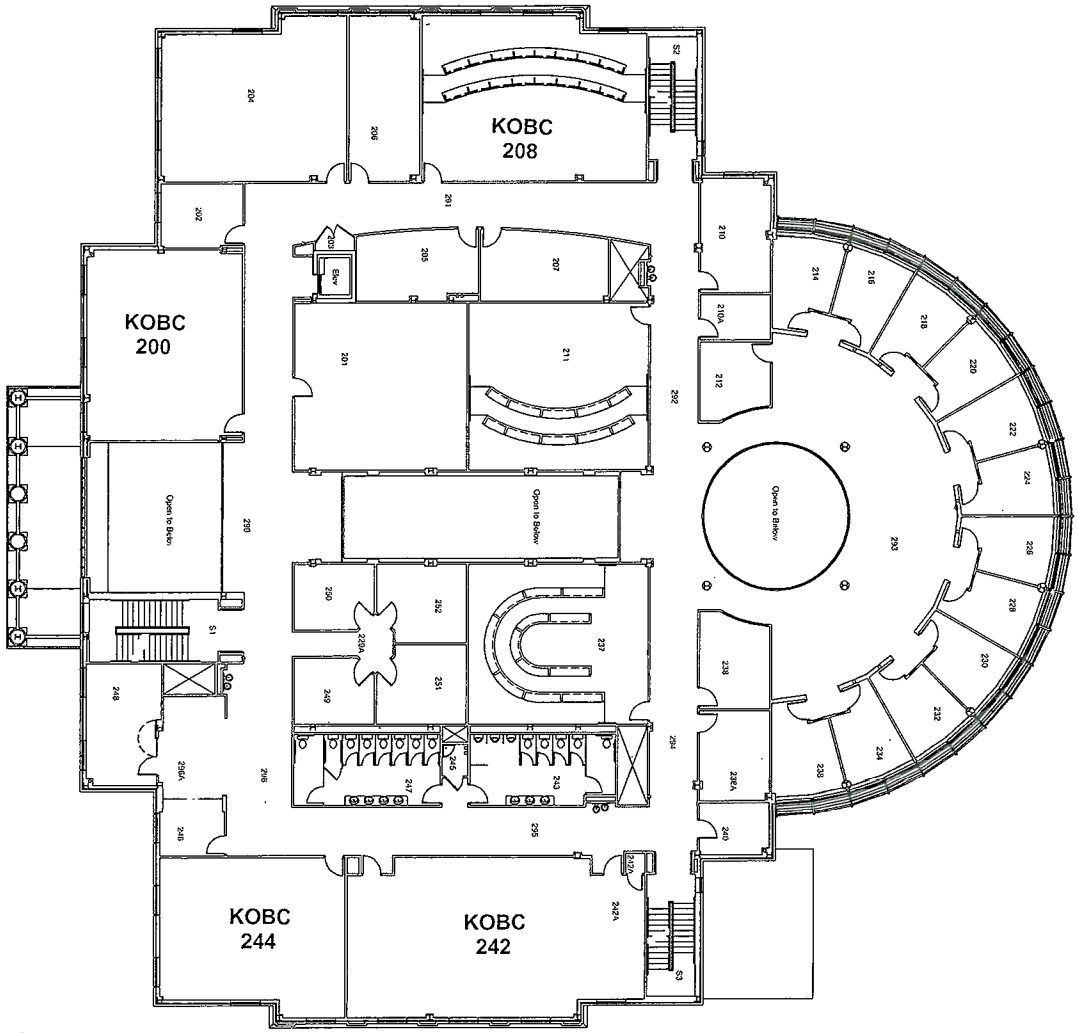
Athletics Facilities

53 Softball Field
54 East Gym
55 Jimmy Powell Tennis Center
56 Koury Center
Alumni Gym
Jordan Gym
Stewart Fitness Center
Beck Pool
57 Koury Field House
58 Latham Park
59 Rhodes Stadium
60 Rudd Field
61 Hunt Field
62 Belk Track and White Field
63 Phoenix Club Sports Fields
64 Driving Range and Putting Green
65 W. Cecil Worsley III Golf Training Center
66 Harden Clubhouse





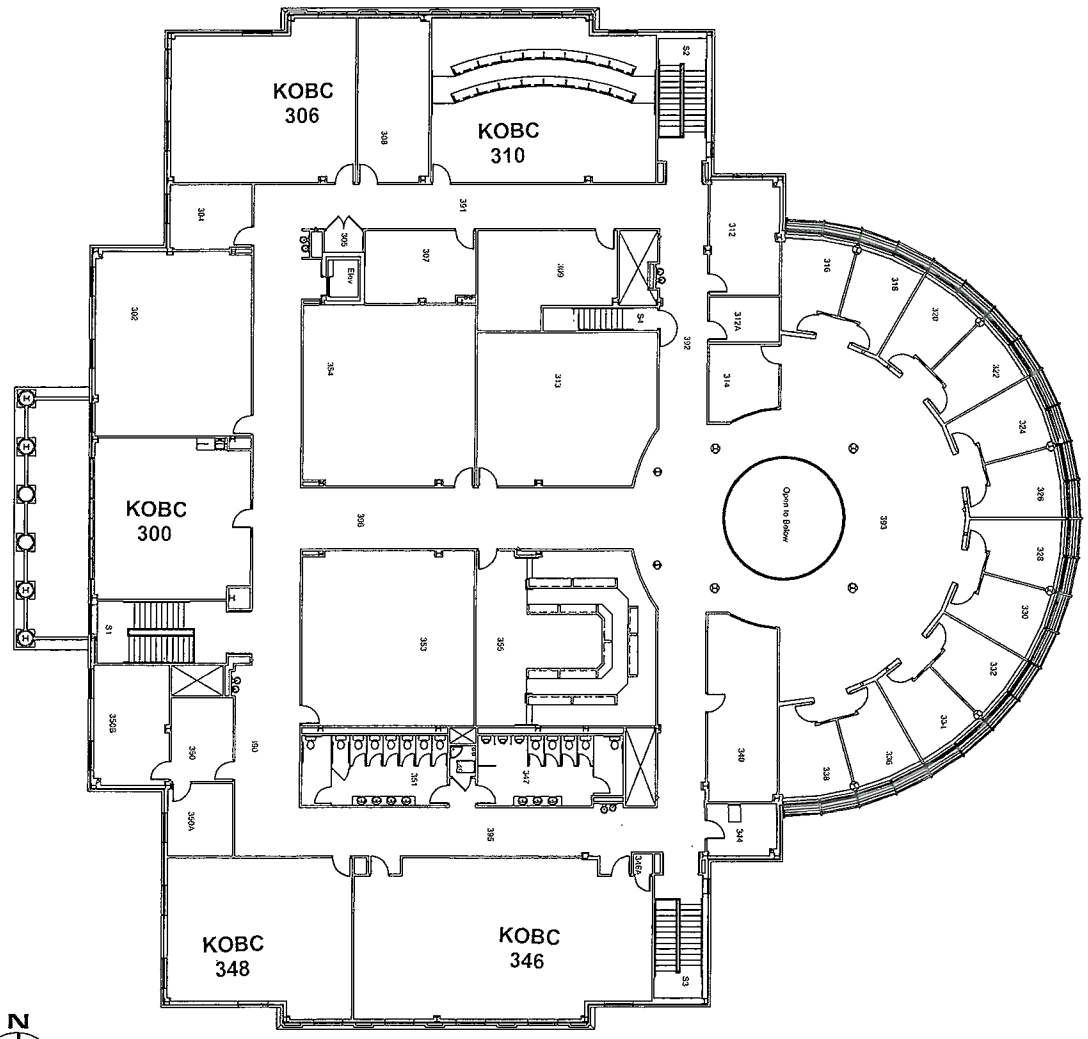
KOURY BUSINESS CENTER	First Floor	Date: 1/5/07



KOURY BUSINESS CENTER

Second Floor

Date: 1/5/07



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Campbell Univ Dept Biology
PO Box 308
Buies Creek NC 27506-0308
Ph 910-814-4365 Fx 910-893-1887
Email: guzman@campbell.edu

Vice President 2010-2011

Dr. James J English
Gardner-Webb University
Department of Natural Sciences
P.O.Box 7291
Boiling Springs, North Carolina 28017
Ph 704- 406-4367
Email: jjenglish@gardner-webb.edu

President-Elect 2010-2011

Dr. Melanie Lee-Brown
Guilford College Dept Biology
3800 W Friendly Ave
Greensboro NC 27410
Ph 336-316-2421 Fx 336-316-2936
Email: mleebro@guilford.edu

Immediate Past-President 2010-2011

Dr. Jean-Luc Scemama
ECU Dept Biology
1000 E 5th St
Greenville NC 27858-4353
Ph 252-328-1838 Fx 252-328-4178
Email: scemamaj@ecu.edu

Executive Secretary 2010-2013

Dr. Gerhard W Kalmus
823 Don Bare Rd
Jefferson NC 28640
Ph 336-982-6132
Email: kalmusg@ecu.edu

Secretary 2009-2012

Dr. Francie Cuffney
Meredith College Dept Biological Sciences
3800 Hillsborough St
Raleigh NC 27607-5298
Ph 919-760-2879 Fx 919-760-8761
Email: cuffneyf@meredith.edu

Treasurer 2008-2011

Dr. Alan Goble
Bennett College Dept Psychology
900 E Washington St Box 23
Greensboro NC 27401-2291
Ph 336-517-2283 Fx 336-517-2291
Email: goble@bennett.edu

Elected Member 2008-2011

Dr Maria Santisteban
UNC Pembroke Dept Biology
PO Box 1510
Pembroke NC 28372-1510
Ph 910-775-4274
Email: maria.santisteban@uncp.edu

Elected Member 2009-2012

Dr. Mickael Cariveau
Mount Olive College Dept Science/Math
634 Henderson St
Mount Olive NC 28365
Ph 919-658-7680
Email: MCariveau@moc.edu

Elected Member 2010-2013

Shaun Williams
Lenoir-Rhyne University
Department of Chemistry
625 7th Avenue NE, Hickory, N.C. 28601
Department of Chemistry or Physics????
Email: Shaun.Williams@lr.edu

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Dr. James R. Fuller
Department of Microbiology & Immunology
University of North Carolina
Campus Box #7290
Chapel Hill, NC 27599
Ph 919-843-8685
Email: james_fuller@med.unc.edu

Finance Committee Chairperson 2009-2012

Dr. Cathy Ciesielski
Department of Natural Sciences
Gardner-Webb University
Boiling Springs, NC
704-406-2141
Box 7203
cciesielski@gardner-webb.edu

Education Committee Chairperson 2010-2013

Dr. Jeffrey S Coker
Elon Univ Dept Biology
2625 Campus Box
Elon NC 27244-2010
Ph 336-278-6206 Fx 336-276-6258
Email: jcoker@elon.edu

Publication Committee Chairperson 2009-2012

Dr. Paul Hager
ECU Dept Biology
1000 E 5th St
Greenville NC 27858-4353
Ph 252-328-1848 Fx 252-328-4178
Email hagerp@ecu.edu

Collegiate Academy Executive Co-Director 2006-2011

Dr. Yuko J Miyamoto
Elon Univ Dept Biology
2625 Campus Box
Elon NC 27244-2010
Ph 336-278-6210 Fx 336-278-6258
Email: ymiyamoto@elon.edu

Collegiate Academy Executive Co-Director 2010-2014

Dr. Erin Lindquist
Meredith College Dept Biological Sciences
3800 Hillsborough St
Raleigh NC 27607-5298
Ph 919-760-8754 Fx 919-760-8761
Email: erinlind@meredith.edu

Collegiate Academy President 2010-2011

Sara Lachance
Guilford College
Ph. 401-323-1075
Email: lachansese@guilford.edu

Student Academy Executive Director 2010-2 015

Dr. Steve Warshaw
North Carolina School Science & Mathematics
1219 Broad St
Durham NC 27705-3577
Ph 919-416-2886 Fx 919-416-2890
Email: warshaw@ncssm.edu

Executive Editor of Journal

Dr. Frank J Schwartz
UNC Institute Marine Sciences
3431 Arendell St
Morehead City NC 28557-3209
Ph 252-726-68 41 ext 139 Fx: 252-726-2426
Email: fjs@email.unc.edu

EX OFFICIO MEMBERS

Annual Meeting Committee Chairperson 2010-2011

Dr. Maria Santisteban
UNC Pembroke Dept Biology
PO Box 1510
Pembroke NC 28372-1510
Ph 910-775-4274
Email: maria.santisteban@uncp.edu

Local Arrangements Committee Chairperson 2010-2011

Dr. Michael B Kingston
Elon Univ Dept Biology
2625 Campus Box
Elon NC 27244-2010
Ph 336-278-6182 Fx 336-278-6258
Email: Kingston@elon.edu

Yarbrough Research Grants Committee Chairperson 2010-2011

Dr. David Webster, Dean
UNCW College Arts and Sciences
601 S College Rd
Wilmington NC 28403-5912
Ph 910-962-3756 Fx 910-962-3114
Email: webste@uncw.edu

Robert R Bryden Research Grants Committee 2010-2011

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Dr. Charles Lytle
NCSU Biology Outreach Program
127F Clark Laboratories
Box 7617
Raleigh NC 27695-7617
Ph 919-515-3273 Fx 919-5327
Email: lytle_bio@ncsu.edu

Dr. Lisa Kelly
UNC-Pembroke Dept Biology
PO Box 1510
Pembroke NC 28372-1510
Ph 910-521-6377 Fx 910-521-6649
Email: lisa.kelly@uncp.edu

Strategic Planning Committee Chairperson 2010-2011

Dr. Parke Rublee
UNC-Greensboro Dept Biology
PO Box 26170
Greensboro NC 27402-6170
Ph 336-256-0067 Fx 336-334-5839
Email: rublee@uncg.edu

Graduate Counselor 2010-2011

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Academy Historian

David Romito
UNC Biology Chemistry Library
CB# 3280
Chapel Hill NC 27599-3280
Ph 919-962-2264
Email dromito@email.unc.edu

Parliamentarian

Dr. John Clamp
NCCU Dept Biology
1801 Fayetteville St
Durham NC 27707-3169
Ph 919-580-6395 Fx 919-530-7773
Email: jclamp@nccu.edu

Office Manager

Dr. Susan Stephenson, NCAS
Meredith College Dept Biological Sciences
3800 Hillsborough St
Raleigh NC 27607-5292
Ph 919-760-8189 Fx 919-788-0956
Email: ncacadsci@email.meredith.edu

Web Master

Dr. James Brown
NC State University
Department of Microbiology
Box 7615
Raleigh, NC 27695
Ph 919-515-8803
Email: james_brown@ncsu.edu

2010 Yarbrough Undergraduate Research Grants

Elisabeth Campbell	Lenoir-Rhyne University	The allelopathic effects of leachates from Japanese honeysuckle (*Lonicera japonica*) on lettuce (*Latuca sativa*)
Alissa Gore	Warren Wilson College	Using molecular modeling to predict products of elimination reactions
Madison Holloway	Lenoir-Rhyne University	Comparison of quercetin content and antioxidant potential in red onions and the nut of acorns of the northern red oak
Steve LeGrand	Warren Wilson College	Decrease in habituation time of the sensitive plant (*Mimosa pudica*) implies information storage and transfer
Mallory Lowder	Lenoir-Rhyne University	The effects of temperature on survival and activity in compost soil of the red worm, *Eisenia foetida*
Jesse Rickard	Warren Wilson College	Effect of patch cut, row thinning, and coppice cut practices on belowground carbon stocks in the WWC forest
Skye Rios	Warren Wilson College	Hydrogen production by *Rhodobacter sphaeroides* under varied conditions of light and ammonium ion concentration
Taija Ventrella	Warren Wilson College	Total antioxidant capacity of fresh, frozen, and baked blueberries
Amy Wagner	Warren Wilson College	Adult wood frog (*Rana sylvatica*) fitness when reared in the non-lethal presence of a predator
Amanda Withers	Lenior-Rhyne University	The effect of compost age on seed germination and growth rate in Clemson spineless okra

2010 Robert R Bryden Graduate Research Grants

Sandra Camilleri	Dept of Biology and Marine Biology	UNCW
Kelly Hines	Dept of Plant Biology	NCSU

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Ramy Ibrahim	Jake Nester	Carsten Peterson
Julie Vernon		

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Robert Wolk

Friday Evening Poster Session
McKinnon Hall, Moseley Center
(6:00-7:30 PM)

(organized alphabetically by title)

Alec Lockhart*, Evan Kelly, John Kennedy and David A. Beamer	A phylogeographic profile of the salamander genus, *Pseudotriton*.
Ryan D. Wagner*, Aaron J. Corcoran, William E. Conner	Acoustic cue discrimination by the sonar-jamming tiger moth *Bertholdia trigona*
Lauren W. Stranahan	Antidepressant impairs zebrafish motor development and behavior: ramifications of pharmaceutical drugs in the environment
John W Furniss* and Dr. David Vandermast	Atmospheric pollution and tree core chemistry in Great Smoky Mountains National Park
Willem Prins	Balancing Magnetic and Elastic Properties of Biomimetic Cilia
Shilpa Reddy and Alice Haddy, UNC Greensboro	Calcium (Ca^{2+}) and Chloride (Cl^-) Dependence of Photosystem II after Ca^{2+} Depletion
Katherine Hlavinka and Linda Niedziela	Cardiovascular and Molecular Toxicity in *Danio rerio*, Zebrafish and *Oryzias latipes*, Medaka
Matt Jester, Zach Huntington-Meath Presenter, R. Duetsch, M. Schug University of North Carolina at Greensboro	Detecting and Modeling Natural Selection in *Drosophila ananassae*
Mariana V. Gattegno*, K. Eloshway, and M. Cariveau	Development of a model of Methotrexate induced hepatic and gastrointestinal fibrosis in the developing zebrafish embryo.
Dr. Ethel J. Gordon, Helen Black, Andrea Gentry, Nicole Hanner, and Desiree Rand	Deviations from safe drinking water standards in an urban environment
Chia-Chi Hsu* and Karen S. Katula	Differential activity of the Wnt5a alternative promoters A and B during adipogenesis.
Brittanie M. Morgan* and Michelle Linster	Do Urban Names Bias Reviewers' Perceptions of Job Seekers?
Priyanka Patel, Sarah Liggett, Victoria Ellis, Marcus Ford, and Karen Guzman Department of Biological Sciences, Campbell University	Effect of Lead Acetate on Early Development of Danio rerio Embryos
Jonathan Preston Cranford* and Wanda Krassowska Neu	Electroporation in a three-dimensional, time-dependent model of a skeletal muscle fiber

Miriam Ferzli, Mary Beth Hawkins, Elizabeth Overman, and Damian Shea	Engaging Undergraduates in Authentic Scientific Research Practice
Danielle Whitman*and Janet MacFall	Enzyme Activity in the Hyporheic Region of Piedmont Streams
Kara E. Salpeter*	Evidence for biotic resistance to invasion across spatial scales in riparian forest vegetation
Ia Lee* and Alice Haddy	Fluoride as an Inhibitor in Oxygen Evolution by Photosystem II
Meghan R. Clark* and Antonio D. Izzo	Fungal Population Response to Increased Temperatures in Soil
Kimberly M. Stratford*, John Stafford, Melissa Martinez, David Cappel	Hepatic Insulin Resistance after Menopause
Justin Castellow*, Lucy Conaty, Margit Schmidt, Mickael Cariveau, and Jean-Luc Scemama	HOX Expression in Exponentially Growing and Differentiated Colon Cancer Cell Line HT-29
Gregory Swan* and Sophia Sarafova	Identification of a novel positive cis-control element in the Cd4 gene
Jessica R. Bame*, Dr. Nadja Cech, Dr. Nicholas Oberlies, Tyler Graf	Identification of Antimicrobial compounds in *Alkanna orientalis*
Nicholas W. Faulkner	Inhibition of Microsomal Triglyceride Transfer Protein by RNA Interference in *Drosophila* S2 Cells
Stephen Vance* and Alice Haddy	Inhibition of Photosystem II by Fluoride
Philna Joubert*, Aparna Meka, and Jason J. Reddick	Investigation of a possible multi-enzyme complex involved in fatty acid metabolism from *Bacillus subtilis*
Denise Reaves*, Tierra Poteat, Fran Turner, John Bang#, Catherine Silver Key	"Investigation of de-pigmentation phenotype in *Drosophila melanogaster* due to silver nanoparticle exposure"
Hollie Young1*, David Butler2,3, Candice Estick2 , Jeannie Hwang1-3, Saranya Kumar2, Ana Charalambides,3 , Rebekah Howell , Meagan L. Wisniewski1, and Ben A. Bahr1-3	Lysosomal Modulator Protects in Alzheimer's Disease Transgenic Mouse Model: Evidence of Enhanced Expression and Trafficking of Cathepsin B
Anna Queen*	Mapping the Motor Connections of the Subthalamic Nucleus in Parkinson Disease Using Deep Brain Stimulation Surgery
John C. Misenheimer*, Elizabeth D. Blue	Measuring Nitrogen Dioxide Concentrations in Ambient Air via a Passive Diffusion Sampling Method

Morgan J Gregg*, Robin L LaCroix	Methicillin-resistant *Staphylococcus aureus* Prevalence in Pregnant Women and Transmission Risk to Newborns
Jose Luis Gutierrez*, Patricia Koplas, PhD, MS, PT and Greg Pillar, PhD	Microbial Fuel Cells Powered by Sediments of the South Fork River Enhanced with Carbon, Sulfur and Iron Substrates
Margo Lowe* and Linda Niedziela	Oil dispersant reduces the reproductive rate in *D magna*
V. Claire James, Michael Terribilini	Peptide binding affinity of the rheumatoid arthritis susceptibility allele HLA-DRB1*0401 through molecular dynamics simulation
Seth Bernstein and Dr. Mark Welker	Preparation of Prostate Cancer Specific BEZ235 Analog PI3 Kinase Inhibitors
Nicholas Forman* and Lynn Moseley	Salamander Populations and their Habitat Feature Associations in Urban Woodlands
Michael J. Bruno, Brian Rybarczyk, Leslie S. Lerea, P.K. Lund and Linda Dykstra	Seeding Postdoctoral Innovators in Research and Education (SPIRE)
Vinogran Naidoo, David A. Karanian, Spyros P. Nikas, Johnathan R. Locklear*, Emily Graves, JodiAnne Wood, Alexandros Makriyannis, and Ben A. Bahr	Selective modulation of the endocannabinoid system for targeted protection in kainic acid models of excitotoxicity
Roberta Smith-Uhl* and Francie Cuffney	Shell Morphology and DNA Sequencing of Disperse Populations of *Corbicula fluminea* in North Carolina
Thalhamer S., Shortt K., Schmidt M., Chalovich J., and Scemama J.L.	Synaptopodin-2 expression and localization in undifferentiated and differentiated HT29 Colon Cancer
Charles E. Hendrick*, Lindsay R. Comstock	Synthetic Efforts Towards an Azide-bearing SAM Cofactor Mimic
Julie C. Ronecker*, Dr. Benjamin A. Evans	Temperature-dependent Release of a Model Drug from Ferroelastomeric Microspheres for the Purpose of Targeted Drug Delivery
Christopher Hadley	Testing the utility of introns to resolve the phylogenetic relationships of closely related salamander taxa.
Joseph M. Hester*, Wayne L. Silver, Erik C. Johnson	The *Drosophila melanogaster* Proboscis Extension Response as an Assay for Chemesthesis
Rachel Reed*, and Alice Haddy	The Effectiveness of Removing the Activating Calcium Ion with Different Salts in Photosystem II

Elizabeth J. Carrow*, Lindsay R. Comstock	The Investigation of an Alternative Means to Probe Kinase Function using an Azide-bearing ATP Analog via a Chemoselective Ligation
Matthew B. Harrell*, David F. Sommerville, Caitlin L. Hall, Diana M. Norden, and Michelle S. Thomas	The phenotypic characterization of halophilic archaeal isolates acquired from a salt brine located in Carlsbad, New Mexico.
Ashley Shilling, Dr. Melinda Harper, and Dr. Patricia Koplas	The Physical and Psychosocial Benefits of Strength Training for Women
Freddy O. Herrera* and Elizabeth P. Lacey	Under what environments is thermoregulation adaptive? Transplant experiments using *Plantago lanceolata*
R.D. Hayes	Variation, Selection, Inheritance: a public outreach podcast on evolution by the NSF BEACON consortium.
Brett Schuchardt and Linda Niedziela	Zebrafish (*Danio rerio*) gill ATPase gene expression response to oil dispersant exposure

Friday Evening Student Social
The Fat Frogg Bar and Grill
(7:30-10:00 PM)

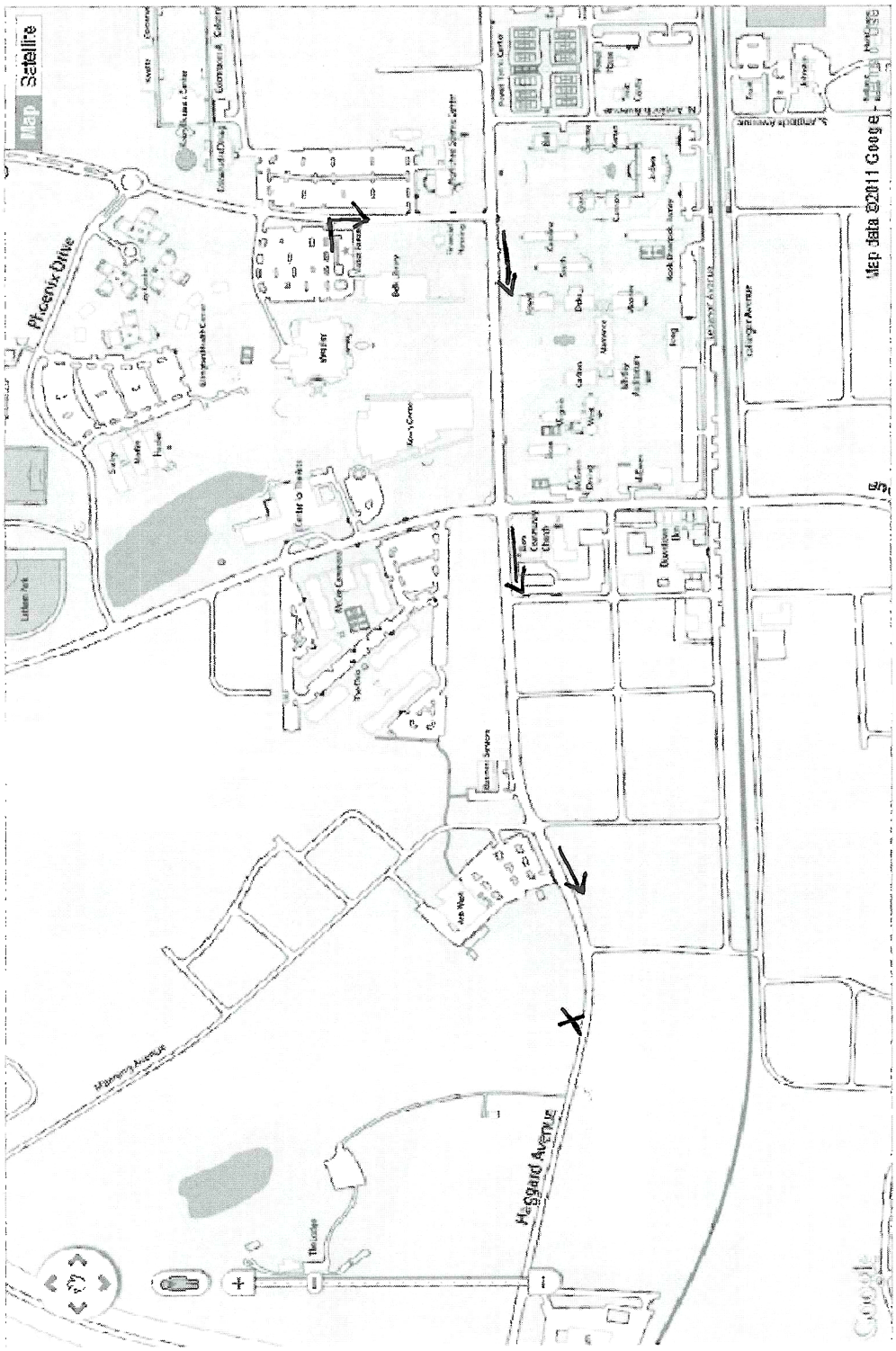
2009 Timberline Station Dr.
Elon, NC 27244

336-584-5546

Driving directions to The Fat Frogg Bar & Grill from the Moseley Center

1. **Leave the Moseley Center Parking Lot and turn right onto N. O'Kelly Avanue**
2. **At the light, turn right onto E. Haggard Avenue**
3. **Continue straight through the light at the intersection with Williamson Avenue**
4. **Continue for 0.5 miles then turn right onto Timberline Station Drive**

Directions to The Fat Frogg



Saturday Morning Contributed Paper Sessions (8:30-9:45 AM and 10:00-11:15 AM)

Ecology I—KOBC 208

8:30 AM	**Kim M. Briones, Jessica A. Homyack, Darren A. Miller and Matina C. Kalcounis-Rueppell.** University of North Carolina at Greensboro, Weyerhaeuser NR Company, NC and MS	**Effects of Intercropping Switchgrass with Loblolly Pine on the Diet and Trophic Position of *Peromyscus leucopus*.**
8:45 AM	**Elliott Diggs*** Guilford College and The School for Field Studies	**Examining Population Structure in Two Species of Australian Freshwater Turtles: *Wollumbinia latisternum* and *Elseya stirlingi*.**
9:00 AM	**Bryan A. Strelow* and Gregory J. Haenel** Elon University	**Exploring Species Boundaries: Morphological Evidence for Interactions between North American Cricket Frogs, *Acris crepitans* and *A gryllus***
9:15 AM	**Sam Flake*, Lynn Moseley** Guilford College	**Effects of White-Tailed deer (*Odocoileus virginianicus*) on Invasive Exotic Woody Plants in Piedmont North Carolina Forest Communities**
9:30 AM	**Katrina L. Calder*** Peace College	**Effects of Frequent Scouring Events on Macroinvertebrate Community Structure**

Molecular Biology I and Biochemistry I—KOBC 112

8:30 AM	**Elise Post*, Dr. Kathy Matera, and Carly Fabrizio** Elon University	**Kinetics and Binding Studies of Lactoperoxidase with Estrogens in the Presence of Hydrogen Peroxide**
8:45 AM	**Jordan Rockensuess* and Joshua Ring** Lenoir Rhyne University	**Analysis of Antioxidants in Wines, Teas and Spices**
9:00 AM	**Morris Patton* and Andrew W. Steele** Lenoir-Rhyne University	**Using the Design of Experiments (DOE) Technique to Optimize Pharmaceutical Tablet Formulations-A Study of Aspirin Drug Product Formulation**
9:15 AM	**Amanda M. Haungs* and Michele Malotky** Guilford College	**Assessing the role of nhr-14 and nhr-69 as possible estrogen-like target receptors for the Estrogenic Endocrine Disrupting Chemical (EEDC) Enterodiol in the soil nematode, Caenorhabditis elegans**
9:30 AM	**Mahmoud Saleh*; Malotky, Michele** Guilford College	**Identification of a possible target receptor for the Estrogenic Endocrine Disrupting Chemical (EEDC) Bisphenol A in Caenorhabditis elegans**

Zoology I—KOBC 242

8:30 AM	**S.A. Camilleri, H.N. Koopman, A.J. Westgate, D. Gannon, and R. Mauck** UNC Wilmington, Grand Manan Whale and Seabird Research Station, Bowdoin College, and Kenyon College	**Provisioning of chicks by Leach's Storm-Petrels: Preliminary insights into energy content, lipid content, and contaminants of stomach oils**
8:45 AM	**Kaira Wagoner, Tovi Lehmann and Gideon Wasserberg** University of North Carolina and NIH, MD	**Identification of Morphologic and Chemical Markers of Adult *Anopheles gambiae* Mosquitoes Exposed to Aestivating Conditions**
9:00 AM	**Theophile Taminin, Laura White, Dr. Brian Byrd, Dr. Gideon Wasserberg** UNC-Greensboro and Western Carolina University	**Does Anthropogenic Disturbance Affect the Activity of the LaCrosse Virus (LACV) within the Sylvatic System in Western North Carolina?**
9:15 AM	**Ryan D. Kuster, Deborah Smith, and Olav Rueppell** University of North Carolina-Greensboro, University of Kansas, University of North Carolina-Greensboro	**Biogeographic Patterns of Host Specificity in Thai *Varroa jacobsoni***
9:30 AM	**Christina Kotraba, Lori Seischab, Christopher Coburn** Western Carolina University	**Use of Pteridine and Lipofuscin Fluorescence for Age Determination in Apis mellifera (Honey Bees)**

Botany I—KOBC 244

8:30 AM	**Kelly Hines** NC State University	**Guide to the Vascular Flora of Howell Woods**
8:45 AM	**Lora L. Sigmon* and Dr. David Vandermast** Elon University	**Composition and Structure of Mature Second Growth Riparian Forests along the Haw River in Central North Carolina**
9:00 AM	**Elizabeth Stapleton* and Dr. Lynn Moseley** Guilford College	**Exotic Invasive Plants: Edge Influence and Distribution In a Suburban Forest Fragment**
9:15 AM	**Amanda R. Withers*** Lenoir Rhyne University	**The Effect of Compost Age on Germination and Growth Rate of Clemson Spineless Okra (*Abelmoschus esculentus*)**

Microbiology—KOBC 306

8:30 AM	**Kayla D. Britton* and Joe Wolf** Peace College	**A Proposed Role for Carbonic Anhydrase in Fatty Acid Biosynthesis by *Bacillus mycoides***
8:45 AM	**Lawrie N. Cashwell* and Joe Wolf** Peace College	**Detection of a Low Molecular Weight Bacteriocin from *Bacillus cereus* by its Activity on Tricine Peptide Gels**
9:00 AM	**Jessica Klaphaak* and Elizabeth Hiltbold** Guilford College and Wake Forest University	***Listeria monocytogenes* Kills Tumor Cells**
9:15 AM	**Zachary Harrison Wood*, Melanie Lee-Brown, Michele Malotky** Guilford College	**Can *Caenorhabditis elegans* acquire antibiotic resistance by ingestion of resistant *Escherichia coli?***
9:30 AM	**Kimberly Heck*[1], James Brown[2], Melanie Lee-Brown[1]** [1]Guilford College and [2]NC State University	**Multilocus sequence typing and analysis to compare natural isolates of *Ensifer adhaerens* to a known type strain**

Physics, Chemistry, and Math—KOBC 310

8:30 AM	**Orville Day, Davidson Wicker, and David Pravica** East Carolina University	**Experimental Confirmation of the Existence of Gravitational Waves and Their Speed**
8:45 AM	**Richard C. Bradt and Lei Zhang** Winston Salem State University and The University of Alabama	**The Indentation Size Effect in Fused Silica and Crystalline Quartz**
9:00 AM	**Daniel Bates*** Western Michigan University	**Facile Synthesis of Monodisperse Metallic Nanoparticles and Their Interaction with Quantum Dots**
9:15 AM	**Elliott M. Betrand*[1], Nailong Guo1 and Woon-Kwan Lam[2].** [1]Johnson C Smith University and [2] Benedict College	**Visualization of Julia sets and its application in pattern designs**

Health Sciences—KOBC 145

8:30 AM	**Ashley Moore*, JaNae Joyner, David Mount, Carlos Ferrario, David Cline** Winston Salem State University MARC U*STAR Program, Hypertension and Vascular Research Center, Internal Medicine, Maya Angelou Research Center on Health Equity, and Emergency Department, Consortium for Southeastern Hypertension Control (COSEHC), Winston-Salem, NC	**A Comparison of Lifestyle and Patient Inertia Factors Among Emergency Department Patients and Church Community Members**
8:45 AM	**John Jacobs* (1); Kevin Shea, MD (2); Nathan Grimm, MD(s) (2); Shawn Simonsen, EdD (3)** (1)Guilford College, (2) University of Utah School of Medicine; (3) Boise State University	**ACL and Knee Injury Prevention Programs for Young Athletes: Do they Work?**
9:00 AM	**Elizabeth Killion*, Dr. Nicholette Allred, Dr. Donald Bowden** Guilford College and Wake Forest University	**Understanding Adiponectin Expression: Sequencing the ADIPOQ Gene in European Americans**
9:15 AM	**Madison O. Holloway*, [1] Fuxia Jin, [2] Wei Jia, [2] Guoxiang Xie and [2] Yunping Qiu** Lenoir-Rhyne University, [1] Appalachian State University, [2]UNC at Greensboro	**A Nutritional Comparison of Chia Seeds *Salvia hispanica* and Acorns of Northern Red Oak *Quercus rubra*: The Future of Functional Foods**
9:30 AM	**Brian Byrd, Laura White*, Alan Goggins, Charles Sither, Bruce Harrison, and Gideon Wasserberg** University of North Carolina at Greensboro	**Evaluation of Four Models of Mosquito Traps for the Surveillance of La Crosse *Encephalitis* Vectors in Western North Carolina**

Molecular Biology—KOBC 112

10:00 AM	**Nicole Joyner-Powell and Karen S. Katula** University of North Carolina at Greensboro	**Characterizing the Contribution of NFkappaB and Involvement of the MAPK Signaling Pathway to Transcription from Wnt5a Alternative Promoters A and B**
10:15 AM	**Kelsey Penland*** Guilford College	**PCR Mediated, Site-Directed Mutagenesis of the FMN Riboswitch of *Photorhabdus luminescens* and the Effect on Symbiosis with *Caenorhabditis elegans***
10:30 AM	**Joshua R. Stokell, Anthony A. Fodor, Melanie D. Spencer, Timothy J. Hamp, Todd R. Steck** University of North Carolina at Charlotte	**Metagenomic Analysis of Microbiota in Response to Antibiotics in Cystic Fibrosis**
10:45 AM	**Luke Dixon** Department of Biology, University of North Carolina at Greensboro	**Testing Genomic Regions for Their Effect on Aging in Honey Bee Workers**

Environmental Science—KOBC 208

10:00 AM	**Jesse M. Rickard* and David S. Ellum** Warren Wilson College	**Changes in Soil Organic Matter and Soil Respiration with Silviculture Treatment.**
10:15 AM	**Mallory M. Lowder*** Lenoir-Rhyne University	**A Comparison of the Efficacy of the Earthworm *Eisenia fetida* and a Locally Collected Earthworm *Lumbricus rebellus* on the Rate of Decomposition of Leaf Litter.**
10:30 AM	**Sean T. Pulsfort* and Dr. John Brock** Warren Wilson College	**Greenhouse Gas Emissions from Cow Manure and Ammonium Nitrate on Simulated Pasture**
10:45 AM	**Linden Blaisus and D. Ellum** Warren Wilson College	**Elevated CO_2 and Growth of *Rosa multiflora***
11:00 AM	**Cordelia Sackey-Mensah*** University of North Carolina at Greensboro	**Effect of Xenobiotics on Honeybee (*Apis mellifera*) Adult Intestinal Stem Cell Proliferation**

Developmental Biology—KOBC 306

10:00 AM	**Priyanka Patel*, Sarah Liggett, Victoria Ellis, Marcus Ford, and Karen Guzman** Department of Biological Science, Campbell University	**Effect of Lead Acetate on Early Development of *Danio rerio* Embryos**
10:15 AM	**Erin E. Witalison* and Constance Rogers-Lowery** Catawba College and North Carolina Research Campus	**Proteomic analysis of metamorphosis in the hydroid, *Hydractinia symbiolongicarpus***
10:30 AM	**Sara Lachance*** Duke University and Guilford College	**Identifying Dachshund's Role in Hedgehog Signaling and Urchin Development**
10:45 AM	**Brian Sullivan*** Lenoir-Rhyne University	**Effects of Caffeine on Zebrafish (*Danio rerio*) Development: Growth Rate, Heart Rate, and Motor Function**
11:00 AM	**Kyla M. Jacobs* and Jeff Holmes** Warren Wilson College	**Teratogenic Potential of Caffeine throughout the Embryonic Development of the Zebrafish, *Danio rerio***

Zoology II—KOBC 242

10:00 AM	**Nick Forman*, Dr. Lynn Moseley** Guilford College	**A Survey of Salamander Populations and Their Habitat Feature Associations in Urban Piedmont North Carolina**
10:15 AM	**Lucas P. Carnohan*** Lenoir-Rhyne University	**Effects of Temperature and Substrate Color on the Growth and Color Morphology of the Chinese Praying Mantis (*Tenodera ardifolia sinensis* S.)**
10:30 AM	**15 minute break**	
10:45 AM	**Brittany Nichols* and Erica Kosal** NC Wesleyan College	**Bird Behaviors and Food Preference as Seasons Change**
11:00 AM	**Karen Love* and Jennifer Frick-Ruppert** Brevard College	**Bioluminescence and Pheromone use in Mate Selection of the Blue Ghost Firefly *Phausis reticulate***

Botany II—KOBC 244

10:00 AM	**Elisabeth M. Campbell*** Lenoir-Rhyne University	**The Effect of Japanese Honeysuckle (*Lonicera japonica)* Extracts on Percent Germination and Radical Lengths of Lettuce Seeds (Latuca sativa)**
10:15 AM	**Britney Phippen*** Queens University	**Pollinator limitation in the endangered sunflower, *Helianthus schweinitzii***
10:30 AM	**Andrew Blank*, Jonathan Slater, Sam Sullivan, Michael Lutfi, Jason Waters, Freddy Herrera, and Elizabeth Lacey.** The University of North Carolina Greensboro	**How are Reproductive Traits in Plants Modified by Temperature? An Examination *of Plantago lanceolata.***
10:45 AM	**Laurel Ann Thwing*, David Ellum, Amy Boyd** Warren Wilson College	**Rhizome Propagation of Galax (Galax urceolata) Using Waste Product from Commercial Harvest Operations**

Chemistry and Biochemistry—KOBC 310

10:00 AM	**Taija Ventrella*** Warren Wilson College	**Antioxidants in Blueberry, Pomegranate, and Açaí Juices**
10:15 AM	**Rebecca K. Smith* and Joshua Ring** Lenoir-Rhyne University	**Deuterium Isotope Effect on the Rate of Reduction by Yeast Alcohol Dehydrogenase**
10:30 AM	**Skye E. Rios* and John W. Brock** Warren Wilson College	**Investigation of hydrogen production by *Rhodobacter sphaeroides.***
10:45 AM	**Maya T. Rios* and V. Collins** Warren Wilson College	**Lifespan of SOD-2 *Caenorhabditis elegans* due to Antioxidant Exposure.**
11:00 AM	**Alissa A. Gore*, D. Kahl** Warren Wilson College	**Using molecular modeling to predict products of elimination reactions.**

Zoology III—KOBC 145

10:00 AM	**Octavia Sola*, L. Weber and S. Fegley** Warren Wilson College	**Human Activity and Shorebird Behavior and Diversity on Onslow Beach, Camp Lejeune**
10:15 AM	**Amy N. Wagner* and Dr. Louise M. Weber** Warren Wilson College	***Rana sylvatica* froglet fitness when reared in the non-lethal presence of a predator**
10:30 AM	**Caroline Ritchey* and David Judge** Gardner-Webb University	**Population Dynamics of a Seed Shrimp (*Crustacea: Ostracoda: Cypria sp*) and Its Association with an Ectocommensal Protozoan (*Ciliphora: Peritricha: Lagenophryidae: Lagenophrys sp***

Keynote Speaker

Dr. Anthony Atala, M.D.

Regenerative Medicine: New Approaches to Healthcare

McKinnon Hall, Moseley Center

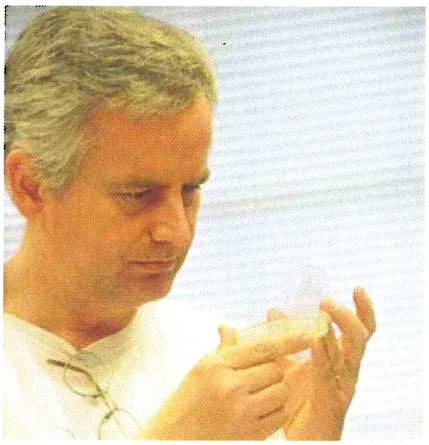
(11:30 AM - 12:45 PM)

Anthony Atala, M.D., is the Director of the Wake Forest Institute for Regenerative Medicine, and the W.H. Boyce Professor and Chair of the Department of Urology at Wake Forest University He is a practicing surgeon and a researcher in the area of regenerative medicine. His current work focuses on growing new human cells, tissues and organs.

Dr Atala is a recipient of the US Congress funded Christopher Columbus Foundation Award, bestowed on a living American who is currently working on a discovery that will significantly affect society, and the Gold Cystoscope Award for advances in his field. Dr Atala was named by Scientific American as a Medical Treatments Leader of the Year for his contributions to the fields of cell, tissue and organ regeneration. In 2006, he was named by Fast Company magazine as one of 50 people who "will change how we work and live over the next 10 years. Dr Atala's work was listed as Discover Magazine`s Number 1 Top Science Story of the Year in the field of medicine, and as Time Magazine's top 10 medical breakthroughs of the year in 2007 A Time Magazine poll ranked Dr Atala as the 56th most influential person of the year in 2007 Esquire Magazine in 2008 named Dr Atala one of the 75 most influential persons of the 21st century Fast Company Magazine named Dr Atala one of 100 Most Creative People in Business in 2009. Dr Atala was featured in U.S. News & World Report as one of 14 Pioneers of Medical Progress in the 21st Century, and his work in 2010 was listed by Smithsonian Magazine as one of 40 things to know about the next 40 years.

Dr Atala has led or served several national professional and government committees, including the National Institutes of Health working group on Cells and Developmental Biology, and the National Institutes of Health Bioengineering Consortium. He is currently an NIH "Quantum Grant" awardee. Dr Atala heads a team of over 270 physicians and researchers. Ten applications of technologies developed in Dr Atala's laboratory have been used clinically He is the editor of nine books, including Minimally Invasive Urology, Methods of Tissue Engineering, Principles of Regenerative Medicine, and Foundations of Regenerative Medicine, and has published more than 300 journal articles and has applied for or received over 200 national and international patents.

Afternoon Workshops (1:45-3:15 PM)

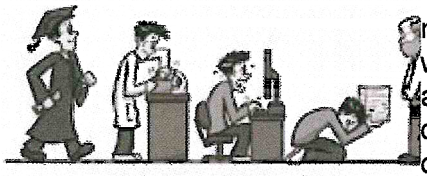


Workshop Option 1: KOBC 101
Dr. Malcolm Campbell, Ph.D.
Synthetic Biology for Organic Learning

Dr. Campbell is the Director of the James G Martin Genomics Program at Davidson College This workshop will introduce participants to the multi-disciplinary field of synthetic biology The presentation will show faculty how young undergraduates can be incorporated into original research that blends computer science, mathematics, and biology with a minimum of cost. Participants with lap top computers will design, construct, and test bacterial computers that solve complex mathematics problems. T

Workshop Option 2: KOBC 242
Ms. Kacy Cook and **Ms. Sara DiBacco**
The Green Growth Toolbox: Incorporating Wildlife Habitat into Land Use Planning

Ms. Cook is a Land Conservation Biologist with the North Carolina Wildlife Resources Commission and Ms. DiBacco is a Conservation Planner with the North Carolina Sandhills Conservation Partnership. Their hands-on computer workshop will provide attendees with the opportunity to learn about and utilize a technical assistance tool that integrates GIS datasets with wildlife habitat conservation recommendations to help communities construct land use plans that conserve natural habitats and resources.



(Randall Munroe, xkcd.com)

Workshop Option 3: KOBC346
Graduate School Panel Discussion/Workshop

This workshop has been designed for undergraduate members of the Collegiate Academy of Science It will begin with a 4 person panel discussion including graduate admissions and recruiting professionals. The panel discussion will be followed up by break-out small group discussions with current graduate students, postdoctoral fellows, faculty, and graduate admissions professionals. Potential topics of interest include choosing the right program, successfully applying, funding your graduate education, adjusting to graduate life, developing a research focus, and navigating the challenges of graduate school.

Saturday Afternoon Contributed Paper Sessions (3:30-4:15 PM)

Physiology and Molecular Biology (KOBC 112)

3:30 PM	**Ryan D. Michalek, Valerie A. Gerriets, Sarah R. Jacobs, Nancie J. MacIver, Amanda N. Gould, Russell G. Jones, Vincent Giguere, Donald P. McDonnell, Jeffrey C. Rathmell.** Duke University	**Distinct Glycolytic and Lipid Oxidative Metabolic Programs of Effector and Regulatory T cells Regulated by Estrogen Related Receptor-alpha**
3:45 PM	**S. Catherine Silver Key and Roketa Sloan** Central University and Duke University	**The role of Cdt2 in Drosophila development**
4:00 PM	**Beth L. Overman and Adam J. Moeser** North Carolina State University	**Intestinal CRF Receptor Subtypes Mediate Distinct Intestinal Barrier Function Responses Through Mast Cell Activation**

Behavior and Learning—KOBC 145

3:30 PM	**Alan Goble and Sara C. Wrenn** Bennett College	**Atypical Performance on the Stroop Color-word Task (1935) and the Hebert & Rogers' (1966) Pronounceable/Non-pronounceable Anagrams Task: Implications for Academic Outcomes**
3:45 PM	**Angela Mason Foster** Kaplan University	**Hand Preference in Nocturnal Lemurs (*Cheirogaleus medius, Mirza coquereli, Microcebus myoxinus*) during Feeding in Captivity**

Ecology II—KOBC 208

3:30 PM	**Lisa Kelly[1], Lee Phillips[1] and Stephen A. Macko[2]** [1]UNC Pembroke and [2]University of Virginia	**Preliminary Assessment of the Dietary Habits of Red Imported Fire Ants (*Solenopsis invicta*) in Southeastern North Carolina Using Stable Isotopes**
3:45 PM	**Gideon Wasserberg, Laura White, Allison Bullard, Jon King, Savannah Jackson, Roberta Maxwell** University of North Carolina at Greensboro	**The Effect of Predation Risk and Food Abundance on Egg-Laying Behavior of the Mosquito *Aedes albopictus***
4:00 PM	**David A. Beamer** Nash Community College	**A Phylogeographic Profile of the Three-Lined Salamander, *Eurycea guttolineata***

Math, Physics, and Environmental Science--KOBC 310

3:30 PM	**Chad Awtrey** Elon University	**Computing Galois groups of p-adic fields**
3:45 PM	**James M. Harrington and Owen W. Duckworth** North Carolina State University	**Siderophore-Mediated Environmental Trace Metal Cycling: Roles in Iron and Manganese Biogeochemistry**
4:00 PM	**Charles Lytle and Brenda Lytle** North Carolina State University	**Causes and Consequences of the 1986 Chernobyl Nuclear Disaster**

Business Meetings
(4:30-5:30 PM)

NCAS (KOBC 101)
CANCAS (KOBC 346)

Banquet and Awards Ceremony
McKinnon Hall, Moseley Center
(6:00-8:00 PM)

A Comparison of Lifestyle and Patient Inertia Factors Among Emergency Department Patients and Church Community Members

Ashley Moore*, JaNae Joyner, David Mount, Carlos Ferrario, David Cline, Biomedical Research Infrastructure Center, Winston Salem State

Blood pressure (BP) control may be impeded by patient inertia (PtInert), defined as the temporary disabling and absence of motivation to actively engage in self-protective behaviors that would reduce, delay, and/or eliminate problematic self-management behaviors. Previously, we documented internalized hopelessness towards BP control as a key PtInert factor in 61% of Forsyth County, NC Emergency Department (ED) patients. The PtInert survey examines resources, socioeconomic factors, psychological distress and awareness among participants. The survey results were inputted into the SPSS system and then calculated using chi squared and the Fisher's Exact Test to determine significance. The current study evaluated the PtInert paradigm within the Forsyth County community and compared the community to the ED population using a PtInert survey administered via facilitated interview. As a result of the PtInert survey comparing the Forsyth County churches to the Wake Forest University ED patients we saw a significant difference in hopelessness between the two groups. The data demonstrates that ED patients possess different lifestyle and PtInert factors including exercise and eating habits and hopelessness related to BP control as compared to Forsyth County community church members. It suggests that the differences in social network and survey location among community members can play a role in lifestyle choices and thoughts related to chronic disease. We conclude that people in the church have a greater sense of community and inclusion in society resulting in better lifestyle choices and less hopelessness related to hypertension in contrast to the ED patients.

A comparison of the efficacy of the earthworm Eisenia fetida and a locally collected earthworm Lumbricus rebellus on the rate of decomposition of leaf litter.

Mallory M. Lowder*, School of Natural Sciences, Lenoir-Rhyne University

The process of vermicomposting relies on earthworms and microorganisms to help stabilize organic materials and convert them into useful amendments as a source for plant nutrients. The aim of this study was to determine the leaf litter decomposition rates by the earthworm, Eisenia fetida and a locally collected species, Lumbricus rebellus. Additionally, this study sought to study the effect of earthworm activity and leaf litter decomposition rates within a range of temperatures normally found in compost piles. Using incubators and PVC pipe microcosms, it was determined that at an extreme temperature of 48°C, there was a significantly greater loss of both soil and leaf litter mass in compost compared to standard potting soil. Although local earthworm survival was low at 48°C, L. rebellus had a higher survival and leaf litter decomposition rate in the compost soil than E. fetida. In the 48°C temperature setting, compost soil contributed to greater rates of leaf litter decomposition and increased survival of L. rebellus. However, high moisture levels may have contributed to the differences in leaf litter mass, although it was attempted to keep moisture levels constant. Analyses of data from the 13°C and 28°C ranges are still in progress. Investigating soil temperature as a parameter of earthworm survivability and litter decomposition rates will allow for enhanced knowledge on the introduction of earthworm species during vermicomposting.

A Nutritional Comparison of Chia Seeds Salvia hispanica and Acorns of Northern Red Oak Quercus rubra: The Future of Functional Foods

Madison O. Holloway*, 1 Fuxia Jin, 2 Wei Jia,2 Guoxiang Xie and 2 Yunping Qiu, School of Natural Sciences, Lenoir-Rhyne University, 1

Functional foods are foods that not only satisfy human nutritional needs, but which may also provide health benefits. Seeds of dark chia (Salvia hispanica) have been used routinely as functional foods because of their high concentration of phenolics, amino acids, and fatty acids. As part of a larger study assessing the health benefits of light and dark variety chia seeds, fruits of Northern red oak (Quercus rubra) were analyzed for their potential to become a functional food. Light and dark chia seeds and acorns were analyzed using standard procedures. We determined levels of specific phenolics, total phenolics, specific amino acids and specific fatty acids as well as antioxidant capacity (FRAP). Amino acid levels were highest in white chia, while antioxidant capacity and total phenolics were highest in acorn cotyledons. Neither red oak cotyledons nor whole acorns seem to be a good source of fatty acids. While acorns of northern red oak show promise as a functional food, research needs to be conducted to detect possible side effects from acorn consumption as well as to support the health benefit claims.

A phylogeographic profile of the salamander genus, Pseudotriton.

Alec Lockhart Presenter*, Evan Kelly, John Kennedy and David A. Beamer, Nash Community College

In contrast to most eastern plethodontid salamander genera, the phylogeography of the red and mud salamanders (Pseudotriton) is largely unexplored. To date, only two species are described though several races have historically been recognized. In order to reconstruct the evolutionary history and evaluate whether any of the formerly recognized races warrant species status we have sampled populations spanning the entire distribution of the genus. For each population we we have amplified, purified, and sequenced 1500 base pairs of the mitochondrial genome. We have produced a phylogenetic reconstruction using Bayesian Inference, with separate partitions for each codon position.

A phylogeographic profile of the three-lined salamander, Eurycea guttolineata

David A. Beamer, Department of Mathematics & Sciences, Nash Community College

The three-lined salamander, Eurycea guttolineata is a wide-ranging lungless salamander in the southeastern United States. Considerable data has been collected on the phylogeographic structure of southeastern salamander species but to date there has not been any such data collected for this species. We have sampled over 50 populations spanning the entire distribution of the three-lined salamander. In order to reconstruct the evolutionary history of these salamanders we have amplified, purified, and sequenced 900 base pairs of the mitochondrial gene Cty-b. We have produced a phylogenetic reconstruction using Bayesian Inference, with separate partitions for each codon position. Our results offer a stark contrast to similar surveys with other salamander species, instead of the pattern of strong geographic partitioning uncovered for nearly every other wide-ranging lungless salamander species, three-lined salamanders are characterized by extreme genetic homogeneity.

A Proposed Role for Carbonic Anhydrase in Fatty Acid Biosynthesis by Bacillus mycoides

Kayla D. Britton* and Joe Wolf, Department of Biology, Peace College

We are interested in environmental influences on bacterial colony morphology. We have observed that the surface area occupied by colonies of Bacillus mycoides 6462, the type strain of a common soil bacterium, increases with elevated atmospheric carbon dioxide concentration. Carbonic anhydrase is the central enzyme involved in cellular carbon dioxide metabolism by many organisms. We have discovered that addition of carbonic anhydrase enzyme inhibitor to B. mycoides culture medium causes a dramatic decrease in colony size, supporting a role for this enzyme in cell growth and colony formation. Southern blotting of genomic DNA from B. mycoides with a Bacillus cereus probe for the carbonic anhydrase gene suggests its presence. The goal of this work was twofold. The first was to use Western blotting to confirm the presence of the enzyme in B. mycoides. A peptide from the B. cereus protein sequence was selected to raise IgY antibodies in chickens. The resulting affinity-purified antiserum was used to probe western blots of whole cell lysates prepared from B. mycoides 6462. The results show reactivity by a protein species of about 21 kD, in good agreement with the predicted size based on the B. cereus gene sequence. The other purpose of this work was to begin identifying, by add-back experiments, essential metabolites synthesized downstream of carbonic anhydrase. Fatty acids were tested in emulsified form as Tweens. Addition of Tween 80, but not Tween 60, Tween 40, or Tween 20, rescued growth-inhibited cultures, implicating carbonic anhydrase as a pathway member in the biosynthesis of fatty acids.

A Survey of Salamander Populations and Their Habitat Feature Associations in Urban Piedmont North Carolina

Nick Forman*, Dr. Lynn Moseley, Department of Biology, Guilford College

Anthropogenic activities, from development to conservation, have been shown to have varying effects on salamander abundance and population density (Dorcas and Willson 2003, Orser and Shure 1972). I conducted a survey of salamander species in two urban locations to examine the species composition of salamander populations and the macro- and micro-habitat features associated with their presence. Preliminary data for this study suggests that species-specific distribution varies between the Two-Lined Salamander, *Eurycea cirrigera*, and the Northern Dusky Salamander, *Desmognathus fuscus fuscus*, according to forest community type. Additional data will be collected across transects investigating micro-habitat features, as well as macro-habitat characteristics such as proximity of transects to streams and land use history. Through an understanding of the distribution of salamander populations in relation to habitat features, conservation efforts can identify the vulnerability of species and the necessary habitat components for maintaining a population. The sites chosen for this study reflect a gradient of habitats including old-growth forest, heavily impacted sections of stream, and rehabilitated streams. Thus, from our results, the response of salamander populations to restoration efforts and other human impacts can be better understood.

ACL and Knee Injury Prevention Programs for Young Athletes: Do they Work?

John Jacobs* (1); Kevin Shea, MD (2); Nathan Grimm, MD(s) (3); Shawn Simonsen, EdD (4), (1)Guilford College; (2) Intermountain Ortho-

The purpose of this study was to determine the level of evidence (LOE) for clinical trials that evaluate training programs to reduce the risk of knee injury Searches for ACL/Knee injury prevention trials were conducted using 3 medical databases (MEDLINE, Cochrane, CINAHL) and the following study designs were accepted for evaluation using the LOE ranking algorithm published by the Journal of Bone and Joint Surgery: randomized prospective (Level I), non-randomized prospective (Level II), case-control (Level III). Fifteen studies were identified that met the research criteria. No Level I studies, 12 Level II studies, and 3 Level III studies were identified. Of the Level II and Level III studies, 7/12 and 2/3 demonstrated a significant reduction of knee and/or ACL injury, respectively. Exercise programs are being promoted to families and their athletes with specific claims about injury prevention. Although these exercise prevention programs may improve performance, when the levels of evidence of these clinical trials are analyzed, a consistent reduction in knee injury risk is not demonstrated at a high LOE. Some of these studies do show a reduction in risk, but these trials have design flaws, and in many cases, the reduction in injury risk is not statistically significant. Because the current lower quality evidence does suggest a beneficial treatment effect, these programs may still be recommended for injury prevention, especially in female athletes. Further research with higher quality clinical trials is necessary to confirm the effectiveness of knee and ACL injury prevention programs.

Acoustic cue discrimination by the sonar-jamming tiger moth Bertholdia trigona

Ryan D. Wagner*, Aaron J. Corcoran, William E. Conner , Department of Biology, Wake Forest University, Winston-Salem, NC

The tiger moth Bertholdia trigona is the only animal known to jam an attacking bat's sonar. They accomplish this by emitting sound just before the moment of capture creating confusion and causing the bats to miss or abort their attacks. A study was conducted to investigate what acoustic cues from attacking bats trigger the sonar-jamming moth Bertholdia trigona to initiate its ultrasonic clicking sound production. It was hypothesized that the moths would begin their clicking response at the optimal time in which to jam an attack call yet also distinguish between attack calls which posed a legitimate threat. To determine the acoustic parameters in a bat's attack call that prompted Bertholdia to initiate its response, moths were exposed to synthesized playbacks of various acoustic parameters in an isolated sound chamber. The ultrasonic calls of bats attacking tethered Bertholdia in the field were also recorded. The point in a bat's attack sequence that the moths responded to in the field was compared to the acoustic parameters that the moths responded to during the playbacks. Our results showed that the moth's clicking threshold was preferential to shorter pulse intervals and higher intensity calls in both the lab and field based experiments. Shorter pulse intervals correlated to attack calls which were honing in on the moth. Higher intensities represented bats which were closer to the moth or calls which were pointed more directly toward the moth. Together, these two acoustic factors told Bertholdia the optimal time to begin its jamming.

Analysis of Antioxidants in Wines, Teas and Spices

Jordan Rockensuess* and Joshua Ring, Department of Natural Science, Lenoir Rhyne University

Wines, teas and spices all contain substances called antioxidants, which essentially protect cells from oxidative damage. When molecules in the body become oxidized, they are converted into an unstable free radical that if not neutralized or replaced with a healthy new cell, can cause cell damage. Antioxidants will neutralize the free radical by donating an extra electron. Polyphenols are common antioxidants in the wines, teas and spices. The analysis of various red and white wines, teas, spices, and combinations of the three showed the highest level of antioxidant content and the most health beneficial substance to consume.1 In order to analyze the polyphenol content, a calibration curve was created with standards reported in the Gallic Acid Equivalent, GAE. GAE was chosen because the polyphenols in the samples will contain other phenols, and small quantities of gallic acid.2 This calibration curve was used to determine the levels of polyphenols in the samples, which was indicative of the antioxidant property. The data from sample subsets (e.g. origin of wine and year of production) were also compared to show a correlating relationship to antioxidant concentration.

Antidepressant impairs zebrafish motor development and behavior: ramifications of pharmaceutical drugs in the environment

Lauren W Stranahan, Department of Biology, Elon University

Antidepressants are one class of drug used for the treatment of human psychological conditions that work by altering brain chemistry. They are one of the most widely prescribed drugs and have been found contaminating surface water in the US and internationally. Fluoxetine (Prozac™) is one popular antidepressant that increases serotonin levels in the human brain and has been detected in rivers at concentrations in the ng/L range. Previous studies have found that high concentrations of fluoxetine permanently impaired the swimming activity of zebrafish exposed embryonically. In this research, zebrafish larvae were exposed acutely to concentrations similar to previous studies and chronically (over the course of several weeks) to several lower concentrations designed to better approximate environmental levels. Swimming activity was monitored by counting number of lines crossed in a testing arena and by using video tracking software (TopScan LITE) to detect any suppression in swimming activity through measurements of velocity and total distance traveled. Our data confirmed previous acute studies by demonstrating that larvae (6-14 days post fertilization) crossed significantly fewer lines in the testing arena than did controls. This investigation also revealed that despite an overall suppression in activity levels, larvae are still capable of eliciting a brief but robust escape response to an artificial predator. The two methods for assessing activity levels were additionally compared, with the software being far more sensitive to larval movement but with consequently higher levels of variation.

Antioxidants in Blueberry, Pomegranate, and Açaí Juices

T. Ventrella*,

The antioxidant properties of four brands (Bom Dia, Bossa Nova, POM Wonderful, and Sambazon) of pomegranate, açai, and blueberry juice combinations were measured using a free-radical scavenging assay of 2,2-diphenyl-1-picryhydrazyl (DPPH). Antioxidant capacity was expressed as vitamin C equivalent antioxidant capacity (VCEAC). The VCEAC of all POM Wonderful juices (5 95 mg vitamin C equivalent/ mL of juice ± 0.116 (mean ± SEM)) were found to be significantly greater than the other brands tested (Bom Dia, 2.26 mg/mL ± 0.116; Bossa Nova, 2.40 mg/mL ± 0.116; Sambazon 1.93 mg/mL ± 0.130). A comparison of juices by berry type, regardless of brand, showed that plain pomegranate (5.86 mg/mL ± 0.197) and pomegranate-blueberry (6.01 mg/mL ± 0.161) juice had significantly higher VCEACs than other juice formulations. However, because the VCEAC of açai-pomegranate juice was not significantly higher than açai alone, the presence of pomegranate itself is likely not responsible for the high VCEAC values of plain pomegranate and pomegranate-blueberry juices. The average VCEAC of all juices tested immediately after opening and one week after opening showed no significant difference. All of the juice brands and formulations, regardless of age, have higher levels of antioxidants than orange juice. For a meaningful comparison of the effects of mixing and storage time on antioxidants in fruit juices, a greater number of juices, mixtures, and samples are required. However, for those looking to supplement their diets with antioxidants, of the brands tested, POM Wonderful may be the most efficacious.

Assessing the role of nhr-14 and nhr-69 as possible estrogen-like target receptors for the Estrogenic Endocrine Disrupting Chemical (EEDC) Enterodiol in the soil nematode, Caenorhabditis elegans

Amanda M. Haungs* and Michele Malotky, Department of Biology, Guilford College

Endocrine Disrupting Chemicals (EDCs) are harmful compounds that interfere with endocrine signaling pathways. In this study, Caenorhabditis elegans, a free-living soil nematode, will be used to determine the target ligand of the estrogenic EDC, enterodiol. Enterodiol is classified as a phytoestrogen because it is able to imitate some of the effects of estrogens. This type of ligand can be found in a variety of foods such as whole grains, fruits, and vegetables. Previous studies have reported that these chemicals can cause irregularities in reproduction and physiological changes in both invertebrates and vertebrates, but the effects of enterodiol have yet to be studied. We are currently using multigenerational assays to observe the physiological effects of enterodiol in C. elegans. In addition, we have created a plasmid containing a small sequence of the gene encoding for two nuclear receptors, nhr-14 and nhr-69. Both receptors have a similar sequence to estrogen receptors in humans. We will transform Escherichia coli with the plasmid construct to create a feeding strain of bacteria to be used to induce RNA interference (RNAi) in the worms. RNAi is a process of gene-silencing in which double-stranded RNA is used to silence the expression of a particular gene. We will use RNAi to shut off the gene for a putative estrogen receptor to determine its role in signaling by enterodiol.

Atmospheric pollution and tree core chemistry in Great Smoky Mountains National Park

John W Furniss*, Dr. David Vandermast, Department of Biology, Elon University

Atmospheric pollution from industrial activities and automobile exhausts deposit high levels of nitrogen in the high-elevation forests of Great Smoky Mountains National Park (GRSM). Although nitrogen is a nutrient for plant growth, it also acidifies soil and the effects of this acidification can cause forest decline. At pH values < 4.5, soil metals such as aluminum become mobile and can poison plant roots and clog vascular tissue. However, data indicate that high-elevation beech (Fagus grandifolia) forests in GRSM have been growing at an anomolously high rate since the mid-1970s. Our research attempts to link the high rates of nitrogen deposition to the anomalous growth through means of dendrochronological and dendrochemical analysis. We collected > 30 cores from high-elevation beech trees (and a few co-occuring species) in three plots in GRSM. In the lab, we measured the cores in 5-yerar increments to examine growth rates over the lifetime of the trees. This analysis indicates that the trees in this analysis grew significantly faster from the period 1950-80 than they have in the past 30 years ($p < 0.05$). Currently we are using Flame Atomic Absorption Spectroscopy (FAA) on 5-year segments of each core to analyze changes in their aluminum, calcium, magnesium and lead concentrations. Results of this analysis will be combined with the tree growth analysis to look for correlations between the two. The results of this second part of our research will be presented.

Atypical performance on the Stroop color-word task among college undergraduates: Implications for reading proficiency and academic outcomes.

Alan Goble and Sara C. Wrenn, Department of Psychology, Bennett College

Decades of research indicate that robust Stroop interference effects are ubiquitous among literate populations, while reduced or lacking interference effects are associated with effortful reading and poor comprehension (MacLeod 1991). The present study attempts to verify the existence of atypical Stroop performance among college students, and to explore the relationship between Stroop color-word task performance and measures of reading proficiency and academic outcomes. Undergraduate students taking entry-level psychology courses completed the Stroop color-word task and gave consent for the researchers to access their scores on the ACCUPLACER English test and their GPAs. Preliminary group-level analyses showed no significant Stroop interference effect; $t(20) = 1.51$, $p = 15$; 50% of participants failed to display typical interference in response to incongruent color-word stimuli. Additional analyses will examine the relationship between Stroop performance, ACCUPLACER scores, and GPA. Results will be discussed in light of the implications and limitations of the present study.

BALANCING MAGNETIC AND ELASTIC PROPERTIES OF BIOMIMETIC CILIA

Willem Prins,

Microactuators are microscale devices which can be manipulated to produce motion at the microscale. We have a novel magnetic-nanoparticle / polymer composite, which is an ideal material for the production of monolithic microactuators, such as biomimetic cilia. The iron content allows magnetic control while the polymer lends flexibility; however, the very iron which makes the material magnetically controllable also makes it less flexible.

My research is to optimize the material for maximum bendability by varying the iron concentration. To accomplish this, I built a device which uses a micrometer to compress our samples against a force probe, which in return allows us to determine the Youngs Modulus, a measure of the flexibility of the material. Combining these measurements with measurements of the magnetization of the material we can calculate the magnetoelastic ratio, which quantifies how well the polymer composite will bend in a magnetic field. We show that our predictions of this magneto-elastic ratio correlate well with the ratios measured in microactuator bending experiments previously completed in the lab.

Biogeographic patterns of host specificity in Thai Varroa jacobsoni

Ryan D. Kuster*, Deborah Smith, and Olav Rueppell, Biology, University of North Carolina-Greensboro, Greensboro, NC, Ecology & Evolu-

The association between the Varroa mite and its honey bee host, Apis, has been studied for decades. In recent years the role of Varroa destructor in relation to the agriculturally important Apis mellifera has received increasing consideration for its potential to elevate disease transmission and affect hive health. V. destructor is an introduced species originating in Southeast Asia where its sister species Varroa jacobsoni parasitizes the Asian honey bee, Apis cerana, with relatively little harm to colony health. This relationship is of particular interest in Thailand because it is home to a range of genetically distinct mtDNA lineages of V. jacobsoni. These subpopulations sharply coincide geographically with subpopulations of A. cerana. Here we investigated whether the sharp boundaries of mite distribution are based on natural barriers to Varroa reproduction. We manually introduced mites to non-native host colonies of A. cerana from three geographically distinct mainland and peninsular regions of Thailand. Upon completion of the normal mite reproductive cycle all capped drone cells were opened and the adult mites as well as any present juveniles were collected from the colonies. Mite mtDNA lineage was determined using diagnostic restriction enzyme digests. Evidence of non-native mite juveniles was found which suggests that there is not an immediate, direct barrier to reproduction. However, we cannot exclude quantitative or long-term resistance effects, such as offspring sterility, and climatic selection on the adult dispersal stage as explanatory causes. Further investigation into this particular host's specificity may provide a richer understanding of Varroa and Apis interaction.

Bioluminescence and Pheromone use in Mate Selection of the Blue Ghost Firefly Phausis reticulata

Karen Love* and Jennifer Frick-Ruppert, Division of Science and Math, Brevard College

While bioluminescence is considered the primary form of communication in most species of fireflies, some diurnal species use pheromones instead. It was hypothesized that nocturnal Phausis reticulata use pheromones as well as bioluminescence in mate selection based on observations of their habitat and behavior. This hypothesis was tested using various trials; attracting males with just the glow of a female, just the pheromones of the female or using both glow and pheromones of the female. More males were consistently attracted to the glow than anything else, though the glow and pheromones attracted the second highest number of males overall. This suggests that P. reticulata uses both glow and pheromones in the process of mate selection.

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Bird Behaviors and Food Preference as Seasons Change

Brittany Nichols* and Erica Kosal, Department of Biology, NC Wesleyan College

Feeding behaviors and food preference of common feeder birds in Rocky Mount, NC were studied from September 28, 2010 to February 4, 2011. In order to observe trends and differences between "warm" (before November 20) and "cold" (after November 20) periods, behaviors were observed and quanitified. Six observation blocks were recorded for each period and studied, consisting of 21 hours of total obsrevation time. Time spent at the feeder, the nubmer of pecks at each feeder, and any behaviors associated with the feeding were determined. It was predicted that during the "cold" period, birds would feed more often and would prefer higher calorie feed than in the "warm" period. Resuls of feeding efficiency, food preference, and dominant behaviors will be discussed.

Calcium (Ca2+) and Chloride (Cl-) Dependence of Photosystem II after Ca2+ Depletion

Shilpa Reddy and Alice Haddy, UNC Greensboro, Department of Chemistry and Biochemistry, UNC Greensboro

Photosystem II (PS II), the membrane bound protein complex involved in the light phase of the photosynthesis, is the major contributor for environmental oxygen. This has provided a wide scope for research in oxygen evolution studies. The site of oxygen formation is a Mn-Ca cluster involving 4 Mn ions and one Ca ion to form a catalytically active di-μ-oxo-bridged cluster. Calcium and chloride, as cofactors, have been known to play very important roles in oxygen evolution. Experiments were conducted to understand the nature of calcium activation in the oxygen evolution and also its dependence on chloride concentration. The PSII preparations used were depleted of 23 and 17 kDa extrinsic polypeptides, which regulate access of Ca2+ and Cl- to the active site, using NaCl wash procedures. Calcium depletion procedures were conducted with the help of EDTA and 15 minute light exposure. This treatment was needed to remove Ca2+ from the O2 evolving complex completely and the activity of this material was lower when compared to untreated control samples. There was a gradual decrease of activity with decreasing calcium concentration and also decreasing chloride concentration. This allowed quantification of the interdependence of calcium and chloride cofactors. Analysis of the data using a bisubstrate model of enzyme kinetics provided the Michaelis-Menten constants Km and binding constants Ks for calcium and chloride activation. (Supported by a grant from the NSF)

Can Caenorhabditis elegans acquire antibiotic resistance by ingestion of resistant Escherichia coli?

Zachary Harrison Wood, Melanie Lee-Brown, Michele Malotky, Guilford College Department of Biology

It has been claimed that resistance to puromycin can be transferred to the nematode Caenorhabditis elegans by ingestion of the filamentous bacterium Streptomyces alboniger bearing the gene for puromycin resistance; puromycin N-acetyl-transferase. We are testing whether puromycin resistance is transferable to C. elegans by ingestion of Escherichia coli HT115 containing the puromycin resistance plasmids pBCH21-R4R3 and pBCH22-R4R3. Puromycin-resistant and susceptible HT115 will be fed to C. elegans , and subsequent survival of the nematodes on plates containing 0.25 mg/ml puromycin will be monitored. Preliminary data suggests that ingestion of puromycin-resistant HT115 has no affect on C. elegans resistance to puromycin. If confirmed, this suggests that the ability of puromycin-resistant Streptomyces to transfer this resistance to nematodes might require further substantiation.

Cardiovascular and Molecular Toxicity in Danio rerio, Zebrafish and Oryzias latipes, Medaka

KATHERINE HLAVINKA AND LINDA NIEDZIELA,

PBDE-47 (2,2',4,4'-tetrabromodiphenyl ether) is a flame retardant compound found in plastic products. Recent studies have found traces of this additive in fish species, marine mammals, and human tissues. There is concern that the compound may cause adverse effects, such as cardiovascular toxicity. Previously in this lab, cardiotoxicity was assessed by measuring heart rate and evaluating morphological abnormalities in developing zebrafish embryos. A statistically significant increase in cardiac arrhythmias of 2:1 was observed following PBDE-47 exposure. Since cardiotoxicity occurred at the zebrafish embryonic stage, our lab was also interested to see if adults experienced similar consequences. To determine if cardiac arrhythmias were occurring in adult fish, a transparent breed of Medaka, ST II Oryzias latipes was exposed to a high concentration of PBDE-47: 5000 ug/L for 48 hours. Cardiac arrhythmias were not observed in adult Medaka, but there was a slight nonstatistical change in this ratio. Additionally, an attempt was made to understand the molecular reason for the embryonic arrhythmia. A known biomarker for myocardial injury, cardiac troponin T (tnnt2), is a calcium sensitive molecular switch for the regulation of striated muscle contraction and has been linked to some arrhythmias. Adult zebrafish were exposed to PDBE-47 and expression rates of tnnt2 were measured using qRT-PCR. However, the expression of tnnt2 did not significantly change with PBDE-47 exposure levels and therefore does not appear related to the arrhythmias induced. Further research will be needed to determine the mechanism of PDBE-47 action.

Causes and consrquences of the 1986 Chernobyl nuclear disaster

Charles Lytle and Brenda Lytle, Department of Biology

The Chernobyl nuclear explosion in Ukraine was the world's largest nuclear accident in history, releasing more than 400X the radioactivity into the world's atmosphere than was released at Hiroshima in 1945. More than 100,000 residents were evacuated from the area by government order and an area 43,000 km2 was later designated as an uninhabited radioactive area for an indefinite period. The Chernobyl facility was designed to be the world's largest nuclear generating site with six adjacent nuclear generators capable of generating some 6000 MWe at full capacity. The explosion occurred in 1986 at the recently completed Unit 4 that was in the final stages of testing. This is the most extensively studied nuclear accident in history with detailed investigations by numerous international organizations in addition to those of the Russian and Ukrainian authorities. Principal factors contributing to the accident include inferior reactor design, inadequate operator training, inadequate emergency precautions, failure to following proper procedures, failure to quickly recognize the magnitude of the problem and to evacuate inhabitants of surrounding area. Although the short-term death and injury toll was remarkably low, the long-range consequences are substantial, including an estimated 4,000 cancer deaths over time. Environmental impacts include significant strontium 90 contamination in the arctic tundra, local concentrations of several radionuclides, later permanent resettlement of some 336,000 people, and creating the large radioactive nuclear exclusion zone. This report is based in part on a recent site visit and interviews with Ukrainian officials and local residents.

Changes in Soil Organic Matter and Soil Respiration with Silviculture Treatment.

Jesse M. Rickard* and David S. Ellum, Warren Wilson College and Department of Environmental Studies, Warren Wilson College.

Forest soils are an important carbon pool that could be managed as a component of carbon sequestration programs. A better understanding of how current silviculture practices affect forest soil carbon fluxes could allow for better management of this resource to mitigate climate change. The objective of this study was to determine what effect three silviculture treatments (Crop-tree, pine 3rd row thinning, and coppice cut) would have on soil respiration and % organic matter (% O.M.). Light, soil temperature, soil moisture, and relative humidity were measured to quantify different conditions in each of three treatments and three controls. Soil samples were collected from each site in May and September and loss-on-ignition analysis used to compare change in % O.M. over one growing season. Soil respiration measurements were collected from each treatment and each control at 06:00 and 12:00 to find mean CO2 respiration. Environmental data confirmed that greater removal of overstory resulted in the greater light and temperature change. There was no significant change in % O.M. over one growing season. There was no significant difference in respiration between the treatment and control in the crop-tree, or in the pine 3rd row thinning at 06:00. The noon measurement in the pine 3rd row thinning and both the morning and noon coppice measurements showed a significant difference in respiration. This suggests that loss of CO2 from the soil associated with greater overstory removal in a stand should be a factor in deciding silviculture practices for carbon sequestration.

Characterizing the contribution of NFkappaB and involvement of the MAPK signaling pathway to transcription from Wnt5a alternative promoters A and B

Nicole Joyner-Powell* and Karen S. Katula, Department of Biology, University of North Carolina at Greensboro

Wnt5a is an extracellular glycoprotein that activates several Wnt signaling pathways important in cancer. Significantly, Wnt5a expression is altered in numerous cancers. Little is known about Wnt5a gene regulation but current data indicate that misregulation of Wnt5a expression involves non genetic changes. Our goal is to characterize transcriptional regulation from the two alternate Wnt5a promoters, A and B, and determine the contribution of the transcription factor NFkappaB and the MAPK signaling pathway Stable lines of NIH3T3 cells with Wnt5a promoters A and B were treated for 6 and 24 hours with TNFalpha, a known inducer of NFkappaB activity, and inhibitors of the MAPK components (Ras and ERK). The cells were collected and assayed for firefly luciferase activity (relative light units) and standardized to DNA content. TNFalpha slightly increases promoters A and B activity at 6 hrs. TNFalpha had no effect on promoter A at 24 hours, whereas promoter B activity increases by approximately 2.8 fold. ERK inhibitor has no effect on promoters A and B at 6 hours but activity of both promoters increased at 24 hours. Ras inhibitor has inconsistent effects on promoter A, whereas promoter B activity decreases at both time points. These data indicate that Wnt5a promoters A and B are differentially regulated and that NFkappaB has a greater regulative role in promoter B activity, whereas ERK influences the activity of both promoters.

Composition and structure of mature second growth riparian forests along the Haw River in central North Carolina

Lora L. Sigmon, Dr. David Vandermast, Department of Biology, Elon University

The Haw River drains a watershed encompassing important central North Carolina cities within its > 1500 mi2. The river is historically important as a source of hydropower for numerous textile mills and demand for raw materials in the region means that virtually all of its riparian forests were harvested at some point in the past. There is much interest in maintaining a healthy riparian buffer along the river that can be used for recreational purposes and to enhance the quality of water that flows from the Haw into Everett B. Jordan reservoir. The purpose of our study was to document the composition and structure of Haw River riparian forests with special interest in invasive species in this highly modified landscape. We established 45 vegetation survey plots in areas containing mature forest. We found 49 woody species (including important shrubs and vines > 2.5 cm DBH) of which 4 were invasive: Chinese privet (Ligustrum sinense), Tree-of-heaven (Ailanthus altissima), Russian olive (Elaeagnus umbellata), and Japanese honeysuckle (Lonicera japonica). Five species represented over 53% of all woody stems: boxelder (Acer negundo), sweetgum (Liquidambar styraciflua), green ash (Fraxinus pensylvanicum), southern sugar maple (Acer barbatum), and yellow-poplar (Liriodendron tulipifera). Despite representing 8% of all species found in Haw River riparian forests, invasive species represented only 0.75% of all woody stems by abundance. Our results suggest that, in the stratum of woody plants > 2.5 cm DBH, Haw River riparian forests have been resistant to invasion. Possible reasons for this will be presented.

Computing Galois groups of p-adic fields

Chad Awtrey, Department of Mathematics and Statistics, Elon University

The p-adic numbers were first introduced over 100 years ago by the mathematician K. Hensel. While they have become a popular tool in many areas of physics (e.g. quantum field theory, string theory, etc.), the p-adic numbers remain a vibrant research area for mathematicians. Of particular interest to number theorists are the arithmetic properties of the p-adic numbers, which are reflected in the Galois groups of p-adic fields. In this talk, we discuss a new method for computing these Galois groups.

Detecting and Modeling Natural Selection in Drosophila ananassae

Matt Jester Presenter, Zach Huntington-Meath Presenter, R. Duetsch, M. Schug, Dept. of Mathematics & Statistics, Dept. of Biology

Evolutionary biologists are interested in detecting genes that are targets of natural selection in the genome of organisms in natural populations. Many factors affect the ability to detect natural selection including, genetic drift, migration, mutation, and recombination. We are currently developing a mathematical model using a coalescent approach to identify genes that have been targets of natural selection. The coalescence model predicts the time at which two or more loci have a common ancestor This model will give us a genealogy of a certain number of alleles at each locus that we will use to generate a neutral genealogy. We will compare data from natural populations with our neutral model to test the hypothesis that natural selection has affected a specific region of the genome. To test the strength of the model and determine that appropriate parameter values for genetic drift, natural selection, migration, and mutation, we will use a molecular markers called microsatellites distributed across the genomic region around the furrowed gene in D. ananassae which was previously shown to be a target of natural selection. We will present the genome markers and parameters of the model.

Detection of a Low Molecular Weight Bacteriocin from Bacillus cereus by its Activity on Tricine Peptide Gels

Lawrie N. Cashwell* and Joe Wolf, Department of Biology, Peace College

Bacillus cereus GS1, a soil isolate from our lab, secretes a diffusible molecule that inhibits the growth of Bacillus subtilis 6633 and select other species of bacteria. The inhibitor can be detected in culture medium by a spot-on-a-lawn plate method. It has been shown to be secreted during the late growth/early stationary phase of broth cultures when grown in media that permit high cell densities to be achieved. Recent experiments suggest that the molecule is durable – resistant to degradation by a number of proteases and denaturation by solvents and high temperature – and is distinct from similarly described molecules produced by other strains of Bacillus cereus. From what is known about the organism's habitat and the behavior of the inhibitor, we hypothesize that the inhibitor molecule is a bacteriocin and, as such, is a small protein. To test our hypothesis we subjected the inhibitor, in impure form as culture filtrate, to electrophoresis on gradient tricine peptide gels followed by staining with Coomassie blue and overlay with agar containing Bacillus subtilis 6633. Analysis of the stained portion of the gel reveals a band of approximately 4 kiloDaltons that co-localizes with agar clearing on the overlay. Furthermore, similar analysis of a variant strain of B. cereus GS1 that does not produce clearing by the spot-on-a-lawn plate method shows that the variant also does not produce the low molecular weight protein. Together, these results support our hypothesis that the inhibitory molecule is a small secreted protein.

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Lawrie N. Cashwell* and Joe Wolf, Department of Biology, Peace College

Bacillus cereus GS1, a soil isolate from our lab, secretes a diffusible molecule that inhibits the growth of Bacillus subtilis 6633 and select other species of bacteria. The inhibitor can be detected in culture medium by a spot-on-a-lawn plate method. It has been shown to be secreted during the late growth/early stationary phase of broth cultures when grown in media that permit high cell densities to be achieved. Recent experiments suggest that the molecule is durable – resistant to degradation by a number of proteases and denaturation by solvents and high temperature – and is distinct from similarly described molecules produced by other strains of Bacillus cereus. From what is known about the organism's habitat and the behavior of the inhibitor, we hypothesize that the inhibitor molecule is a bacteriocin and, as such, is a small protein. To test our hypothesis we subjected the inhibitor, in impure form as culture filtrate, to electrophoresis on gradient tricine peptide gels followed by staining with Coomassie blue and overlay with agar containing Bacillus subtilis 6633. Analysis of the stained portion of the gel reveals a band of approximately 4 kiloDaltons that co-localizes with agar clearing on the overlay. Furthermore, similar analysis of a variant strain of B. cereus GS1 that does not produce clearing by the spot-on-a-lawn plate method shows that the variant also does not produce the low molecular weight protein. Together, these results support our hypothesis that the inhibitory molecule is a small secreted protein.

Deuterium Isotope Effect on the Rate of Reduction by Yeast Alcohol Dehydrogenase

Rebecca K. Smith* and Joshua Ring, Department of Natural Sciences, Lenoir-Rhyne University

Methanol is an alcohol commonly found in automobile windshield washer solvent, gas line antifreeze, copy machine fluid and many household-cleaning supplies. While methanol itself is only mildly intoxicating, it is converted to formaldehyde by alcohol dehydrogenase, and is highly toxic. In the early nineteen-thirties the existence of deuterium was confirmed and shortly after this, the study of deuterium became prevalent in a number of problems, including rates of reaction mechanisms. In the current research project, the determination of the reaction mechanism rates of yeast alcohol dehydrogenase with the substrates methanol, deuterated methanol, ethanol and deuterated ethanol were done in order to determine the difference in the rates of normal and deuterated alcohols based on the deuterium isotope effect. It was predicted that deuterated alcohols would have a slower reaction rate. In order to obtain the initial rate of the reaction, the absorbance at 340 nm (resulting from reduction of NAD+) was measured. The kinetic data was obtained and analyzed for the reaction between the enzyme and multiple concentrations of the alcohol substrates. In support of the hypothesis, deuterated alcohols were shown to have slower catabolic rates than corresponding non-deuterated alcohols, which indicate lower toxicity.

Development of a model of Methotrexate induced hepatic and gastrointestinal fibrosis in the developing zebrafish embryo.

Mariana V. Gattegno*, K. Eloshway, and M. Cariveau, Department of Science and Mathematics, Mount Olive College

Methotrexate (MTX) is an antimetabolite commonly used for treating malignant neoplasms, arthritic and autoimmune diseases. MTX binds to and inhibits dihydrofolate reductase, blocking purine nucleotide and thymidylate synthesis, thus inhibiting DNA and RNA synthesis. It has been concluded that prolonged usage of MTX has numerous adverse effects on various tissue systems, including the liver and gastrointestine culminating in the development of fibrotic lesions and cirrhosis in affected organs. However, the molecular mechanisms of these events have not been elucidated. Therefore, we set out to develop a zebrafish embryo model of gastrointestinal and hepatic fibrosis in response to MTX. Zerbafish were bred, embryos collected and staged, and then exposed to increasing doses of MTX from 1mM to 12 mM for 8 hours. Following treatment, emrbyos were photographed and morphological changes recorded at 24 hour intervals up to 144 hours. The embryos were then sacrificed using an overdose of Finquel and prepared for histological examination. In all treatment groups, we noticed an increase in morphological anomalies with respect to increasing doses of MTX. These malformations included yolk sac edema, pericardial edema, restriction of blood flow and inhibition of pigment production. We established an LD50 value of 10mM from the survival of embryos over a dose range of 0-12mM in a separate series of experiments. These data suggest a dose dependent response of embryos to MTX and histological analyses are ongoing to determine the extent of fibrosis in the liver and gastrointestine of embryo's treated with MTX.

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Deviations from safe drinking water standards in an urban environment

Dr. Ethel J. Gordon1, Helen Black2, Andrea Gentry3, Nicole Hanner2, and Desiree Rand2, Department of Biology1, School of Nursing2, and

This study is the consequence of preliminary investigations to determine whether local water from a variety of sources meets the standards for potable (safe) drinking water. The study grew out of a component of the course content for a Basic Microbiology course at North Carolina Agricultural and Technical State University. Based on the preliminary study, it was determined that a more rigorous examination was needed to confirm the initial findings. This study investigates the potability of water taken from fourteen different sources. It resulted from a preliminary finding that some drinking sources were below standards, while some unconventional sources were above standards. Safe drinking water should have no coliform organisms in 100 ml of water. These organisms are associated with the gut, and should not be found in drinking water.

Differential activity of the Wnt5a alternative promoters A and B during adipogenesis.

Chia-Chi Hsu* and Karen S. Katula, Department of Biology, The University of North Carolina at Greensboro

Obesity and type 2 diabetes are major health problems today. Studies have shown the critical role of adipocytes in the pathogenesis of insulin resistance that leads to obesity and diabetes. Hence, it is important to increase the understanding of adipocyte formation. Wnt5a is shown to be involved in adipocyte differentiation, but the regulation of Wnt5a transcription has not been thoroughly investigated. The Wnt5a gene contains two alternative promoters, promoter A and promoter B. In this study, the level of Wnt5a promoter A and promoter B specific transcript levels were measured during adipogenesis by qRT-PCR. RNA was isolated from 3T3-L1 cells, a model for adipogenesis, at exponential, confluent, confluent with MDI induction, and differentiated stages. RNA was converted to cDNA for qRT-PCR analysis. Primers specific to total Wnt5a, promoter A and promoter B specific transcripts, and control primers, GAPDH and ribosomal protein (RplpO), were used for amplification. PCR cycle numbers (CT) for the Wnt5a were standardized using GAPDH or ribosomal protein values. The ddCT values were calculated by comparing the exponential stage to each of the other developmental stages and fold-change determined. Results showed the relative levels of Wnt5a transcripts were increased after MDI induction and in mature adipocytes. Promoter A specific transcripts decreased after MDI induction but increased significantly in mature adipocytes. Promoter B specific transcripts decreased after MDI induction, and were not detected in mature adipocytes. These data indicated that promoter A and B are differentially regulated during adipogenesis.

Distinct Glycolytic and Lipid Oxidative Metabolic Programs of Effector and Regulatory T cells Regulated by Estrogen Related Receptor-alpha

Ryan D. Michalek, Valerie A. Gerriets, Sarah R. Jacobs, Nancie J. MacIver, Amanda N. Gould, Russell G. Jones, Vincent Giguere, Donald P.

Stimulated CD4+ T lymphocytes differentiate into effector (Teff) or regulatory (Treg) subsets with specific immunological roles. We show that Teff and Treg require distinct metabolic programs to support these functions. Th1, Th2, and Th17 cells expressed elevated surface levels of the glucose transporter Glut1 and were highly glycolytic. Treg cells, in contrast, expressed low levels of Glut1 and had high lipid oxidation rates. Consistent with glycolysis and lipid oxidation promoting Teff and Treg, respectively, Teff were selectively increased in Glut1 transgenic mice and reliant on glucose metabolism, while Treg expressed activated AMPK and were dependent on lipid oxidation. Importantly, AMPK stimulation was sufficient to decrease Glut1 and increase Treg generation in an asthma model. Furthermore, we identified a mechanistic role for the nuclear receptor Estrogen Related Receptor-alpha (ERRa) in promoting glucose metabolism necessary for Teff proliferation and function. Acute inhibition of ERRa prevented activated T cells from elevating glucose metabolism; blocking cell growth, proliferation, and Teff differentiation. In contrast, Tregs were selectively generated by lipid oxidation rather than glucose metabolism and were refractory to ERRa loss. In support of a distinct role in Teff differentiation, inhibition of ERRa reduced morbidity in a mouse model of experimental autoimmune encephalomyelitis. Together, these data demonstrate that CD4+ T cell subsets require distinct metabolic programs that can be manipulated by ERRa to regulate Treg and Teff development and provide a means to control inflammatory diseases.

Do Urban Names Bias Reviewers' Perceptions of Job Seekers?

Brittanie M. Morgan* and Michelle Linster, Department of Psychology, Bennett College

It is not uncommon to hear a person joke that if someone has a "ghetto" name then he or she will never obtain a "good" job. Although this may seem like a joke, it is known that some job applicants have been discriminated against because of their names. Like several past studies, the following study raised the question "Are people who have more traditional (European American) names more likely to be hired than those who have more ethnic/urban (African American) names?". Thirty undergraduate students were asked to rank four job applications then record who they would most likely hire and why. At the end of the study, it was determined that the applicant's name did not affect his or her chance of getting hired. The participants were more interested in whether or not he or she meet the requirements in the given job description.

Does anthropogenic disturbance affect the activity of the LaCrosse Virus (LACV) within the sylvatic system in western North Carolina?

Theophile Tamini, Laura White, Dr. Brian Byrd, Dr. Gideon Wasserberg, Department of Biology, UNC-Greensboro and Department of Envi-

In this study, we applied an ecological approach to evaluate if and how anthropogenic disturbance affects the activity of the La Crosse virus (LACV) within the sylvatic system. We used oviposition traps and a Nasci aspirator to compare egg-laying rate and number of resting adults between peridomestic and an adjacent forest patch habitats in Maggie Valley, NC. A total of 93158 eggs were collected with Ae. triseriatus being the most common (≈83.2%) followed by Ae. japonicus and Ae. albopictus (15.3% and 1.5%, respectively). Ae. triseriatusis appears more abundant in the forest habitat whereas Ae. japonicus appears more abundant in the peridomestic habitat. However, in two sites characterized by large numbers of artificial containers, this trend disappears for Ae. triseriatusis but is amplified for Ae. japonicus. A total of 1039 resting adults were collected. 516 were resting adult females with Ae. triseriatus being the most abundant (279) followed by Ae. japonicus and Ae. albopictus (194 and 43 respectively). Among the resting adult females collected, approximately 13.7% were gravid, 15.3% had a blood-meal. Moreover, the proportion of gravid and blood-fed Ae. triseriatus females appears higher in the forest habitat than in the peridomestic habitat.

Effect of Lead Acetate on Early Development of Danio rerio Embryos

Priyanka Patel*, Sarah Liggett, Victoria Ellis, Marcus Ford, and Karen Guzman, Department of Biological Science, Campbell University

Lead, a common environmental toxicant, is capable of affecting virtually every organ system. Much less, however, is known about the effect lead has on embryonic development. Our goal was to investigate the effect of lead acetate on the early embryonic development of zebra fish, Danio rerio. Eggs were exposed to 30, 200, 500 and 1500μg/L of lead acetate. Embryos were observed at 24, 48, 72, 96 and 120 hours for general features: melanin pigmentation, mortality, hatching, heartbeat. In addition, changes in melanocyte number and melanin content were evaluated. To count melanocytes, individual fish were fixed in 4% paraformaldehyde on day 5 and observed under a dissecting microscope. Melanocytes on the dorsal surface from the tip of the head to the posterior end of the yolk sac were counted. To evaluate melanin content, 30 fish were dissolved in 1mL of 1M sodium hydroxide and the absorbance at 414 nm was measured. Of the parameters assessed, the changes observed were increases in melanin pigmentation, melanocytes number, and melanin content. However, due to small sample size and a high variability of the data, the differences were not statistically significant. Procedures are being modified to improve the sampling and precision. The cause of the increase in melanocytes is unknown, but since melanocytes are derived from the Trunk neural crest cells, alterations in migration or differentiation of these cells may explain our observations. A better understanding of the alterations caused by lead exposure may help us to understand defects that occur during cell fate determination.

Effect of xenobiotics on Honeybee (Apis mellifera) adult Intestinal Stem Cell Proliferation

Cordelia Sackey-Mensah*, Department of Biology, University of North Carolina at Greensboro

Honeybee decline over the past decades is not just an environmental matter but also an economical problem because of the role of honeybees as honey producers and pollinators. One of many hypotheses proposed to explain honeybee decline suggests that exposure to xenobiotics, such as pesticides, might cause damage to bees by affecting physiological changes, which in turn affect bee health. While most honeybee toxicity studies focus on mortality or sub-lethal effects on the brain and cognitive functions, other target organs and physiological functions cannot be neglected. In particular, the gut is important because it functions as the first physical barrier after xenobiotics are ingestion by honeybees. Intestinal stem cells (ISCs) have been found to proliferate in the midgut of adult Apis mellifera and other insects to maintain the intestinal epithelium. My research investigated the proliferation rate of these adult honeybee ISCs after the bees were exposed to 12 relevant xenobiotics. The xenobiotics were selected because of their use in agriculture and or their prevalence in honeybee hives. I hypothesized that xenobiotics will affect ISC proliferation even if mortality is not significantly affected. This may either be observed as a decrease in proliferation due to direct poisoning of the ISCs, or an increase in ISC proliferation due to epithelial cell death requiring ISC proliferation and differentiation into replacement epithelial cells. I collected mortality data during a feeding period. Afterwards, honeybee midguts were harvested and assayed for xenobiotic proliferation effects. My talk will discuss the mortality effects and proliferation effects observed.

Effects of Caffeine on Zebrafish (Danio rerio) Development: Growth Rate, Heart Rate, and Motor Function

Brian Sullivan*, School of Natural Science, Lenoir-Rhyne University

Due to the high rate of consumption of caffeine, a psychoactive stimulant present in many beverages and foods consumed daily by much of Western society, the possible negataive effects of this chemical have been studied extensively Many of these studies have focused dosage dependent effects of caffeine as a possible teratogen in a range of experimental organisms from invertebrates to mammals. Discrepancies have been found in the extent of caffeine's effect or development, especially in human studies where subtle effects on development are easily overlooked. In this study zebrafish (Danio rerio) were used as a model organism to determine if there are time-dependent effects of caffeine on development. Embryos were immersed in caffeine at various stages of development, starting at 24 hours after fertilization. Growth rate, heart rate, and locomotor activity in response to tactile stimulus were evaluated.

Effects of Frequent Scouring Events on Macroinvertebrate Community Structure

Katrina L. Calder*, Department of Biology

Crabtree Creek (Wake County, NC) is subject to frequent rainfall-related scouring events throughout the year. These disturbances change the physicochemical properties of the creek and thus affect the structure of the aquatic macroinvertebrate community. In this study, we documented the variability in community composition and species diversity in response to erratic flow rates from heavy rainfall in order to determine patterns of community assembly, individual species population resilience and recolonization mechanisms. We began monitoring fluctuations in water levels at the USGS gauging station and then timed our sampling dates before, immediately after and between scouring events. During each of twelve dates, benthic macroinvertebrates were collected by standard methods for 3 man-hours from pool, riffle, run and undercut bank habitats. Furthermore, sampling nets were set several hours after dusk to capture the species that exhibit behavioral drift. All organisms were preserved in 70% isopropanol and identified to the lowest practical taxonomic level using standard keys. Our data suggest that macroinvertebrate species richness and relative population abundance were drastically reduced after scouring events, which altered substrate morphology and disturbed microhabitats. While most populations were either eliminated or greatly reduced in abundance after heavy rainfall, a few species maintained or even increased in numbers immediately after water levels receded. Other upstream pioneering species, which exhibit a high rate of behavioral drift, rapidly recolonized the scoured uninhabited substrates. During extended periods of steady water flow, the subsequent recolonization of other species stabilized benthic community structure and generally returned it to the pre-scour condition.

EFFECTS OF INTERCROPPING SWITCHGRASS WITH LOBLOLLY PINE ON THE DIET AND TROPHIC POSITION OF PEROMYSCUS LEUCOPUS.

Kim M. Briones* Presenter, Jessica A. Homyack, Darren A. Miller and Matina C. Kalcounis-Rueppell. , University of North Carolina at

Intercropping switchgrass (Panicum virgatum L., a native C4 grass) in existing loblolly pine (Pinus taeda) plantations is a potentially sustainable method for producing biofuel feedstocks. Because potential effects on small mammals are unknown, we examined if white-footed mice (Peromyscus leucopus) would use planted switchgrass as a food source, or if they would use existing food resources associated with pine. We live trapped rodents in four replicates of three treatments: (1) pine only, (2) pine intercropped with switchgrass and (3) switchgrass-only in 2009 and 2010. We assessed diet and trophic position of mice using carbon (δ13C) and nitrogen (δ15N) stable isotopes in tissue samples. We hypothesized that the presence of switchgrass would alter the dietary preference and trophic position of P. leucopus. We predicted that C3 and C4 signals would indicate that mice would consume switchgrass and function primarily as granivores in the presence of switchgrass. Analysis of 2009 samples revealed that there was no treatment effect on the mean δ13C and δ15N of tissue samples. However, we detected a seasonal effect. For δ13C, mouse tissue was more enriched in the summer and became more depleted in the fall. Enriched values suggest some influence of switchgrass on diet. For δ15N, mouse tissue was more enriched in the fall than in the summer, which suggests mice were eating at a higher trophic position in the fall. We are currently analyzing data from the 2010 field season and will discuss combined results from 2009 and 2010, as well as management implications.

Effects of temperature and substrate color on the growth and color morphology of the Chinese praying mantis (Tenodera ardifolia sinensis S.)

Lucas P. Carnohan*, School of Natural Sciences, Lenoir-Rhyne University

The Chinese praying mantis (Tenodera ardifolia sinensis S.) is a generalist predator that is commonly used as a biological control agent. Since its performance is influenced by its development, this study looked at the effects of temperature and substrate color on their growth and color morphology. The mantids kept at low temperatures developed much more slowly and consumed significantly fewer fruit flies (Drosophila melanogaster) per day during each instar than did the mantids at high temperatures. However, the mass of each mantid at each ecdysis was very similar in both temperature groups. Almost all mantids raised in high temperatures turned green and the majority of mantids at low temperatures turned brown. These results suggest that temperature has a strong influence on growth rate, but does not affect the size potential of the Chinese praying mantis, and that color morphology is likely determined by temperature rather than by substrate color.

Effects of white-tailed deer (Odocoileus virginianicus) on invasive exotic woody plants in Piedmont North Carolina forest communities

Sam Flake*, Lynn Moseley, Department of Biology, Guilford College

Invasive exotic plants are associated with ecological and economic damage to natural communities. Studies in mid-Atlantic, Great Lakes, and Northeastern regions have found that numbers of exotic invasive plants increase in the presence of white-tailed deer; however, no study assessing the effects of deer on invasive exotic plants has been conducted in forest communities of Piedmont North Carolina. I am conducting line transects to measure the number of deer bites on woody plants of both native and exotic species and corellating bites with deer population and with community type. To determine if invasive seeds are being spread by deer, I will collect fecal pellet samples for germination. Preliminary results from bite count transects suggest that deer prefer to forage upon Eleagnus umbellatus and Ligustrum sinense, two of the most common woody invasives, and do not show a preference for native saplings. This study may present evidence counter to the prevailing enemy release hypothesis, wherein herbivores facilitate invasive plants by avoiding them, suggesting that other factors, such as edge effects or seed dispersal by animals, may be facilitating the spread of invasive exotic plants in these communities. Results of population estimates and pellet germination data are pending.

Electroporation in a three-dimensional, time-dependent model of a skeletal muscle fiber

Jonathan Preston Cranford* and Wanda Krassowska Neu, Department of Biomedical Engineering, Duke University

Electroporation, in which strong electric pulses create transient pores in the cell membrane, holds promise for improving delivery of DNA to skeletal muscle fibers in gene therapy applications. However, the results of delivery are difficult to predict, as electroporation is a nonlinear process. This study investigates the full spatiotemporal dynamics of electroporation using a new time-dependent model of a 3-D muscle fiber. The model assumes a cylindrical fiber and two point source electrodes positioned parallel to the fiber in an isotropic conductive solution. The membrane of the fiber responds to strong transmembrane potential (Vm) by developing electropores (pore density N) at a rate that is an exponential function of the square of Vm. Outputs of model simulation are the time evolution of Vm and N over the entire fiber membrane, which are compared to electroporation predicted from a linear, non-electroporating version of the model. The linear model shows that the magnitudes of Vm and N, and the region of elevated Vm and N are greater on the side of the fiber facing the electrodes. However, the nonlinear model shows that the magnitudes of Vm and N are approximately equal at the sides of the fiber facing and opposite to the electrodes, and that the region of elevated Vm and N is greater on the side of the fiber opposite to the electrodes. Therefore, the nonlinear electroporating model produces different results than the linear, non-electroporating model.

Elevated CO2 and Growth of rosa multiflora

Blaisus L. Presenter* and D. Ellum

With coming global climate change there is a concern that invasive species will change their growth patterns, enabling them to spread into habitat where they are currently unable to grow. This study examines the growth response of rosa multiflora (multiflora rose) to shading as well as elevated carbon dioxide (CO2) levels. Treatment groups of randomly selected terminal branch cuttings were grown in two CO2 levels (ambient 390 ppm, elivated 700ppm) and two shading levels (full sun, 60% shade); four treatments total. Open-topped chambers were constructed inside a small greenhouse to simulate summer conditions and maintain the correct fraction of CO2 in the atmosphere surrounding the growing cuttings. Each cutting was weighed before and after the three-month growth period. Data was collected on total, leaf, shoot, and root biomass, and these results were compared using an ANOVA and post-hoc Tukey test. The full sunlight treatments exhibited significantly greater total biomass accumulation than the shaded treatments. Cuttings grown in full sun also exhibited a significantly greater root-to-shoot ratio than shaded cuttings. The results of this study show that increased CO2 does not have a positive effect on the short-term growth or shade tolerance of rosa multiflora. Shading did have a negative effect on rose growth. These results suggest that rosa multiflora will keep its current growth rate and remain a shade intolerant species as CO2 levels in the atmosphere rise.

Engaging Undergraduates in Authentic Scientific Research Practice

Miriam Ferzli, Mary Beth Hawkins, Elizabeth Overman, and Damian Shea, Department of Biology, NC State University

Undergraduate science majors often have little opportunity to develop an appreciation for the authentic practice and discourse of science. In addition, research opportunities for undergraduate students may be limited, and students going into independent research laboratories are often unprepared. Based on these problems, which seem to be inherent to traditional undergraduate research experiences, we designed an alternative model, the "Research PackTrack (RP) Program," that provides research training experiences to freshmen and sophomore students. Our rationale includes the need to get students actively involved in research gradually and early on so they can engage in authentic scientific practice, overcome their apprehension about scientific research, and build a solid foundation for becoming researchers. It calls for retaining women and other minorities, who learn best in collaborative settings with problem-based approaches. Our program is anchored in a two-semester experience, starting with second semester freshmen, that scaffolds students' understanding in evaluation of primary literature; organization, representation and interpretation of data; experimental design; database searches; scientific writing and oral presentations; peer review; and ethical issues. The second course, taught in a fully operational research lab, allows first semester sophomores the opportunity to work cooperatively, manage lab experiments, and produce meaningful data that they can present at research symposia or publish. Unlike "cook-book" laboratory experiments, students learn how a research lab operates as they move from guided to independent research studies. Students can then continue on with their research during subsequent semesters and mentor incoming students or they can progress to an independent research laboratory.

Enzyme Activity in the Hyporheic Region of Piedmont Streams

Danielle Whitman*, Dr. Janet MacFall, Department of Environmental Studies, Elon University

Streams and rivers are the source of our drinking water, scenic beauty, recreational opportunities and wildlife habitat. Unfortunately, increased urbanization has reduced riparian cover and changed runoff patterns, leading to changes in natural stream flow that result in flooding and erosion. As the number of stream restoration projects continues to grow, the depth of restoration criteria that needs to be addressed during planning and implementation must expand. The goal of this research project was to establish baseline measurements that could be used as assessment tools based on biochemical and microbial characteristics. This research focuses on the hyporheic region of soil. Five major enzymes involved in nutrient cycling within soil were examined. These enzymes included phenol oxidase, protease, acid phosphatase, β-glucosidase, and β-galactosidase. Preliminary data collected during the summer of 2010, indicated a correlation between degree of erosion—determined by bank height—and enzyme activity for phenol oxidase, acid phosphatase, β-glucosidase, and β-galactosidase. Generally, bank height was used as a measure of erosion with bank height ranging from 15 cm to 244 cm. Effect of depth was also measured by comparing surface to 20 cm deep. There was a difference shown in acid phosphatase and protease activity with greater activity in surface soils.

Evaluation of Four Models of Mosquito Traps for the Surveillance of La Crosse Encephalitis Vectors in Western North Carolina

Brian Byrd, Laura White*, Alan Goggins, Charles Sither, Bruce Harrison, and Gideon Wasserberg

In this study we evaluated the efficacy of four models of mosquito traps for the determination of the most suitable surveillance tool of the La Crosse virus (LACV) and its vectors. The study was conducted in Cullowhee, North Carolina. Four trap models were used: three host-seeking traps (CDC Light Trap, Fay-Prince Trap, and CO2-Baited BG-Sentinel Trap), and one infusion-baited Gravid Trap. Trapping was conducted in 4 peridomestic sites, with four trap types per site, twice a day (morning and afternoon), during four days in June and August 2010. Traps were rotated daily between the four locations in each site. Relative abundance and parity status of target mosquitoes were assessed to determine the most effective trap type. Parity dissections identified female mosquitoes as parous, nulliparous, gravid, or bloodfed. 668 target female mosquitoes were collected over 128 trap days, with 76% of captured mosquitoes in the evening session. The BG-Sentinel had the highest vector yield for both trapping sessions, followed by the Gravid, Fay-Prince, and CDC Light Trap. There was a trap bias in regards to species, with a significantly greater abundance of Ae. albopictus, and Ae. triseriatus in the BG-Sentinel, and the greatest abundance of Ae. japonicus in the Gravid trap. All host seeking traps from the June collection had similar distributions of parous mosquitoes with around 38% parous. The Gravid trap had 89% gravid (parous) mosquitoes. Although the preliminary data supports the use of the BG-Sentinel and Gravid traps, a more targeted approach for surveillance would be ideal.

Evidence for biotic resistance to invasion across spatial scales in riparian forest vegetation

Kara E. Salpeter*, Department of Biology, Elon University

Charles Elton's biotic resistance hypothesis suggests that areas that are rich in native species are more resistant to invasion. Our research tests Elton's hypothesis for accuracy in a riparian forest environment. Riparian forests are regularly scrubbed by floodwaters, which can remove existing species and deposit seeds of invasive ones. Our work involves collecting data from 40 vegetation survey plots along the Haw River in the Piedmont of North Carolina. In this study, we 1) report on the identity and frequency of invasive species encountered in the watershed, and 3) the average cover of invasive species, and 3) examine the relationship between native and invasive species richnesses across spatial scales ranging from 0.01 m^2 to 1000 m^2. Of 251 species identified, 30 (8.4%) were invasive. The most frequent invasive species were stilt grass (Microstegium vimineum: 90.5%), Japanese honeysuckle (Lonicera japonica: 71.4%), and ground ivy (Glechoma hederacea: 61.9%). Furthermore, our data indicate that, unlike studies that report greater invasion in more species rich communities, the relationship between invasive and native species is consistently (albeit weakly) negative across spatial scales from 0.01 to 100 m^2 in Haw River riparian forests. Our results suggest that biotic resistance may be a better explanation of the relationship between native and invasive specie richnesses in riparian forests. Possible reasons for this will be discussed.

Examining Population Structure in Two Species of Australian Freshwater Turtles: Wollumbinia latisternum and Elseya stirlingi.

Elliott Diggs*, Guilford College and The School for Field Studies

Freshwater turtle populations are declining across the world. Understanding the population structure of a species, such as its ecological niche and demography, is critical to its conservation. Two important aspects of population structure are age class and sex ratios. Age class ratios compare juvenile and adult subpopulations. Sex ratios compare breeding pairs (adults) and future breeding pairs (juveniles). I examined these ratios in four populations of freshwater turtles, Elseya stirlingi and Wollumbinia latisternum, in four pools in the North Johnstone River, Queensland, Australia. Data shows that the age class ratios varied in different pools. W. latisternum populations were composed of more juveniles in most pools. E. stirlingi age class ratios favored juveniles in two pools, and adults in two pools. Sex ratios differed in the two species. For juveniles, E. stirlingi populations had a higher proportion of females in two pools, and two pools contained more males. For adult E. stirlingi, the same trend occurred within the pools. W. latisternum populations' favored adult females for one pool, adult males for two pools, and one pool had only juveniles. Collectively, both species' sex ratios were approximately equal and both populations skewed toward adults.

Exotic Invasive Plants: Edge Influence and Distribution In a Suburban Forest Fragment

Elizabeth Stapleton, Dr. Lynn Moseley, Department of Biology, Guilford College

In central North Carolina, forests frequently exist as fragments within a suburban matrix. Native species within these fragments are challenged by limited habitat, as well as habitat degradation from the increased presence of exotic invasive plants. Invasive species likely become established along forest edges and although trends have begun to emerge there is no overarching model for edge invasion. A significant section of the Guilford College Woods, a 240-acre fragment in Guilford County, NC, has remained uncultivated within known history. Unlike other sections of the fragment, this area appears largely devoid of invasives. To determine forest characteristics that may prevent or allow invasion, this study seeks to 1) confirm that there are significantly fewer exotic invasive shrubs across the old growth edge when compared to other edges of the fragment and 2) to determine significant ecological differences in abiotic factors and species composition that could account for such a trend. I established four transects in each of three different forest habitats: the old growth area, an area of newer growth, and a small corridor area. Tree and undergrowth composition and focal invasive species were measured and recorded along each transect. Preliminary results confirm no significant invasion of the old growth section, in contrast with other areas. Further study will examine abiotic characteristics at the different sites in hopes of determining the importance of various factors in invasive plant distributions and help provide management recommendations for the college.

Experimental confirmation of the existence of gravitational waves and their speed

Dr. Orville Day, and Davidson Wicker*, Department of Physics, East Carolina University

Gravitational waves become trapped in the potential energy well ("cavity") situated just outside of and surrounding a black hole (BH). Those gravitons having proper wavelength will form standing waves as outgoing waves reflect from the boundary in phase with incoming waves. The proper wavelength depends upon the physical size of the cavity, which depends upon the BH mass and spin. Standing-wave gravitons, spin-2 bosons, will attract each other into coherent resonant oscillations forming a Bose-Einstein condensate within the cavity. The speed with which the gravitons travel determines the frequency, given the wavelength. Vice versa, measured frequency allows the speed to be calculated.

The cavity radius extends from 1.4 to 2.0 times that of the event horizon. The cavity volume is therefore 5.5 times the BH volume, sufficiently large that the number of radiating electrons occupying the cavity within the plasma will be enormous. The large cavity volume also allows the gravitons to significantly influence the distribution of the electrons via their masses within the cavity, which in turn influences the amount of radiation emitted via their electric charges. Because of the collimated strong magnetic field permeating space outside the BH (and within the cavity), the hot plasma electrons emit polarized synchrotron, near-infrared radiation. The influence of the slow graviton oscillation frequency upon the emitting electrons within the cavity modulates the amplitude of the synchrotron waves originating near the BH, seen later at Earth.

EXPLORING SPECIES BOUNDARIES: MORPHOLOGICAL EVIDENCE FOR INTERACTIONS BETWEEN NORTH AMERICAN CRICKET FROGS, ACRIS CREPITANS AND A. GRYLLUS

Bryan A. Strelow*, Gregory J. Haenel, Department of Biology, Elon University

Due to climate change, many species' ranges are shifting; a phenomenon which brings previously isolated species together. Within the NC piedmont, the range of the northern cricket frog, Acris crepitans, and its southern counterpart, A. gryllus, overlap, which makes this area an excellent model to test ideas about the genetic interactions of closely related species. This project seeks to determine the evolutionary history and trajectory of these species, which is important for conservation in light of the global trend of declining amphibian populations. I identify gene-flow in this study through the comparison of species-specific morphological characters. To do this, I compared 8 physical traits (including snout-to-vent length, leg measurements, etc.) from 94 specimens obtained from the NC Museum of Natural Science. These specimens were taken from 4 populations: 2 sympatric populations from the edge of each species' range and 1 allopatric control population of each species. These populations were compared against two models of divergence or convergence. The former explains a significant interspecific difference in trait expression as a factor of independent evolution and limited gene-flow. The latter explains decreasing phenotypic variation through hybridization. Comparisons of means using Holm-Sidak and Fischer's Exact Tests demonstrate that 4 of the 8 characters measured support a hypothesis of divergence, while the other 4 traits indicate convergence. These results suggest that both species are affected by cohabitation, implying recent or ongoing genetic exchange. Currently, I am moving forward with genetic analyses to resolve patterns within these interactions and to quantify this interspecific gene-flow.

Facile synthesis of monodisperse metallic nanoparticles and their interaction with quantum dots

Daniel Bates*, Department of Chemistry, Western Michigan University

Nanoparticles are known to quench the fluorescence of quantum dots. There are however types of nanoparticles that have not been thoroughly investigated with quantum dots. It important to study palladium and platinum nanoparticles' effects on quantum dots because they are in the same column of the periodic table and we might be able to distinguish trends between them. We started by synthesizing three sizes of palladium nanoparticles (1.4, 1.9, and 2.5nm) and two sizes of platinum nanoparticles (2.0 and 2.5nm). All the nanoparticles were then imaged to determine if they were colloidal and uniform using Transmission Electron Microscopy (TEM). The CdSe QD's were then titrated with all five sizes where the data obtained from the spectrofluorometer was used to make Stern-Volman plots to obtain quenching coefficients for each of the nanoparticles. The quenching coefficients for the 1.4nm, 1.9nm, and 2.5nm Pd nanoparticles were determined to be 170.15, 106.43, and 92.81 respectively. The quenching coefficients for the 2.0nm and 2.5nm Pt nanoparticles were 117.71 and 80.44 respectively. From the results from the Stern-Volman and the TEM images we were able to determine that we in fact synthesized monodispersed, uniform palladium and platinum nanoparticles. We also were able to conclude that as the diameter of a nanoparticles decrease there ability to quench, as well as the quenching coefficient, tends to increase.

Fluoride as an Inhibitor in Oxygen Evolution by Photosystem II

Ia Lee* and Alice Haddy, Department of Chemistry and Biochemistry, UNC-Greensboro

Plants, algae, and cyanobacteria all contain an enzyme complex, called Photosystem II (PSII), which carries out the fundamental process of splitting water into molecular oxygen using energy gained by light absorption. Chloride and calcium are known to be important cofactors required for oxygen evolution, which takes place at a catalytic Mn4Ca complex. In previous studies fluoride was found to be a competitive inhibitor of the chloride cofactor in oxygen evolution. It appears that F- interferes with Ca2+ function although the question of whether F- further damages the oxygen formation site still remains elusive. In this experiment we have tested for the inhibition caused by F- using a spectrophotometric assay to determine the electron transfer rate through the observation of a blue-colored electron acceptor, 2,6-dichlorophenolindophenol, in NaCl-washed PSII. In this study PSII was treated with fluoride with and without electron acceptor The sample with acceptor present was exposed to light for 3 minutes to promote catalytic turnover and allow for Ca2+ to be released. In the illuminated sample the activity in CaCl2 was 69% of the control and in the non-illuminated sample the activity was 92% of the control. The recovery of electron transfer activity by addition of CaCl2 shows that inhibition was due to loss of Ca2+ in the presence of F-, whereas unrecovered activity in a portion of PSII undergoing turnovers in the presence of F- suggests that permanent damage occurred in addition to Ca2+ depletion. (Supported by NSF and the UNCG Office of Research)

Fungal Population Response to Increased Temperatures in Soil

Meghan R. Clark* and Antonio D. Izzo, Department of Biology, Elon University

Fire is an important form of disturbance in forests worldwide. Fungi in the soil play important roles in these systems and are also impacted by these fires similar to the plants and animals on the surface. Some fungi are known to be adapted to survive increases in temperature, and therefore may be important in natural fire-disturbed systems as well. To understand how fungal populations respond to increased temperatures in soil, a treatment was performed in the lab that simulated the heat disturbance of a fire. Culture-based techniques were performed to compare the changes between fungal community composition and diversity prior to and after treatment. The heat treatment caused a significant decrease in number of fungi detected in the cultures. Three fungal types were isolated for further analysis because of their observed responses to the heat treatment (positive, negative, and neutral). Spores from these fungi were harvested and subjected to the same heat levels that the soils had been exposed to, and then monitored for germination and growth. Spores from the isolate that had the positive response were not impacted by the heat treatment. Spores from the other two fungal isolates were able to survive, however they showed a significant delay in their germination. Results support that the observed increase of the resistant isolate was probably not due to being more prominent in the soil, but instead managed to germinate faster and have an advantage.

Greenhouse gas emissions from cow manure and ammonium nitrate on simulated pasture

Sean T. Pulsfort*, Dr. John Brock, Warren Wilson College and Department of Chemistry, Warren Wilson College

Worldwide, livestock activities are responsible for 18% of greenhouse gas emissions. A significant portion of these emissions come from manure management and agricultural soils. The objective of this study was to quantify carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions from a simulated pasture environment with three treatments: cow dung pats, inorganic fertilizer, and the combination of the two. Total CO2, CH4, and N2O emissions were measured over eight days for a 1 kg dung pat (n=4), ammonium nitrate (1 73 g) (n=4), and the combination of the two (n=4). Samples were taken with a gas syringe, separated by gas chromatography, and detected with either flame ionization or electron capture; CO2 was analyzed using an infrared CO2 probe. The dung pat treatment had the highest emission (7.3□ 2.1 g CO2 eq), followed by the dung pat and fertilizer treatment (5.6 ⊏ 1.6 g CO2 eq) then the fertilizer treatment (2.3 □ 0.8 g CO2 eq). There was a significant difference between the dung pat treatment and fertilizer treatment ($P < 0.01$). Previous studies indicate an inverse relationship between methane emission and carbon to nitrogen ratio in manure. The dung pat and fertilizer treatment did not result in greater overall emissions, despite the additional nitrogen in applied fertilizer. Further research needs to be conducted to confirm and explain these unexpected results. The results of this study have implications for greenhouse gas inventories and timing of fertilizer application.

Guide to the Vascular Flora of Howell Woods

Kelly Hines, Department of Plant Biology, NC State University

Located in southeastern Johnston County (North Carolina), Howell Woods is "the most significant terrestrial natural area in the county" as designated by the NC Natural Heritage Program. Howell Woods is one of the largest tracts of intact forest remaining in the county, comprising 2,856 acres and is between 40 and 60 km from any other known floristic inventory. It hosts large areas of good quality Coastal Plain Bottomland Hardwood Forests (brownwater subtype) and Mesic Mixed Hardwood Forest (Coastal Plain subtype). Particularly notable communities include examples of Streamhead Atlantic White Cedar Forest (S2 G3), Streamhead Pocosin (S3 G4), and Wet Pine Flatwoods (S3 G3G4) that require management to maintain as such. Over 500 voucher specimens were collected and are supplemented by eighty additional taxa reported from grey literature reports. Multiple rare plant species occur on site including a state threatened species, Macbridea caroliniana (Walter) S.F. Blake. Based on field collection and herbarium study, a taxonomic manual will be developed complete with keys, scientific names with brief synonymy, known species vouchers, fruiting and flowering phenology, illustrations and discussion of climate, soils and plant communities. This work will provide the requisite baseline documentation for future management, monitoring, and research at the site.

Hand Preference in Nocturnal Lemurs (Cheirogaleus medius, Mirza coquereli, Microcebus myoxinus) during Feeding in Captivity.

Angela Mason Foster, Department of Science, Kaplan University

Three species of nocturnal lemurs were observed while feeding in captivity to determine hand preference of individuals as a measure of cerebral lateralization. The lemurs in this study were housed at the Duke Lemur Center in Durham, NC, and were observed as they fed on chopped fruit, vegetables, primate chow, and crickets. In all three species, the left hand emerged (using binominal z-score 2.54, $p<.01$) as the dominant hand at the population level, though individual lemurs did show a preference toward right handedness. Fisher's exact test was applied the data for analysis by sex and age. Though both males and females showed a hand preference during feeding, males tended toward left handedness more strongly than did females. Individuals less than two years of age were much more likely to be ambipreferent than adults, suggesting that hand preference becomes hardwired as the brain matures. This study provides further support for the Postural Origins Theory (MacNeilage, 1991).

Hepatic Insulin Resistance after Menopause

Kimberly M. Stratford*, John Stafford M.D., Ph.D, Melissa Martinez, David Cappel, Department of Molecular Physiology and Biophysics,

For non-diabetic men, death due to heart disease has decreased by forty percent and for non-diabetic women by twenty percent. The most surprising part is that diabetic men only have one third the benefit of non-diabetic men. While for diabetic women, death from heart disease has increased. Before menopause, women are protected from the effects of over nutrition. After menopause, there is a transition where protection from heart disease is lost. We wanted to test the molecular transitions of this metabolic disease so an ovariectomy was used as a model in mice. They were either fed a high fat diet or low fat diet after the surgery. Food intake and the development of obesity were monitored. Next, the mice had another surgery to insert catheters in the carotid artery and jugular vein. Then we performed a hyperglycemic clamp to assess insulin sensitivity in the model. Our goal was to define if a high fat diet differentially impacted insulin resistance before or after menopause. We found that a high fat diet impairs insulin signaling in mice with and without estrogen signaling. But the mice with estrogen are able to inactivate Fox01 which provides protection against blood sugar and triglyceride abnormalities. Our results suggest that estrogen may activate AMPK in the liver, which may contribute to why women are protected from the complications of obesity before menopause but at risk after.

How are Reproductive Traits in Plants Modified by Temperature? An Examination of Plantago lanceolata.

Andrew Blank*, Jonathan Slater, Sam Sullivan, Michael Lutfi, Jason Waters, Freddy Herrera, and Elizabeth Lacey , Department of Biology,

Mean annual temperature continues to rise due to global warming. As a result, it has become necessary to predict the physiological response of organisms to climate change. Previous studies by Lacey et al. have shown that certain genotypes in Plantago lanceolata exhibit plasticity in floral and spike (inflorescence) reflectance. Plasticity generally increases with increasing latitudes and altitudes. This variation is thought to have evolved in response to the relative exposure to low temperatures during the reproductive season. By altering floral reflectance, P. lanceolata is able to partially thermoregulate internal flower and fruit temperature, thereby increasing overall fitness of offspring. We propose that other reproductive traits may also be affected by temperature and that these traits may be correlated to floral reflectance plasticity They may help to partially thermoregulate internal temperature. In our experiment 39 genotypes were cloned. One clone per genotype was induced to flower at cool temperature and the other at warm temperature. Then data were obtained for flowering time, spike length and width, stalk length, and floral pubescence. Mixed-model statistical analyses showed that temperature significantly affected all traits and that plasticity affected stalk length. Also, interactions between floral reflectance plasticity and temperature were significant for flowering time, spike length, and stalk length. These data suggest that a suite of reproductive traits may be jointly influencing internal floral/fruit temperature and, thus, offspring fitness.

HOX Expression in Exponentially Growing and Differentiated Colon Cancer Cell Line HT-29

Justin Castellow*, Lucy Conaty, Margit Schmidt, Jean-Luc Scemama, Department of Biology, East Carolina University

We are studying how the variation in HOX gene expression regulates the differentiation of two colon cancer cell lines; HT29 and Caco2. These colon cancer cell lines acquire differentiated characteristics after reaching confluency (Caco2) or after being exposed to galactose (HT29). When cultured for two weeks post confluency, Caco-2 cells develop brush border membranes, tight junctions, become polarized and express enzymes characteristic of a differentiated epithelium. HOX genes play an essential role in the patterning of the anterior/posterior and proximal/distal embryonic body plans. It has been recently demonstrated that these genes play an important role in maintaining tissue differentiation and become de-regulated in cancer cells. Nevertheless, the mechanism and role of HOX gene regulation during carcinogenesis remains unclear. Our research is aiming to answer these questions by analyzing HOX gene expression in proliferating and differentiated colon cancer cells. To date we have analyzed the expression of the 39 Hox genes in differentiated and undifferentiated cells using RT-PCR. Difference in expression are presently being more precisely quantified using qRT-PCR. From these data, we will select hox genes which are preferentially expressed in differentiated colon cancer cells and analyzed their role using gain and loss of function experiments.

Human Activity and Shorebird Behavior and Diversity on Onslow Beach, Camp Lejeune

Sola O.*, Weber L., Fegley S., Undergraduate Student, Department of Environmental Studies (Concentration: Conservation Biology), Warren

Recent population estimates indicate that many species of shorebirds are declining and human population is increasing. Human activity on coastal beaches is the primary cause of habitat loss and disturbance, which are significant threats to many shorebird species. I studied how human activities on Onslow Beach, Camp Lejeune affect shorebird behavior (using focal animals) and diversity (using diversity indices). Analysis of shorebird abundance on Onslow Beach using one-way ANOVA show ($p=0.005$) fewer birds used the area where military training takes place than the recreation and control zone. The diversity results from both the Shannon and Simpson's Diversity indices show the recreation use beach has lower diversity ($p=0.004$) compared to the control zone. The behavioral time budget of Willets (Tringa semipalmata) show that they spend significantly less ($p=0.0001$) time foraging in the recreation zone where there were many humans when compared to the control zone where humans are absent. These results suggest human activity on Onslow Beach could negatively impact the ecological fitness of shorebirds by preventing them from gaining fat reserves crucial for migration.

Identification of a novel positive cis-control element in the Cd4 gene

Gregory Swan* and Sophia Sarafova, Biology Department, Davidson College, Davidson NC 28035

CD4 helper T cells coordinate the immune response and are highly dependent on the expression of the Cd4 gene for proper development and function. The function of a promoter, an enhancer and a silencer have been well documented and togeather explain how the Cd4 gene gets turned on in CD4 T cells and off in CD8 T cells. However, once turned on, the amount and timing of Cd4 expression varies during T cell development and activation. This modulation of CD4 surface levels is essential for proper lineage specification and T cell function. Yet how subtle changes of CD4 expression are regulated remains unclear. In this study we describe the identification of a new positive cis-acting transcriptional regulatory element (NCE) in the Cd4 locus. Although NCE displayed no promoter activity, it was able to enhance Cd4 promoter function in a transient transfection assay with an eGFP reporter construct in RLM11 murine thymoma cell line. Surprisingly, it consistently did so better than the known Cd4 proximal enhancer in this assay. Thus NCE represents a novel transcriptional control element that may be involved in the modulation of CD4 expression during development or activation.

Identification of a possible target receptor for the Estrogenic Endocrine Disrupting Chemical (EEDC) Bisphenol A in Caenorhabditis elegans

Mahmoud Saleh*, Malotky, Michele, Department of Biology, Guilford College

Endocrine Disrupting Chemicals (EDCs) are compounds that alter hormonal and homeostatic systems by interfering with endocrine signaling pathways. Bisphenol A (BPA) is an estrogenic EDC used in the synthesis of polycarbonate plastic. Human studies show a correlation between urinary BPA concentrations and cardiovascular diagnoses. BPA has also been shown to cause abnormalities in growth and reproduction in Caenorhabditis elegans, a free-living soil nematode. In this study, we conducted a multigenerational bioassay to observe the effect of BPA on the physical appearance and fecundity of C. elegans. Our results show a decrease in egg laying and hatching by the fourth generation at BPA concentrations between 100nM and 10μM. Although similar toxicological studies have been done, target receptors have not been identified. We are currently in the process of creating plasmid constructs containing a short sequence of two potential estrogen receptors in C. elegans. These genes, nhr-14 and nhr-69 have significant similarities in gene sequences to estrogen receptors in humans. Once the plasmids are transformed into a feeding strain of E. coli, these bacteria will be used in an RNA interference assay to determine the relative contribution of each target receptor to signal transduction by BPA in C. elegans.

Identification of Antimicrobial compounds in Alkanna orientalis

Jessica R. Bame*, Dr. Nadja Cech, Dr. Nicholas Oberlies, Tyler Graf, Department of Chemistry and Biochemistry, UNCG

Alkanna orientalis is an understudied plant in the family Boraginaceae, therefore being related to Forget-me-nots, Myosotis discolor. During a screening with other plants chosen for having been said to have antimicrobial properties in folklore, but unsubstantiated by science, Alkanna orientalis was found to have activity against the Gram positive bacteria Staphylococcus aureus. With S. aureus being the bacterial species responsible for the Methicillin-resistant Staphylococcus aureus, MRSA, the compound responsible for the activity would be of interest as an alternative drug to penicillins or cephalosporins for individuals with the drug resistance. The observed activity of A. orientalis led to isolation of the compound responsible.

Alkanna orientalis was extracted and separated into fractions by a series of normal phase flash chromatography and later preparatory HPLC. The fractions were tested against the wild type S. aureus using a disc diffusion assay as well as later antimicrobial micro-dilution assays. Analysis of the mass spectrum & associated chromatography of the fractions tracked compounds that were consistently found in the active fractions, showing consistently a compound with a mass/charge ratio of 359.00 in the positive mode, as the possible active compound. Currently there are no journal articles reporting a compound with a mass of 358 AMU with antimicrobial in Alkanna orientalis. The final object of this project is to characterize the structure of this active compound against S. aureus using mass spectrometry and NMR, which may in the future be a possible drug alternative against S. aureus.

Identification of Morphologic and Chemical Markers of Adult Anopheles gambiae Mosquitoes Exposed to Aestivating Conditions

Kaira Wagoner*, Tovi Lehmann and Gideon Wasserberg, Wagoner and Gideon:

Increased understanding of the dry season survival mechanisms of Anopheles gambiae in semi-arid regions could benefit vector control efforts by identifying weak links in the transmission cycle of malaria. In this study we examine effect of seasonal indicators on morphologic and chemical characteristics known to contribute to suppression of water loss in mosquitoes. Anopheles gambiae wing size (an index of body size), mesothoracic spiracular index (spiracle length / wing length or width), and cuticular hydrocarbon (CHC) profiles were examined for their ability to differentiate mosquitoes exposed to aestivating and non-aestivating conditions in a laboratory setting. Mosquitoes exposed to aestivating conditions were expected to exhibit larger wing lengths and widths, smaller mesothoracic spiracular indices, greater total CHC amount (standardized), and larger mean CHC chain-length than mosquitoes exposed to non-aestivating conditions. As predicted, females exposed to aestivating conditions demonstrated a statistically significant increase in mean wing length and width (4.4% and 5.8% respectively). Surprisingly, females exposed to aestivating conditions also showed a statistically significant increase in spiracular index (4.1% and 5.5% by length and width respectively.). Males exposed to aestivating conditions showed a similar but less extreme increase in wing width and spiracular index (3.5% and 3.6% respectively, calculated by width). Analysis of CHC profiles is currently underway.

Identifying Dachshund's Role in Hedgehog Signaling and Urchin Development

Sara Lachance*, Duke University, Guilford College

This research studies embryogenesis using sea urchin embryos in order to gain a better understanding of the processes involved in development. An important process in embryogenesis is germ layer specification into endoderm, mesoderm, and ectoderm. This process is controlled by transcription factors, which are controlled by regulatory networks, comprised of genes, that determine the expression of certain genes at different developmental stages. This study looks specifically at the gene dachshund, which is believed to be expressed in the endoderm and whose role in invertebrate development is unknown. Dachshund is evolutionarily conserved between invertebrates and vertebrates and was identified in the urchin genome. Sequence alignment programs were used to identify the conserved gene sequences between different species. From this information, degenerate primers were used in order to clone dachshund from a cDNA library. This clone was then used to develop and optimize an in situ hybridization probe in order to identify the spatio-temporal expression of RNA transcripts in a developing sea urchin embryo. With the expression pattern of dachshund identified, the next step is to use a morpholino in order to knock down gene expression and determine dachshund's function within the developing sea urchin embryo.

Inhibition of Microsomal Triglyceride Transfer Protein by RNA Interference in Drosophila S2 Cells

Nicholas W. Faulkner, Department of Biology, UNCP and RISE, UNCP

A major source of crop destruction worldwide is the pests, particularly insects, which consume them. As such, the overarching goal of our research is to explore the potential use of RNA interference in developing species-targeted insecticides. In our experiments, we use Drosophila melanogaster as a model for all insects, which share many similarities in the lipid-transfer pathways, yet are divergent enough to allow for species specificity. The bulk of lipid transport in the hemolymph of insects is facilitated by lipoproteins, which package and transport neutral lipids from dietary or stored sources to the peripheral tissues to be used in ATP generation. The lipoproteins we have focused on are apolipophorin II/I (apoLpII/I) containing particles, of which there are at least two main requirements for formation: apoLpII/I and microsomal transfer triglyceride protein (MTP). While the role of MTP in apoLpII/I containing lipoprotein biogenesis is not fully defined, it is suggested to have a similar role as mammalian MTP in promoting the acquisition and filling of apoLpII/I with lipids for transport through the hemolymph. In this work, we have explored the inhibition of MTP expression by RNA interference, with the ultimate goal of examining its effect on lipoprotein biogenesis and the phenotype this confers on whole flies. This project specifically involved the construction and screening of an anti-MTP RNA that was capable of specifically knocking down the expression of MTP mRNA by >95% in drosophila S2 cells.

Inhibition of Photosystem II by Fluoride

Stephen Vance* and Alice Haddy, Department of Chemistry and Biochemistry, UNCG

Photosystem II (PSII) oxidizes water to molecular oxygen using a chloride cofactor that activates the Mn complex (Mn4Ca), allowing it to cycle through 5 oxidation states. An electron paramagnetic resonance signal due to a tyrosine radical, TyrZ, is observed when the Mn complex is inhibited from proceeding to the S3 state. In this study the signal was produced by inhibiting the sample with 20 and 150 mM NaF and observing at 77 K with an illumination at 273 K and quickly freezing in liquid nitrogen. Another stable tyrosine radical signal, TyrD, was determined by preilluminating the samples for 10 seconds and dark adapting for an hour. In the 20 mM NaF sample the TyrZ signal present was 87% of the TyrD signal and in the 150 mM NaF sample the TyrZ signal was 100% of the original TyrD signal. Induction half time of TyrZ was determined to be around 4 seconds and the decay half time was determined to be 102 sec for the 20 mM NaF sample and 138 sec for the 150 mM NaF sample. Fluoride is known to act as a competitive inhibitor to Cl- activation, which implies that F- deactivates from the Cl- site. We propose that F- inhibits the function of Ca2+, preventing the Mn4Ca cluster from proceeding to the S3 state, as has been observed in previous studies of Ca2+ depleted PSII.
(Supported by NSF and NSF-REU grants)

Intestinal CRF Receptor Subtypes Mediate Distinct Intestinal Barrier Function Responses Through Mast Cell Activation

Beth L.Overman and Adam J. Moeser, DVM PhD, College of Veterinary Medicine, Departments of Physiology, Population Health and Patho-

Psychological stress contributes to the onset and exacerbation of gastrointestinal disease through poorly understood mechanisms. Our previous studies in show stress-induced disturbances in mucosal barrier function are regulated by peripheral activation of CRFr subtypes CRFr1 and CRFr2. These results suggest that CRFr1 mediates deleterious barrier responses to stress while CRFr2 may play a protective role. The objective of this study was to further elucidate the role of CRFr subtypes in stress intestinal barrier dysfunction. Porcine ileum was mounted on Ussing Chambers and exposed to CRFr1 and CRFr2 agonist treatments: 1) Control 2) CRF;(1μM;CRFr1/r2 agonist) 3) UCN2;(0.1μM CRFr2 agonist) 4) Stressin 1 (2nM;CRFr1 agonist). Intestinal barrier function was measured in terms of mucosal-to-serosal flux of 4 kDa-FITC dextran (FD4) over 180-minutes on Ussing chambers. CRF treatment increased ($p < 0.005$) paracellular flux of FD4 compared with controls. Ileum treated with the CRFr1 agonist Stressin 1 exhibited the greatest FD4 flux compared with all other treatments ($p < 0.001$) whereas treatment with the CRFr2 agonist UCN2 had no effect on baseline ileal barrier function. When added in combination with Stressin 1, UCN2 inhibited ($p<0.05$) Stressin 1-induced increases in FD4 flux. Blockade of mast cell (MC) activation with MC stabilizer cromolyn (10-4M) prevented increases in paracellular flux induced by CRF and Stressin 1 ($p <0.05$). Overall, these data demonstrate MC activation and CRFr1 and CRFr2 play distinct roles in regulation of stress-induced mucosal barrier dysfunction with CRFr1 mediating intestinal barrier dysfunction and CRFr2 mediating protection, potentially through negative regulation of CRFr1 pathways.

Investigation of a possible multi-enzyme complex involved in fatty acid metabolism from Bacillus subtilis

Philna Joubert*, Aparna Meka, and Jason J. Reddick, Department of Chemistry and Biochemistry, The University of North Carolina at Greens-

Our group has studied a cluster of genes called the mmg operon, in Bacillus subtilis strain 168. B. subtilis is an important model organism in microbiology, and is also studied because of its ability to form dormant spores. The genes in the mmg (for mother cell metabolic gene) operon are activated at an early stage of sporulation, and their sequences suggest that they are involved in fatty acid and propionate metabolism. Four of these genes, mmgABCD, encode fatty acid degradation enzymes, a family of enzymes known to often function as large multi-protein complexes. The goal of the research in this report is to determine whether or not these proteins indeed form such a complex. We have cloned these four genes in a multiplasmid system for coexpression in E. coli, such that only one (mmgA) carries a polyhistidine nickel-affinity tag. If any or all of the mmgBCD proteins form a complex with mmgA, we expect that they will coelute from the affinity column as a multi-protein assembly. If the mmgBCD proteins do not associate with the mmgA protein as a complex, their lack of affinity tags will result in affinity chromatography that releases only the mmgA protein. This research is ongoing, and we will discuss the latest results in this report.

Investigation of de-pigmentation phenotype in Drosophila melanogaster due to silver nanoparticle exposure

Denise Reaves*, Tierra Poteat, Fran Turner, John Bang#, Catherine Silver Key#

Silver is an antimicrobial agent and an effective killer of pathogenic bacteria such as E.coli, B. subtilis, and S. aureus. It is used in many consumer and medical products including Band-Aids and burn cream. Human exposure to silver nanoparticles (Ag NP) is increasing due to its use in biomedicine thereby increasing the importance of investigating Ag NP's adverse and toxic effects. Adverse effects include neurologic problems, kidney damage, stomach problems, headaches, fatigue, and skin irritation. Recently we have discovered a de-pigmentation effect of Ag NP using Drosophila melanogaster as a model. Due to larval exposure, the adult fruit fly cuticle is devoid of pigment and the adults exhibit altered locomotor behavior. To investigate if interference with the melanin biosynthetic and/or the oxidative stress pathways cause the phenotypes, RNA was extracted, from non-pigmented flies, and used to synthesize cDNA for gene expression analysis on genes in these pathways. Primer sets to study expression level of these genes involved were designed and tested for use in qPCR. Targeted genes in the pathways are yellowf, yellowf2, ple and hsp70 with endogenous control genes rp49 and actin. It is hypothesized that gene transcription will be increased in oxidative stress responsive genes and that melanin biosynthetic genes will exhibit decreased expression.

Investigation of hydrogen production by Rhodobacter sphaeroides.

Skye E. Rios*, John W. Brock , Department of Chemistry, Warren Wilson College.

Most current methods for producing hydrogen gas are not sustainable; so many research groups have explored alternative methods of hydrogen gas production using photosynthetic bacteria, cyanobacteria, algae or fermentative bacteria. Rhodobacter sphaeroides O.U. 001 was used to produce hydrogen gas in Sistrom's medium for the production of hydrogen gas in order to investigate the efficiency of substrate conversion. A novel method for the analysis of molecular hydrogen was developed. This indirect method for detecting hydrogen involves the conversion of cyclohexene to cyclohexane. Using this method, the composition of evolved gas was determined to be approximately 89% hydrogen. In each trial, hydrogen gas evolved at an average rate of about 1 mL/hr, producing a total of 350 mL. Using succinic acid as a substrate for hydrogen production resulted in a conversion efficiency of 49%. Due to recent advances in hydrogen storage technology, biohydrogen is emerging as a sustainable fuel that has a strong potential to be highly transportable, efficiently storable, and virtually pollution-free.

Kinetics and Binding Studies of Lactoperoxidase with Estrogens in the Presence of Hydrogen Peroxide

Elise Post*, Dr. Kathy Matera, and Carly Fabrizio, Elon University Chemistry Department, Elon Universtiy SURE Program, Elon Undergradu-

Lactoperoxidase (LPO) is an enzyme of the peroxidase family and is produced by the immune system as a defense mechanism against pathogens. In some cases, LPO is capable of oxidizing other biomolecules, such as protein, DNA or hormones. Because of LPO's presence in breast ducts, estrogen molecules are susceptible to oxidation by LPO, and the oxidized estrogen molecules are further able to attack and oxidize nearby DNA. The mutations in the DNA replicate when the cell divides and thus, the oxidized estrogen substrates are regarded as an important risk factor for breast cancer. Understanding the mechanism by which DNA becomes oxidized will provide necessary information to develop potential treatments and pharmaceutical drugs against these types of breast cancer.

Spectroscopic binding studies were performed to examine whether specific hormones interacted with LPO. Estradiol was initially used to confirm hormone binding to LPO. Interactions between hormone and LPO was determined by observing shifts in the enzyme spectrum as binding occurred, indicating the hormone will likely be oxidized by the enzyme. Kinetics experiments helped determine oxidation rates of three types of estrogen; estriol, estradiol, and estrone, which led to indications of how susceptible estrogens are to oxidize DNA. KM values, which indicate the binding affinity of LPO to the estrogen molecule, were found to be 0.1393 mmol/L, 0.2781 mmol/L, and 4.067 mmol/L for estriol, estradiol and estrone, respectively.

Lifespan of SOD-2 Caenorhabditis elegans due to Antioxidant Exposure.

Maya T. Rios* and V. Collins, Warren Wilson College

A mutant strain of the nematode C. elegans (SOD-2) lacks the enzyme SOD2, one of the primary antioxidant defenses. Previous studies suggest that oxidative stress causes ageing and pathogenesis of disease. Despite increased oxidative stress, SOD-2 strains are longer lived than wild type C. elegans. Studies have shown that oxidative stress can be alleviated by the presence of antioxidants. The objective of this study was to observe the effect of the antioxidant ascorbic acid on longevity in wild type and SOD-2 worms. Wild type and SOD-2 C. elegans were cultured in growth media containing 0 mM, 20mM or 40 mM ascorbic acid (three plates per treatment). The number of worms on each plate was counted every two days for fifteen days. The initial growth rate was greater for all SOD-2 treatments than for all wild type treatments. Despite slower initial growth rates, the wild type worms in the 0 mM and 40 mM treatments reached higher peak populations. Wild type and SOD-2 populations in 40 mM ascorbic acid decreased three days after peaking. All other treatments had significant population decreases by seven days after peaking. Statistical analysis was not performed on the data due to high variability, possibly due to contamination of the plates. Contamination of the plates suggests that a method needs to be developed to prevent contamination in future research. Longevity of the C. elegans was not significant affected by strain or concentration of ascorbic acid.

Listeria monocytogenes Kills Tumor Cells

1 Jessica Klaphaak* and 2. Elizabeth Hiltbold , 1. Guilford College and 2. Wake Forest University

The Gram-positive bacterium Listeria monocytogenes (Lm) has been well studied because of its unique intracellular life cycle. Listeria's ability to kill tumor cells has allowed Lm to take the spotlight as an immunotherapeutic for tumors; however the mechanism of cell death is not understood. Upon entering the cytosol of a host cell, Lm triggers the formation of a protein aggregate called an inflammasome that activates the protease Caspase-1. Among other functions, Casp-1 has been implicated in a newly identified form of cell death called pyroptosis. To address the mechanism of cell death, Casp-1 activation was quantified using flow cytometry in time course and dose response assays in multiple melanoma cell lines upon WT Lm infection. Microscopic images were examined in parallel, depicting cell death. At both high MOI and later time points, Casp-1 activation and cell death were maximal, suggesting a pyroptotic mechanism. A cytotoxicity assay will also be performed to determine if lactate dehydrogenase (an indicator of pyroptosis) is released by tumors upon Lm infection. We are also monitoring tumor cell death in vivo induced by Lm infection. The results of these experiments will inform our overall understanding of how Lm might best be utilized as a tumor therapeutic.

Lysosomal Modulator Protects in Alzheimer's Disease Transgenic Mouse Model: Evidence of Enhanced Expression and Trafficking of Cathepsin B

Hollie Young1*, David Butler2,3, Candice Estick2 , Jeannie Hwang1-3, Saranya Kumar2,

Alzheimer's disease (AD) is an age-related neurodegenerative pathology in which defects in proteolytic clearance of amyloid □ peptide (A□) appear to contribute to the disease's progressive nature. Lysosomal proteases in particular the cathepsins exhibit up-regulation in response to accumulating proteins. We used the lysosomal modulator Z-Phe-Ala-diazomethylketone (PADK) to test whether proteolytic activity can be enhanced to reduce the accumulation events in AD mouse models. Systemic PADK injections in APPSwInd and APPswe/PS1□E9 mice caused 3-8-fold increases in cathepsin B (CB) protein levels and 3-10-fold increases in the enzyme's activity in lysosomal fractions. The robust increase in CB activity was found in lysosomes isolated from the mouse neocortical and hippocampal tissue after 10 daily treatments with 18mg/kg PADK (unpaired Mann-Whitney U-test: P<0.0001). The PADK-modulated CB also colocalized with LAMP-1-positive organelles, indicating proper trafficking to the lysosome compartment. Levels of neprilysin and insulin-degrading enzyme remained unchanged. The lysosomal modulation reduced A□ immunostaining as well as A□x-42 sandwich ELISA measures. Selective ELISA analyses also found that a corresponding production of the less pathogenic A□1-38 occurs as A□1-42 levels decrease in the two mouse models, indicating that PADK treatment leads to A□ truncation. Also associated with A□ clearance was the elimination of behavioral and synaptic protein deficits evident in the transgenic mouse models. To address the mechanism of PADK, enhanced expression as well as trafficking of CB was evident. First, the proform of CB exhibited an 80% increase by PADK (P=0.0296) while the mature forms of CB of 25-30 kDa showed more than a 200% increase by PADK (p<0.001). Second, Rab 5a and Rab 7 endosome markers also indicate enhanced trafficking. In hippocam-

Mapping the Motor Connections of the Subthalamic Nucleus in Parkinson Disease Using Deep Brain Stimulation Surgery

Anna Queen*, Department of Neurology and Movement Disorders, Washington University School of Medicine in St. Louis

Background: Bilateral deep brain stimulation (DBS) of the subthalamic nucleus (STN) improves motor function in Parkinson disease (PD). However, little is known about the quantitative and qualitative effects on motor behavior of different parts of the STN. We hypothesize that dorsal STN stimulation improves all motor effects more than ventral STN stimulation.
Methods: In 26 PD subjects with STN DBS, we quantified in a double-blinded manner rigidity (n=21), bradykinesia (n=21). Subjects were tested in three DBS conditions: dorsal STN stimulation, ventral STN stimulation, and OFF stimulation. A force transducer was used to measure rigidity across the elbow, and gyroscopes were used to measure angular velocity of hand rotations for bradykinesia. About half of the subjects were rated using the Unified Parkinson Disease Rating Scale (part III) motor scores for arm rigidity and repetitive hand rotation simultaneously during the kinematic measurements.
Results: Significant improvement was observed in the rigidity UPDRS dorsal vs. ventral vs. OFF, bradykinesia average velocity dorsal vs. ventral vs. OFF, bradykinesia UPDRS dorsal vs. ventral, and preDBS total UPDRS vs. kin/cog UPDRS.
The was no significant difference between rigidity impedance, impedance dorsal vs. ventral vs. OFF, Rigidity UPDRS (minus or percent change), bradykinesia velocity average, bradykinesia UPDRS (minus or percent change), axial total UPDRS, or axial total UPDRS dorsal vs. ventral vs. OFF.
Conclusions: Unilateral STN DBS decreased rigidity and bradykinesia contralaterally as well ipsilaterally. As expected, bilateral DBS im-

Measuring Nitrogen Dioxide Concentrations in Ambient Air via a Passive Diffusion Sampling Method

John C. Misenheimer*, Elizabeth D. Blue, Department of Chemistry and Physics, Campbell University

Nitrogen dioxide (NO_2) is an air pollutant of concern in urban areas which is formed by motor vehicles in the high temperatures of internal combustion engines and in small quantities by microbial and other natural processes. The purpose of this project was to determine the concentrations of nitrogen dioxide in ambient air in the Buies Creek, NC area by a passive diffusion technique. The hypotheses were that nitrogen dioxide concentrations would be greater in sites with the highest vehicular density and that the samples closest to the road would have a higher concentration of nitrogen dioxide compared to the samples furthest from the road. Sampling tubes were constructed and exposed at three sites with high, medium, and low vehicular densities. The tubes were placed in triplicate on both sides of the road at locations beside the road, at thirty-five yards, and at seventy-five yards. Filter paper soaked with triethanolamine (TEA) was placed in the tubes, which absorbed the NO2 from the air. The exposed samplers were developed to produce a colored azo dye and analyzed by a UV-Vis spectrophotometer. Preliminary results show that the nitrogen dioxide concentrations decrease with decreasing vehicular densities and that samples closer to the road show higher nitrogen dioxide levels. The data shows a difference in concentration levels when comparing cold and wet weather to warm and dry weather. Trends also support a higher concentration of NO2 during the week, compared to that of the weekend traffic. Further research is needed to conclusively determine the trends discussed.

Metagenomic Analysis of Microbiota in Response to Antibiotics in Cystic Fibrosis

Joshua R. Stokell*, Anthony A. Fodor, Melanie D. Spencer, Timothy J. Hamp, Todd R. Steck, Department of Biology, University of North

Chronic bacterial infections are the leading cause of mortality in individuals with Cystic Fibrosis (CF). Recent evidence indicates CF is a polymicrobial disease and can be used as a model to identify in vivo interactions between bacterial species in a disease condition. The specific interactions studied here are changes in bacterial diversity and abundance over time in response to antibiotic therapy. We analyzed sputum samples collected weekly from a CF patient who underwent multiple exacerbations during a nine-month study period. We hypothesized we would be able to characterize a change in bacterial abundance and diversity correlating to transient relief of patient symptoms. Bacterial DNA was isolated from 21 sputum samples and subjected to 454 FLX pyrosequencing using universal 16S rDNA primers. Quantitative PCR (qPCR) was used then to quantify total bacteria within each sample. Genus-specific 16S rDNA primers were used to also measure the abundance of Pseudomonas and Burkholderia. Pyrosequencing yielded approximately 114,000 sequences from which more than 150 genera were identified. Although we found a 350-fold range in relative bacterial abundance between samples, the major pathogens from the genera Pseudomonas, Burkholderia, and Streptococcus were found to be the most abundant in all samples. We found a significant positive association when comparing total bacterial abundance to bacterial diversity. We also identified a significant difference in diversity and abundance between sputum samples associated with specific antibiotic treatment. We conclude that the change in abundance of the pathogens may be responsible for improved patient health arising from antibiotic therapy.

Methicillin-resistant Staphylococcus aureus Prevalence in Pregnant Women and Transmission Risk to Newborns

Morgan J Gregg*, Robin L LaCroix, Department of Biology, Elon University

MRSA is emerging as a major pathogen in pediatric and adult populations alike. However, minimal information is available describing the prevalence of MRSA colonization in pregnant women or the risk of transmission to the infant. Review of hundreds of medical records in this retrospective study, prevalence and incidence of MRSA infection or colonization in peripartum mothers and their newborns MRSA colonization was determined using real time automated polymerase chain reaction. Of 102 evaluable mother/baby pairs examined in this study, 8 were positive for MRSA in both mother and baby, providing an overall MRSA transmission rate of 7.84%

Microbial Fuel Cells Powered by Sediments of the South Fork River Enhanced with Carbon, Sulfur and Iron Substrates

Jose Luis Gutierrez*, Patricia Koplas, PhD, MS, PT and Greg Pillar, PhD, Queens University of Charlotte Deparment of Biology

Microbial Fuel Cells (MFCs) are electrochemical systems in which microbes transform the chemical energy from substrates into electricity. Once electrons are produced, donation can occur as electrons are shuttled by a secondary molecule, by conductive nanowires, or by direct donation from the bacterial surface to electrodes. In order to test whether substrates or MFC design affect voltage output, sediments of the South Fork River were enhanced with the addition of iron sulfur or carbon and placed in prefabricated Keego Mud Watt MFC kits or custom built "H" design MFCs. Initial recordings indicate that the microbes contained in both MFC designs favor the presence of iron and sulfur sources and do not produce voltage as efficiently in the presence of a carbon substrate. The average voltage output difference of MFCs containing supplemental iron or sulfur versus the average output of MFCs with just plain sediment is approximately .03V higher in the Keego Mud Watt MFC with a 500Ω resistor For the H design MFC with a 500Ω resistor, the average voltage output of sediment containing sulfur and iron is higher than the plain sediment by .004 and .007V, respectively. For the carbon substrate, the average voltage output is .02V lower in comparison to plain sediment in the Keego Mud Watt MFC and .001V lower in the H design MFC using a 500Ω resistor The voltage output of the multiple MFCs will be recorded and analyzed to track MFC output over time and to determine if any differences in voltage and power output are significant.

Multilocus sequence typing and analysis to compare natural isolates of Ensifer adhaerens to a known type strain

Kimberly Heck*, James Brown, Melanie Lee-Brown, Department of Biology, Guilford College, Department of Microbiology, NC State Uni-

Ensifer adhaerens are Gram-negative, rod-shaped aerobic α-proteobacteria, in the family Rhizobiaceae, related to Sinorhizibium. E. adhaerens are predatory soil inhabitants that non-preferentially attack both Gram-positive and Gram-negative bacteria. In this study, four cave isolates of E. adhaerens isolated from two different caves in the United States were compared to the characterized type strain ATCC 33212 Small subunit rRNA, RNase P RNA, and five protein encoding genes from each strain were used to generate phylogenetic trees of each gene independently and catenated alignments in a multilocus sequence typing analysis. These will be used to determine the evolutionary relationships between these natural isolates and the type strain, and between Ensifer adhaerans and related species of Ensifer and Sinorhizobium.

Oil dispersant reduces the reproductive rate in D. magna

Margo Lowe* and Linda Niedziela, Department of Biology, Elon University

The recent accident in the Gulf of Mexico not only increased public concerns about the environmental impact of the oil spill; but also worries of the potential effect of oil dispersants, which were the compounds used in massive quantities to clean up the oil spill. Dispersants are considered to be safe when compared to the potential harm of the oil; however, studies have found that the dispersants can have toxic effects on aquatic organisms exposed during oil spill clean-up. The goal of this research is to study the effects of oil dispersants on reproduction and stress in Daphnia magna. One day old D. magna were introduced to the oil dispersant, Dispersit SPC 1000, at five different concentrations for twenty one days in individual beakers. Over the twenty one days the number of offspring produced by each D. magna was recorded and also the number of casualties. Oil dispersant exposure induced statistically significant decreases ($p < 0.05$) in total reproductive output per parent. The highest number of average D. magna produced per day was 2 2 in the control and the lowest was 0.6 in the 0.1 ppm. However, there were no statistically significant changes in reproductive rate over time or cumulative mortality Stress is currently being assessed by measuring D. magna heart rate after exposure to various concentrations of the oil dispersant. D. magna under 60X magnification are being videotaped for 15 seconds and heart rate counted during slow motion playback.

PCR mediated, site-directed mutagenesis of the FMN riboswitch of Photorhabdus luminescens and the effect on symbiosis with Caenorhabditis elegans

Kelsey Penland*, Guilford College

Riboswitches are non-coding RNAs that regulate the expression of downstream genes through metabolite-binding induced secondary structures. Bacterial riboswitches to regulate key metabolic pathways, and so are a potential targets for the development of novel metabolite analogs antibiotics. This study uses PCR-mediated, site-directed, mutagenic recombination to deactivate the FMN riboswitch either in the "on" (constitutive expression) or "off" (suppression) position in Photorhabdus luminescens. The FMN/FAD metabolic pathway is controlled by the binding of riboflavin to the FMN riboswitch upstream of the rib operon. P. luminescens is an insect predator, that has a complex symbiotic relationship with soil nematodes. Upon insect invasion by a nematode harboring P. luminescens, the bacteria are released, multiply and release virulence factors that kill the insect, and so provide nutrients for the host nematode. Using the P. luminescens and Caenorhabditis elegans model, this research will investigate the effect of FMN riboswitch activity on this symbiotic relationship. Site-directed mutagenic products have been assembled and preliminary virulence studies indicate the predation of C. elegans by P. luminescens, suggesting that the symbiosis of these organisms is more complex than has been recognised.

Peptide binding affinity of the rheumatoid arthritis susceptibility allele HLA-DRB1*0401 through molecular dynamics simulation

V. Claire James, Michael Terribilini, Department of Biology, Elon University

Rheumatoid arthritis (RA) is an autoimmune disease characterized by chronic swelling and stiffness of joints and affects up to 1% of the US population. Like other autoimmune diseases, RA is caused by an adaptive immune response against self-tissues. The adaptive immune system normally functions as a specialized line of defense, recognizing pathogens and remembering them for future encounters; however, in autoimmune diseases, white blood cells mistakenly identify normal body tissues as foreign and begin to attack. Certain HLA-DRB1 alleles of MHC class II proteins have been associated with greater susceptibility to RA. The peptide binding affinity of these alleles has been studied in order to characterize their role in the immunopathogenesis of RA, however, little molecular dynamics data has been generated for these interactions. We modeled binding of the RA risk allele HLA-DRB1*0401 (DR4) with the immunodominant peptide (CII263-270) and used molecular dynamics simulations to predict the molecule's binding affinity We performed both peptide-bound and unbound simulations of the DR4 molecule and quantified molecular movement by calculating root mean square fluctuation (RMSF) of each residue. Thus far, we've found DR4 to be stabilized by peptide binding and to show a similar binding pattern to a related risk allele HLA-DRB1*0101 (DR1). We also ran a series of simulations in which each of the 9 residues of the CII peptide was individually mutated to alanine and calculated RMSF. From this, we expect to identify key areas for binding on the DR4 allele and to see marked changes in the peptide's binding affinity.

Pollinator limitation in the endangered sunflower, Helianthus schweinitzii

Britney Phippen*, Department of Biology, Queens University

Native to the piedmont of North and South Carolina Helianthus schweinitzii, commonly named Schweinitz's sunflower, was added to the endangered species list in 1991. The effectiveness and frequency of pollinators may have contributed to the decline of this once plentiful flower in the prairie fauna. In this experiment, the effects of hand-pollination verses open pollination were examined as well as observational trends of pollinators. Six 1x1 meter plots were flagged off at Redlair in Belmont, NC and three plots were open pollinated while the other three were hand pollinated once a week from the time flowers bloomed until seeds had fully formed. Fifteen seed heads were collected from each plot and tested for durability using a metal probe and dissecting microscope. Observation of pollinators occurred at Redlair and Latta Plantation both of which had healthy populations of the flower. The results showed a significant difference between plots that were hand-pollinated and plots that were open-pollinated only. On average, 91.48% of total seeds were viable in hand-pollinated plots compared to 73.37% in open-pollinated plots. Trends in pollinators included limited amount and types of pollinators, sporadic visitation rates and ineffective motility by the pollinators for effective pollination of the flowers. These observations support the results of the pollination experiment, that inadequate natural pollination may result in lower seed set than that for which the plants are capable.

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Preliminary assessment of the dietary habits of red imported fire ants (*Solenopsis invicta*) in southeastern North Carolina using stable isotopes

Lisa Kelly, Lee Phillips and Stephen A. Macko , Department of Biology, UNCP; Department of Geology and Geography, UNCP; and Depart-

Stable isotopes of carbon and nitrogen ($\delta^{13}C$ and $\delta^{15}N$) are commonly used to investigate the dietary habits and trophic relationships of consumers. We report initial efforts to quantify diets of invasive, red imported fire ants (*Solenopsis invicta*) from 'natural' and disturbed areas in southeastern North Carolina. Ants and vegetation were collected during August and October of 2009 from colonies occupying two Carolina bays (Antioch and Goose Pond Bays) supporting native vegetation and from colonies occupying disturbed landscapes. Carbon and nitrogen isotopic ratios were measured from dried, whole body samples and representative plant tissues. Vegetation sampled from each location represented a mix of C3 and C4 plants, with the exception of C3 domination in Goose Pond Bay. Carbon was highly variable between plants and ants from each location. The $\delta^{13}C$ values for ants indicate a diet dominated by C4 plants in all locations except Goose Pond Bay, where diets were clearly C3 (averaging ~ -25 ‰). Nitrogen isotope values for fire ants suggest a mixed diet incorporating the dominant plants of each site. An enrichment of the $\delta^{15}N$ composition in ants is noted between the summer and fall sampling efforts. This study is ongoing.

Population dynamics of a seed shrimp (*Crustacea: Ostracoda: Cypria sp*) and its association with an ectocommensal Protozoan (*Ciliphora: Peritricha: Lagenophryidae: Lagenophrys sp*)

C Ritchey* and D. Judge. Gardner-Webb University, Boiling Springs, NC 28017.

In an ongoing study of a seed shrimp (*Cypria sp*) and an ectocommensal protist (*Lagenophrys sp*) found in a pond on Gardner-Webb's campus, we continue to observe the biology and population dynamics of each organism. This *Cypria sp* is a free-swimming planktonic species found in the photic zone; individuals have been kept alive in beakers for up to three weeks. We have been unable to culture pure seed shrimp specimens with the purpose of introducing *Lagenophrys sp* in order to study its life cycle, as very few *Cypria sp* are found without the ectocommensal attached. *Cypria sp* populations sampled with a plankton seine have declined each November for the past three years with only a few (1-4 individuals) being found until mid February when samples have contained hundreds. Adult male *Cypria sp* specimens have been found in February, suggesting that they overwinter as full instar adults. *Lagenophrys sp* have been found on *Cypria sp* specimens throughout the year. Stratified sampling at various depths is planned with a Van-Dorn-style bottle sampler (1 L). We have examined filtering options to better observe dilute samples of *Cypria sp* in relatively large 1 L volumes. Finer filter paper clogged readily and coarser ones (Whatman #5) allowed for thorough filtering, but specimens became imbedded in the matrix of the filter paper We have decided to process the Van-Dorn samples by the contents through a plankton seine, which concentrates plankton in a 40 mL or smaller tube.

Preparation of Prostate Cancer Specific BEZ235 Analog PI3 Kinase Inhibitors

Seth Bernstein and Dr Mark Welker, Department of Chemistry, Wake Forest University

Prostate cancer is considered to be the second leading cause of death in American men. Clinical research data has indicated that prostate cancers predominantly use PI3 kinase (PI3K) signaling for their growth and survival, a finding that has led to the discovery of many PI3K inhibitors as well as the importance of PI3K signaling in cancer. Research has indicated that the PI3K pathway is one of the most active for signaling in cancer cells, resulting in the mutation or augmentation of its constituents, and it is responsible for these cells' metabolic activity, growth, proliferation, survival, and angiogenesis. In my portion of Dr. Welker's PI3K inhibitors project, we are synthesizing imidazo[4,5-c] quinoline analogs of BEZ235 with oxygen or nitrogen linkers (CH2OH or CH2NH2) that can attach to prostate-specific antigen (PSA) cleavable peptide sequences. By synthesizing PI3K inhibitors linked to the peptide sequence that is recognized and cleaved by PSA, we hope to disable malignant prostate cancer cells' ability to offset apoptosis, which would allow for the specific termination of prostate cancer cells.

Proteomic analysis of metamorphosis in the hydroid, Hydractinia symbiolongicarpus

Erin E. Witalison* and Constance Rogers-Lowery, Catawba College, North Carolina Research Campus

Hydroids, similar to other members of the phylum Cnidaria, possess a complex lifecycle involving the metamorphosis of a planula larva into a primary polyp (the adult form). After metamorphosis, the primary polyp will undergo clonal expansion to form a colony of genetically identical polyps, with different morphotypes that specialize in feeding, defense, or reproduction. The hydroid Hydractina symbiolongicarpus has been the subject of extensive research concerning the biochemistry of their developmental processes, including examining the roles of a few proteins of interest. However, no research has attempted to look at the entire proteome and changes that may occur during development and metamorphosis. The objective of the current project was to develop and evaluate techniques for isolating proteins to be subsequently analyzed by mass spectrometry. Proteins extracted using various protocols, kits, and instrumentation were analyzed and compared. Additionally, protein quantitation of the study samples, gel electrophoresis for study quality control, and protein digestion were performed. Mass spectrometry method will be utilized to analyze the samples and detect peptide patterns within the sample. Ultimately, the technique developed will be used to study the proteome of Hydractinia at different stages of development and discover which proteins are at different levels in each stage.

Provisioning of chicks by Leach's Storm-Petrels: Preliminary insights into energy content, lipid content, and contaminants of stomach oils

S.A. Camilleri* (1), H.N. Koopman (1,2), A.J. Westgate (1,2), D. Gannon (3), and R. Mauck (4) , 1. Biology & Marine Biology, UNC Wil-

Many adult Procellariiformes provision their chicks with oils extracted and concentrated from the prey they consume. This contrasts with most seabirds, who supply chicks with whole prey. The "oil" strategy is considered adaptive because chicks are provided with relatively higher energy lipids to better sustain them between parental foraging trips. Consequently, chicks may be ingesting higher concentrations of halogenated lipophilic contaminants than if they ingested whole prey. Our goal was to evaluate the "oil" strategy by determining the energy content, lipid composition and organic contaminant concentrations in stomach oils of Leach's storm-petrels (LHSPs; Oceanodroma leucorhoa) from the Bay of Fundy, Canada and compare these with similar measurements from whole prey items. Measured energy content of stomach oils were high (35.18 kJ/g ±6.86 for adult oil, n=27) compared to wet weight values for potential prey items (herring 7.5 kJ/g; copepods 6.3kJ/g) suggesting that stomach oils are a significantly concentrated form of energy The lipid class composition of adult oil (n=34) varied across individuals, providing the first information that there is dietary variation during chick provisioning. Preliminary contaminant analyses of adult stomach oils (n=30) revealed ΣPCB levels ranging from 91–1510 ppb (mean 523, SD=425) and ΣDDT levels ranging from 31–801 ppb (mean 269, SD 216). These average values are higher than published values for zooplankton collected from the same area (ΣPCB 114-241 ppb, ΣDDT 14-23 ppb), suggesting that stomach oils concentrate contaminants; consequently chicks may be receiving oils with enhanced organochlorine concentrations compared to whole zooplankton and other prey items.

Rana sylvatica froglet fitness when reared in the non-lethal presence of a predator

Amy N. Wagner* and Dr. Louise M. Weber, Warren Wilson College

Numerous studies have illustrated that Wood Frog (Rana sylvatica) tadpoles exhibit phenotypic plasticity when reared in the non-lethal (caged) presence of predators. My objective was to determine if morphological changes occurred in froglets reared with Eastern Pondhawk (Erythemis simplicicollis) dragonfly nymphs, and if so, whether jumping ability was affected. I hatched 90 Wood Frog tadpoles from three unrelated egg masses. I then reared them in a greenhouse within six mesocosms, of which three were treatment mesocosms containing one caged predator each, and three were control mesocosms, containing zero predators each. There were 15 tadpoles in each mesocosm. I collected measurements of tadpole body length and tail depth to assess larval morphology I also collected measurements of froglet body width, hindlimb length, and forelimb length to assess froglet morphological differences. I then tested froglet jumping distance and jumping speed. I analyzed my data using two-sample t-tests and found that tadpoles raised with nymphs had significantly deeper tails than those raised without nymphs. However, no directionally-significant differences ($p>0.05$) were found for froglets in the experimental group versus the control group for any of the variables. This suggests that Rana sylvatica tadpoles may not exhibit lasting morphological phenotypic plasticity when reared in the presence of Erythemis simplicicollis, which was not a voracious predator. These results provide a greater understanding of phenotypic plasticity as it relates to Rana sylvatica, which may then be extrapolated to other anurans. Such knowledge may be useful in conservation, should amphibian populations worldwide continue to decline.

Rhizome propagation of Galax (Galax urceolata) using waste product from commercial harvest operations

Laurel Ann Thwing*, David Ellum, Amy Boyd, Warren Wilson College

Galax urceolata is an evergreen ground cover endemic to the Appalachian Mountains, occurring mostly in the mountains of North Carolina and Virginia. Galax is a valuable, wild-harvested non-timber forest product that is used in floral arrangements. Profits from this plant range between 10 to 30 million dollars annually in Western North Carolina. Within the past ten years, demand for galax has increased and harvest techniques have changed. Because of these factors, populations have been significantly impacted within public and private lands. There is little known about the growth and propagation of this plant. With more information, local industry could be sustained and native populations restored. The objectives for this project are to establish successful and sustainable propagation methods using rhizomes salvaged from commercial harvest operations and to make recommendations to sustain local industry. Three different treatments were applied to three groups of rhizomes: no treatment, a water soak and gibberillic acid (GA-3). These rhizomes were planted in two different soil compounds: soil harvested from Warren Wilson College and compound using synthetic materials. Data was collected of vegetative success, leaf count, petiole length, chlorophyll fluorescence, specific leaf area and root to shoot ratio. A two-way ANOVA was used to analyze the data. There was a significant difference in leaf count between GA-3 and the other two treatments. There was also a significant difference between soil type. For petiole length, there was a significant difference between the means of all three rhizome treatments and no difference between soil type. For chlorophyll fluorescence, there was a significant difference between GA-3 and no treatment rhizomes, but no difference between H2O.There was also a significant difference between soil treatments. There was no significant difference anywhere for specific leaf area. These applica-

Salamander Populations and their Habitat Feature Associations in Urban Woodlands

Nicholas Forman* and Lynn Moseley, Department of Biology, Guilford College

Anthropogenic activities, from development to conservation, have been shown to have varying effects on salamander abundance and population density (Dorcas and Willson 2003, Orser and Shure 1972). I conducted a survey of salamander species in two urban locations to examine the species composition of salamander populations and the macroand micro-habitat features associated with their presence. Preliminary data for this study suggests that species-specific distribution varies between the Two-Lined Salamander, *Eurycea cirrigera*, and the Northern Dusky Salamander, *Desmognathus fuscus fuscus*, according to forest community type. Additional data will be collected across transects investigating micro-habitat features, as well as macro-habitat characteristics such as proximity of transects to streams and land use history. Through an understanding of the distribution of salamander populations in relation to habitat features, conservation efforts can identify the vulnerability of species and the necessary habitat components for maintaining a population. The sites chosen for this study reflect a gradient of habitats including old-growth forest, heavily impacted sections of stream, and rehabilitated streams. Thus, from our results, the response of salamander populations to restoration efforts and other human impacts can be better understood.

Seeding Postdoctoral Innovators in Research and Education (SPIRE)

Michael J. Bruno1,2, Brian Rybarczyk1, Leslie S. Lerea1, P.K. Lund1 and Linda Dykstra1, 1SPIRE Postdoctoral Fellowship Program, Univer-

Seeding Postdoctoral Innovators in Research and Education (SPIRE) is an integrative postdoctoral fellowship program that combines research training, professional development and hands-on teaching experience. This NIH-funded program involves a partnership between the University of North Carolina at Chapel Hill (UNC Chapel Hill) and Minority Serving Institutions (MSIs) in North Carolina. The objective of the program is to prepare SPIRE scholars for academic careers and to have a lasting impact at the MSIs through the exchange that takes place as the postdoctoral scholars teach science courses and interact with faculty and students. During the three-year fellowship, SPIRE scholars engage in cutting-edge research at UNC Chapel Hill, develop core professional skills, learn pedagogical skills from education professionals, and participate in workshops to bring technology into the classroom. This training, combined with a mentored teaching internship at SPIRE's partner MSIs, provides SPIRE scholars with a strong foundation in independent research and undergraduate education. At the MSIs, SPIRE scholars bring active learning techniques into the classroom, develop advanced-level courses, and design problem-based learning and research -based courses. SPIRE scholars often teach special topics courses that would not otherwise be offered at the MSIs, advancing the frontiers of undergraduate education in the sciences. Other SPIRE scholars work within an established curriculum to develop course-specific innovations that can be sustained at the MSI after the internship has ended. The result is a synergistic relationship that advances undergraduate education at the MSIs and prepares SPIRE scholars to be research-oriented educators and committed mentors for students in the sciences.

Selective modulation of the endocannabinoid system for targeted protection in kainic acid models of excitotoxicity

Vinogran Naidoo[1], David A. Karanian[3], Spyros P Nikas[2], Johnathan R. Loclear[1], Emily Graves[1],
JodiAnne Wood[2], Alexandros Makriyannis[2], and Ben A. Bahr[1-3]
[1]Biotech. Research Center, University of North Carolina Pembroke, Pembroke, NC 28372.
[2]Ctr Drug Discovery, Northeastern University, Boston, MA 02115
[3]Dept. Pharm. Sci , University of Connecticut, Storrs, CT 06269

The endocannabinoids anandamide (AEA) and 2-arachidonoylglycerol (2-AG) have been implicated in neuroprotective responses against excitotoxic events linked to seizure activity and associated neurodegeneration. Related to such responses to injury, excitotoxic kainic acid (KA) injections increase AEA levels in the brain. To study the modulation of this response *in vitro* and *in vivo*, we utilized new-generation compounds (AM5206 and AM6702) that selectively inhibit the AEA deactivating enzyme fatty acid amide hydrolase (FAAH), as well as a dual inhibitor (AM6701) that blocks FAAH and the 2-AG deactivating enzyme monoacylglycerol lipase (MAGL). AM5206 protected against the KA-induced degenerative cascade in hippocampal slices assessed 24 h post-insult. Cultured slice data also suggest AM6701 elicits more protection than AM6702 by ameliorating cytoskeletal breakdown and declines in synaptic markers and neuronal integrity. *In vivo*, KA administration induced seizures and the same neurodegenerative events exhibited *in vitro*. Protection by AM5206 and AM6701 was evident with respect to cytoskeletal damage, pre- and postsynaptic markers, seizure scores, and behavioral deficits. Our study has identified and characterized new-generation inhibitors of endocannabinoid-degrading enzymes to enhance cannabinergic signaling, and in turn prevent excitotoxic progression that cause brain damage.

Shell Morphology and DNA Sequencing of Disperse Populations of Corbicula fluminea in North Carolina

Roberta Smith-Uhl* and Francie Cuffney, Biological Sciences, Meredith College

This study is part of continuing research on the Asiatic clam Corbicula fluminea. Populations of C. fluminea found in Wake County and Franklin County show visible differences in shell morphology. SEM imaging was used to examine fine structure for comparison of shells from the two populations. A subsequent study was developed to examine whether the species exhibit significant differences in DNA. If there is a difference between populations, then a classification of the North CArolina species could be pursued. Evaluation of literature indicated that information on bivalve genomes is typically based on extraction of mitochondrial 18S rRNA sequences and 18S ribosomal RNA genes; partial sequence. The procedure used for nucleic acid extraction followed a protocol using the Promega Corporation; Kit protocol. The protocol is specific for mouse tissue and was modified for use in bivalves. DNA was successfully extracted from whole clam homogenate. Contamination by gut contents was taken into account as a factor for whole clam DNA isolate. Further experiments are being done with individual tissue samples, specifically gill tissue, to negate potential contribution of contaminant DNA.

Siderophore-mediated environmental trace metal cycling: Roles in iron and manganese biogeochemistry

James M. Harrington and Owen W. Duckworth, Department of Soil Science, North Carolina State University

All organisms require metals to support a range of essential biological processes. These metals are generally present in the environment in nonbioavailable forms, necessitating the use of special mechanisms for solubilizing the metals. One metal that is particularly important is iron, which plays a central role in biological processes ranging from electron transfer reactions to small molecule transport. Iron is highly insoluble and is generally found in the environment in the form of goethite and hematite. One mechanism developed mainly by bacteria, plants, and fungi for obtaining iron from the environment involves the production of small molecules called siderophores that are released into the environment to solubilize the metal, return it to the cell and facilitate its uptake by the organism. While siderophores are generally viewed as primarily iron chelating molecules, recent evidence has shown that manganese may interfere with iron uptake by siderophores due to extremely stable chelation of manganese(III). The high thermodynamic stability of siderophores for chelating manganese(III) will be related to the iron(III) chelating properties of the molecules and the role of siderophores in environmental trace metal cycling, and some examples of manganese-siderophore complexes will be discussed in relation to their role in manganese cycling in the environment.

Synaptopodin-2 expression and localization in undifferentiated and differentiated HT29 Colon Cancer

Thalhamer S., Shortt K., Schmidt M., Chalovich J., and Scemama J.L., Department of Biologyand Department of Biochemistry, Brody School

Synaptopodin-2 is an actin-binding protein commonly found in brain, kidney, and skeletal muscle tissues in mammals. It binds to and causes rapid polymerization of G-actin, a protein essential in many cell functions. Synaptopodin-2 can also associate with a number of other proteins, such as myosin, calmodulin and □-actinin. Association with □-actinin is thought to promote the translocation of synaptopodin-2 from the cytoplasm to the nucleus, where it is involved with the chromatin-remodeling complex and therefore transcriptional activity. In prostate and bladder cancers, the synaptopodin-2 gene is either deleted or hypermethylated.
The goal of this research project is to analyze the expression of synaptopodin-2 in differentiated and undifferentiated colon cancer cells (HT29) in culture. As a result of alternative splicing, synapotopdoin-2 exists in three different forms. By performing qRT-PCR, I plan on determining the expression level of each isoform, in proliferating and differentiated HT29 cells. My hypothesis states that synaptopodin-2 will have a different expression pattern in proliferating HT29 cells as compared to differentiated cells. I am also predicting that the location of synaptopodin-2 will vary during phases of the cell cycle for differentiated and undifferentiated cells. To test these hypotheses, HT29 cells, will be fixed at different stages of the cell cycle. The localization of synaptopodin-2 will be analyzed by immunofluorescence using isoform specific antibodies. We hope to confirm a pattern similar to other cancers as this will help to understand the role of synaptopodin-2 in oncogenesis.

Synthetic Efforts Towards an Azide-bearing SAM Cofactor Mimic

Charles E. Hendrick*, Lindsay R. Comstock, Department of Chemistry, Wake Forest University

DNA methylation plays an important role in healthy cellular function, serving as a binary switch to manipulate gene expression as well as a natural defense against viral DNA. Flaws in this mechanism have been linked directly to carcinogenesis and the development of other cellular diseases. In order to develop a biochemical tool which could broaden our knowledge of this process, our research focuses on the synthesis of an S-adenosyl-L-methionine (SAM) cofactor mimic containing an aziridium precursor. The goal of this mimic is to promote the addition of an entire molecule of the cofactor on to the target DNA. The proposed SAM cofactor mimic also contains an azide functionality on the adenine base which serves as a ligatable handle for post-translational chemistry, such as a Staudinger ligation or "Click" Chemistry. We hypothesize that this will allow for identification and isolation of methylation sites with more precision than is offered by existing methods. Synthesis of the target molecule must be achieved in order to test the viability of the cofactor mimic as a tool for identifying sites of DNA methylation. Proposed here is our synthetic route towards the final cofactor mimic. Thus far, this pathway has permitted the synthesis and characterization of all intermediates up to and including the penultimate step. The final multi-step reaction is currently being explored to obtain optimal yield and purity for its future biological evaluation as a probe of DNA methylation.

TEMPERATURE-DEPENDENT RELEASE OF A MODEL DRUG FROM FERROELASTOMERIC MICROSPHERES FOR THE PURPOSE OF TARGETED DRUG DELIVERY

Julie C. Ronecker*, Dr. Benjamin A. Evans, Department of Biochemistry, Department of Physics, Elon University

As an alternative to surgical resection and radiation, magnetic drug delivery is a viable method utilized to target and control the spread of malignant cells in the body. In a typical implementation, nano-scale magnetic particles would adsorb a drug and then be directed via external magnetic fields to specific regions of the body (Meyer et al., 2001). We present in this work a novel polymeric magnetic microsphere composed of iron oxide nanoparticles that are complexed with poly(dimethyl siloxane). These spheres can absorb a drug throughout their volume, leading to a greater carrying capacity; in addition, their unique hydrophobicity may make them particularly suited for transporting lipophilic pharmaceuticals. We demonstrate the ability of these new microspheres to absorb rhodamine dye as a drug model and use UV-VIS spectroscopy to quantify the amount of rhodamine released from the microspheres over time. Anticipating in-vivo heating of the microspheres via radio-frequency magnetic stimulation, we measure the drug concentration leached (g/L of rhodamine) over a period of two hours at room temperature and across a range of physiologically-relevant temperatures: 20°C, 25°C, 37°C (body temperature), 40°C, 43°C, 46°C, and 49°C. We show that the rate of drug release increases with temperature, suggesting magnetic heating as a mechanism for triggering drug release in a targeted system.

TERATOGENIC POTENTIAL OF CAFFEINE THROUGHOUT THE EMBRYONIC DEVELOPMENT OF THE ZEBRAFISH, DANIO RERIO

Kyla M. Jacobs*, Jeff Holmes, Warren Wilson College

The zebrafish (Danio rerio) is used extensively as a vertebrate model organism to study biological processes in vivo. There are many advantages to using zebrafish as a model for vertebrate development such as: high fecundity, rapid ex utero development, and transparent embryos. Previous studies showed that zebrafish larvae exhibit shorter body lengths, misalignment of muscle fibers and motor neuron defects after exposure to caffeine. The objective of this study is to determine whether larval body length defects, caused by caffeine, are dependent upon the embryonic stage of exposure. Treatment groups were continuously exposed to caffeine (150 ppm) for either 0-24, 24-48, or 0-48 hours post-fertilization (HPF). All body length measurements were made at 48 HPF. Results indicated no significant difference in mean body length (99% CL, $P > 0.05$) between the 0-24 HPF treatment group and the control (0 ppm) group (0-24 HPF: 2.72±0.08 mm, n=21; compared to control: 2.73 ± 0.07 mm, n=30). Similarly, embryos exposed to caffeine from 24-48 HPF exhibited no significant difference in mean body length compared to embryos exposed from 0-48 HPF (24-48 HPF: 2.3±0.1 mm, n=23; compared to 0-48 HPF: 2.3±0.1 mm, n=24). All other combinations among treatment groups indicated significant differences between mean body lengths, $P < 0.001$. This research suggests that caffeine alters one or more biological mechanisms that occur between 24-48 hours post-fertilization, rather than the effects of caffeine being duration dependant, as previously thought.

Testing genomic regions for their effect on aging in honey bee workers

Luke Dixon, Department of Biology, University of North Carolina at Greensboro

Across all species, lifespan is determined by a combination of environmental and genetic factors. Many genes have been found to influence aging in model organisms. However, in honey bees (Apis mellifera) little is known about the genetic architecture of lifespan. The age of first foraging and foraging specialization of honey bee workers is known to affect their life expectancy. Quantitative trait loci (QTL) mapping has revealed several loci that affect worker foraging behavior. These regions and several other loci, that were selected based on preliminary evidence, were tested for their effect on the lifespan of honey bee workers. We genotyped microsatellite markers in these regions to compare the allelic distribution between young and old worker bees. We will present our results and discuss them in the broader context of the pollen hoarding syndrome and lifespan determination in honey bees.

Testing the utility of introns to resolve the phylogenetic relationships of closely related salamander taxa.

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Christopher Hadley, Katherine Braden, Nasser Nahshal, Christopher Moss, David Beamer

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Mitochondrial DNA has been utilized extensively to reconstruct the evolutionary relationships of numerous taxa. One of the great strengths of using mtDNA for inferring evolutionary history is that this marker is characterized by high substitution rates. However mtDNA is also inherited as a single locus, this fact combined with its maternal mode of transmission can lead to recovered histories that differ drastically from other portions of the genome. In order to independently test hypotheses generated by mtDNA we have targeted introns. Since introns are not coding they should not be under strong selection and evolve at a higher rate than other areas of the nuclear genome. Salamander genomes are enormous and have likely been duplicated several times, as a result many nuclear regions may exist as multiple copies which presents difficulties in obtaining sequencing and for analyzing the resulting data. Here we present some of the findings from our ongoing efforts to develop variety of nuclear encoded markers.

The Drosophila melanogaster Proboscis Extension Response as an Assay for Chemesthesis

Joseph M. Hester*, Wayne L. Silver, Erik C. Johnson, Department of Biology, Wake Forest University

Chemesthesis, the sensation of irritation caused by chemicals, is linked to the trigeminal nerve innervating the nasal and oral cavities, and is an essential defense mechanism against harmful chemical irritants. Transient receptor potential (TRP) channels are among those receptor proteins responsible for chemesthesis. In particular, TRPA1 channels mediate responses to a number of pungent environmental compounds such as AITC, the active ingredient in wasabi. In the fruit fly, Drosophila melanogaster, the pain gene is responsible for the expression of TRPA1 channels. The present experiment tested flies with the wild-type pain allele that express TRPA1 channels and "painless" mutants which lack expression. The proboscis extension reflex (PER) assay was used to measure aversion to ten chemical irritants. The PER assay involved exposing fruit flies to a 10mM solution of the irritant in a 1% sucrose solution. The solution was applied to the tarsi (legs) of the flies and it was noted whether or not the proboscis extended in order to consume the solution. Thus, proboscis extension indicated attraction to the chemical while a lack of extension indicated the irritant had an aversive effect. The response to the irritant was compared with the response to a 1% sucrose solution in both wild-type and painless flies. We hypothesized that wild-type flies would demonstrate suppressed PER when exposed to compounds for which TRPA1 is a receptor, while painless flies would show no suppressed PER. Results confirmed this hypothesis, indicating that flies behaved aversively when exposed to all ten of the chemical irritants tested.

The Effect of Compost Age on Germination and Growth Rate of Clemson Spineless Okra (Abelmoschus esculentus)

Amanda R. Withers, School of Natural Sciences, Lenoir Rhyne University

Compost as a soil amendment provides nutrients and organic materials for the growth of plants. The maturity of the compost plays an important role in determining its potential effect on germination, growth rate, nitrogen availability in soil and fruit production. Compost maturity refers to the stage of decomposition of remaining organic compounds. Less mature and immature composts can be identified by odors and has minimal to significant impact on soil nitrogen and limited to relatively high toxicity levels. Very mature compost represents the end of the composting process; it has minimal negative effects on plant development with no potential toxicity. Compost application had numerous effects on Clemson Spineless Okra (Abelmoschus esculentus) germination, plant height, root extent and number of fruit produced. Okra plants in very mature, or cured, compost grew the tallest, produced the most fruit, and had the lowest root to shoot ratio out of the okra in compost. Okra in the mature, or three month, compost had the highest root to shoot ratio, the longest root extent and the shortest plant height. Okra in the immature, or one week, compost produced the fewest fruits and was significantly different in plant height only from the okra in very mature compost. There were no significant differences in date of germination between trial 1 and trial 2 for any compost age ($P = 0.793$). No correlation between plant positioning, precipitation, pH and soil temperature were found to affect plant growth.

The Effect of Japanese Honeysuckle (Lonicera japonica) Extracts on Percent Germination and Radical Lengths of Lettuce Seeds (Latuca sativa)

Elisabeth M. Campbell*, School of Natural Sciences, Lenoir-Rhyne University

Allelopathy is the plant world's version of chemical warfare. Plants are capable of releasing chemical compounds, known as allelochemicals, into the soil or transferring them to other plants through dew drops. Known allelopaths are black walnut trees (Juglans nigra) and tree of heaven (Ailanthus altissima). One known allelochemical is juglone, found in black walnut trees. Japanese Honeysuckle (Lonicera japonica) is a fragrant, invasive perennial vine that competes physically for the resources around it. Does it also compete chemically? Other researchers have reported five potential allelochemicals in the leaves of honeysuckle. Germination experiments were carried out to test the effect of extracts from Japanese honeysuckle leaves, roots, and stems on lettuce seeds (Lactuca sativa). Percent germination was recorded for four days and on day four, radical lengths were measured. Further germination experiments were carried out to test the effects of three potential allelochemicals found in honeysuckle leaves; 3,4-dihydroxybenzoic acid, coumaric acid, and caffeic acid. Leaf, root and stem extracts all had a significant effect ($p=.001$) on the radical length of lettuce seeds. High performance liquid chromatography (HPLC) was used to test for the presence of three potential allelochemicals and their relative concentrations in the leaf, root and stem extracts.

The effect of predation risk and food abundance on egg-laying behavior of the mosquito Aedes albopictus

Gideon Wasserberg, Laura White, Allison Bullard, Jon King, Savannah Jackson, Roberta Maxwell, Department of Biology, University of North

Gravid female mosquitoes are expected to lay their eggs in sites containing sufficient food for their progeny and avoid sites containing larval predators. Studies have addressed the effect of predators and food separately but only few have addressed their combined effect. As part of a class project in the course "Ecology of infectious diseases", we conducted a field experiment in which we evaluated the effect of the presence of larval predator (a caged dragonfly nymph) and four levels of larval food on the oviposition behavior of Aedes albopictus females. Using oviposition traps (black plastic cups containing a seed germination paper and filled two-thirds with water), we deployed the eight treatment combination along 6 replicate transects. Treatment location was randomized and rotated weekly within transects. Experiment was conducted during 5 weeks (late August – early October) at Peabody Park within the University of North Carolina at Greensboro campus. Every week, treatments were applied to the cups and left for 5 days after which germination papers were collected and brought to the lab. In the lab, eggs were counted and then reared to adulthood for species identification. All hatched adult mosquitoes belonged to the species Ae. Albopictus. As expected, female mosquitoes laid more eggs in predator-free traps and exhibited positive correlation with respect to food abundance. In addition, a significant edge effect was observed with lower number of eggs laid at the forest edge. Similar slope but different intercepts suggest that food and predation risk affect oviposition choice independently of one another

The Effectiveness of Removing the Activating Calcium Ion with Different Salts in Photosystem II

Rachel Reed*, and Alice Haddy, The Department of Chemistry and Biochemistry at the University of North Carolina at Greensboro

Photosystem II (PSII) is a protein complex in higher plants which produces molecular oxygen from water at a manganese cluster (Mn4Ca) through a series of catalytic steps coupled with the absorption of light. It has been known that calcium (Ca^{2+}), in addition to chloride (Cl^-), is required for oxygen evolution. It has been shown that Ca^{2+} can be removed from the Mn4Ca using a mildly low pH (pH 5.5), in addition to moderately high sodium chloride (NaCl) concentration (150-200 mM). Through oxygen evolution assays, the effectiveness of removing Ca^{2+} with a comparison of different salts including NaCl, potassium chloride (KCl), and tetramethylammonium chloride (TMACl) was studied. Experiments were performed measuring oxygen evolution rates at pH 5.5 at various salt concentrations. Results showed that moderately high KCl concentration was more effective at decreasing activity than NaCl, by 10% or more at all concentrations. Also, TMACl was found to decrease activity more than NaCl (by 5-13%), but not as much as KCl. On the other hand, low TMACl concentration (20 mM) has about the same effect on activity as 20 mM NaCl (79% active). With the addition of Ca^{2+} to intact PSII samples in various KCl concentrations, it was noted that the oxygen evolution rate decreased (e.g. 25% in 15 mM Ca^{2+} at 75 mM KCl). These results support the proposal that the Ca^{2+} ion is displaced by a second ion. (Supported by a grant from the NSF and the UNCG Office of Undergraduate Research)

The Indentation Size Effect in Fused Silica and Crystalline Quartz

Richard C. Bradt and Lei Zhang , Chemistry Department, Winston Salem State University

The Indentation Size Effect (ISE) in Fused Silica and Crystalline Quartz were measured by both Knoop and Vicker indenters and that both exhibit a crossover for the different indenters at about the same indentation load. The crossover can be explained by the ratio of the (surface area/indentation volume) from the geometries of the two indenters.

The Investigation of an Alternative Means to Probe Kinase Function using an Azide-bearing ATP Analog via a Chemoselective Ligation

Elizabeth J. Carrow*, Lindsay R. Comstock, Department of Chemistry, Wake Forest University

Phosphorylation is the most universal, and pivotal, post-translational regulatory mechanism which alters enzyme activity, cellular location, and association with other proteins. Over or under expression of kinases, which catalyze the phosphorylation reaction with adenosine triphosphate (ATP), have been linked to some cancers and neurodegenerative diseases. While research has been conducted to understand the pathways in which kinases function, we anticipate that the development of novel ATP analogs containing ligatable handles will lead to an alternate means to probe general kinase function in the cell through chemoselective ligations. Specifically, the work presented here relies on an analog of ATP functionalized with an azide, which is transferred along with the gamma phosphate to a model peptide for protein kinase A. Previous work from our lab has shown from a combination of HPLC and mass spectrometry analysis that phosphorylated peptide is generated, but the presence of the ligatable handle is still in question. Thus, subsequent ligation chemistry, particularly Click chemistry, is being explored to visualize the modified peptide. A bioanalytical methodology is currently being developed using pyrene-alkyne bioindicator tag to undergo the Huisgen [2+3] cycloaddition with the phosphorylation product. The progress towards the characterization of the modified peptide will be discussed.

The phenotypic characterization of halophilic archaeal isolates acquired from a salt brine located in Carlsbad, New Mexico.

Matthew B. Harrell*, David F. Sommerville, Caitlin L. Hall, Diana M. Norden, and Michelle S. Thomas, Department of Biological Sciences,

Experimentation on newly discovered prokaryotes is vital to the field of microbiology for the purpose of classification of new species. The organisms being researched are halophilic archaeal isolates, Isolate D and a mixture of organisms designated MEA. The purpose of this research was to determine optimal growth conditions and to phenotypically characterize these new species. The halophiles were grown in media containing 20% NaCl. Various concentrations of MgCl2 and pH intervals were used to characterize the isolates. Isolate D showed a narrow pH preference, growing at pH 6.8 and above but not at or below pH 6.0. Isolate D grew in a wide range of MgCl2 concentrations from 0.01 M to 1.0 M. The upper and lower pH limits and MgCl2 concentrations above 1M are being examined. Isolate D demonstrated growth in a wide temperature range between 8°C and 50°C, with no growth observed at 4°C. The range above 50°C is being tested. Growth in differential media was performed to phenotypically characterize Isolate D and MEA. When examining fermentation properties, supplementing the phenol red broth with NaCl did not permit growth. When differential media was supplemented with NaCl, MgCl2, CaCl2, and KCl, growth was observed. Nitrate broth modified in this manner also permitted growth, with organisms appearing to be nitrate reductase negative. Other testing revealed that the organisms were catalase positive and do not grow anaerobically. Screening for fermentation and growth on selective and differential media is currently being researched.

The Physical and Psychosocial Benefits of Strength Training for Women

Ashley Shilling, Dr. Melinda Harper, and Dr. Patricia Koplas, Department of Business Administration, Queens University of Charlotte; Depart-

Strength training is generally unpopular for women due to various misconceptions and traditional gender roles. Weight-bearing exercise is especially important for older women to counteract decreased estrogen levels and potential bone tissue changes like osteoporosis. The purpose of this study was to observe the impact of a weight training program on physical and psychosocial measures in a group of women over 30 years old with no lifting experience. Nine females completed a six-month weight training program consisting of two sessions per week. Eight exercises were provided targeting upper and lower extremity muscles. Physical variables include Body Mass Index and muscle strength. Psychosocial surveys were completed to measure self-esteem, perceived stress, mastery, and body satisfaction. Results indicated a significant increase in leg and back strength in experimental subjects following the six month exercise program. There was a small increase in BMI that approached significance which may be due to a relative increase in muscle mass from strength training. Perceived stress was significantly lower in subjects following program completion. Correlations between number of completed sessions and perceived stress and body image were significant. Stress was significantly correlated with mastery, body image, and self-esteem. Control subjects demonstrated no significant changes in psychosocial variables over the same six month interval. Statistical analyses were performed with an α level of 0.05. Experimental subjects experienced additional positive effects from the weight training program as indicated by their subjective comments. Research demonstrating physical and psychological benefits of exercise is extremely important to help promote healthy lifestyle choices.

The role of Cdt2 in Drosophila development

S. Catherine Silver Key (Grand Frommage is presenter) and Roketa Sloan (now at Duke University), Department of Biology, NC Central Uni-

Cell cycle regulation is a conserved mechanism from yeast to man. During S phase, once DNA replication has been initiated, it is important to assure timely removal of factors involved in initiation. Misregulation could lead to genomic instability, a hallmark of carcninogenesis. The Cdt2 protein has been shown to target cell cycle proteins for destruction by ubiquitination in a number of species. Disruption of the Drosophila Cdt2/l(2)dtl gene causes larval lethality and has been reported to cause genomic instability. To investigate the role of the Cdt2/l(2)dtl gene during development, we have mobilized transposable elements in two strains of flies creating both 1)rescue stains, that restore developmental progression through adulthood, and 2)deletion strains to use in ongoing studies. In collaboration with the Duronio at UNC-CH, we have found that deletion of the Cdt2 gene does not effect embryonic replication. The mechanism leading to lethality is in progress. In adult transheterozygous flies, we have discovered a male reduced fertility phenotype which is associated with altered Cdt2/l(2)dtl expression levels suggesting that the Cdt2/L2DTL protein is involved in spermatogenesis.

Under what environments is thermoregulation adaptive? Transplant experiments using Plantago lanceolata

Freddy O. Herrera* and Elizabeth P. Lacey, Department of Biology, University of North Carolina Greensboro

Climate change models predict a rise in surface temperatures in the range of 2-4°C by century's end. Thermoregulation, an example of phenotypic plasticity, has evolved as a possible response to climate change. What environmental pressures, however, make thermoregulation adaptive remain unanswered. One hypothesis, the selection intensity, states that thermoregulation evolves in thermally variable environments where there is a relatively high exposure to cool temperatures. My project will be the first manipulative experiment that tests this hypothesis. I will use Plantago lanceolata a perennial herb in two outdoor transplant experiments. Past research has shown that P. lanceolata can thermoregulate its reproduction (i.e. fitness via seed production) by changing floral reflectance and color of spikes in response to ambient temperatures. I will transplant 64 genotypes of thermoregulators (i.e. express high plasticity) and thermoconformers (i.e express low plasticity) into two different sites. These sites, Greensboro, NC and Mt. Lake Biological Station, VA, were chosen because they differ in temperatures. In the first experiment, clones of these genotypes will be transplanted at both sites to measure the natural timing of seed production. The second experiment, I will artificially induce clones of the same genotypes to produce "cool" phenotype spikes. Mixed model analyses of variance will be used to measure the effects of thermoregulation (i.e. low vs. high plasticity) and transplant site (i.e. cool vs. warm) on total seed production (i.e. fitness). Insights into what environments make thermoregulation adaptive will help our understanding of how organisms might cope with the expected temperature changes.

Understanding Adiponectin Expression: Sequencing the ADIPOQ Gene in European Americans

Elizabeth Killion*, Dr. Nicholette Allred, Dr. Donald Bowden, Department of Biology, Guilford College and Department of Biochemistry,

Adipose tissue is important for regulating the body's metabolism through the secretion of many proteins, including adiponectin. While the exact mode of action of adiponectin is not completely understood, it is known that obesity reduces the expression of this protein. Levels of blood plasma adiponectin are highly heritable, so it is likely that differences in adiponectin levels within populations can be explained by genetic variations such as single nucleotide polymorphisms (SNPs) in the ADIPOQ gene, the gene coding for adiponectin. Previous research found a rare genetic variant in the ADIPOQ gene in a population consisting of Hispanic American families. The SNP found was able to account for 17% of plasma adiponectin variance in Hispanic Americans studied. The purpose of this research is to detect rare variants in the ADIPOQ gene in forty-eight Caucasian individuals diagnosed with type 2 diabetes that have either significantly low or significantly high levels of blood plasma adiponectin. This technique is used in order to find SNPs in this population that would explain such extreme differences in adiponectin expression. Methods used include PCR amplification of the promoter, exons, and 3' untranslated regions of the ADIPOQ gene, direct sequencing of these regions, and visualizing data using Sequencher Software. No unique SNPs were observed in this population; however, fourteen previously recorded SNPs were noted. Two of these SNPs, rs2241766 (exon 2) and rs17366743 (exon 3), are located in translated regions of the ADIPOQ gene, and therefore, they may account for differences in adiponectin expression in this Caucasian population.

Use of Pteridine and Lipofuscin Fluorescence for Age Determination in Apis mellifera (Honey Bees)

Christina Kotraba, Lori Seischab, Christopher Coburn, Department of Biology, Western Carolina University

In 2006, honey bee colonies began to disappear in large numbers throughout the world. Despite extensive research, no specific cause has yet been identified. To understand the epidemiology of disease transmission both within and between honey bee colonies, a method for determining the age distribution within a colony is needed. Currently, there is no precise method for estimating the age of a honey bee. This is particularly challenging because honey bees are holometabolous insects, which means their body size is fixed at the time of pupal eclosion. We are investigating whether levels of tissue extractable lipofuscins and/or pteridines may be used to accurately predict honey bee age. These compounds are autofluorescent and have been found to accumulate in tissues over time in a variety of arthropod taxa.

Using molecular modeling to predict products of elimination reactions.

Alissa A. Gore*, D. Kahl, Warren Wilson College, Department of Chemistry

Three elimination reactions were studied for thermodynamic and kinetic control by both theoretical and experimental means. Each reaction involved a substituted cyclopentyl alcohol synthesized by a Grignard reaction. The alcohols were dehydrated to form a mixture of two isomeric cyclopentenes. The distributions of products were monitored by GC/MS with eight samples taken over a period of approximately two hours. Kinetic and thermodynamic control were observed in varying amounts. The results were compared with theoretical predictions made using the ab initio 6-31G* basis set.

Using the Design of Experiments (DOE) Technique to Optimize Pharmaceutical Tablet Formulations-A Study of Aspirin Drug Product Formulation

Morris Patton* and Andrew W. Steele, Department of Natural Sciences, Lenoir-Rhyne University

The most common formulation type for pharmaceutical products is the tablet formulation. The tablet formulation process has unique challenges in that in almost all cases, the active drug ingredient (API) cannot be used by itself to make a tablet with acceptable physical characteristics, such as disintegration rate and hardness. Excipients must be added to the API in order to produce a usable tablet. Two common excipients used in many tablet formulations are micro-crystalline cellulose, which functions as a binder, and talc powder, with acts as a lubricant for tablet release from the tablet press. The challenge in the formulation of pharmaceutical tablets is in determining the optimal composition of the tablet in terms of excipients and API that will produce the desired physical characteristics for the tablet.

In this study, the Design of Experiments (DOE) method was used to determine the effects of the amounts of the various components of an aspirin tablet on the physical characteristics of the tablet. The tablet formulation was the common commercial formulation consisting of micro-cellulose, talc and aspirin API (acetylsalicylic acid). The weight percent of each of the three components plus the table press pressure were the four variables studied. The rate of disintegration rate and the tablet hardness were the physical characteristics of the tablet that were measured as a function of the composition and tablet press pressure. The presentation will describe the tablet formulation process, the experimental procedures employed to determine disintegration rate and tablet hardness, and results of the DOE experiments. In addition, a comparison of a full-factor and partial factor designs will be made.

Variation, Selection, Inheritance: a public outreach podcast on evolution by the NSF BEACON consortium.

R.D. Hayes, Department of Biology, North Carolina Agricultural & Technical State University

Variation Selection Inheritance is a 15-minute weekly podcast on evolution, broadly defined as systems that display all three of those characteristics. These three abstract principles are embodied in different ways in biological, cultural, and technological systems because of the differing constraints under which those systems operate. For instance, biological organisms (on Earth) are limited to at most two parents simply because DNA is a two-stranded molecule, while a computer program can use code from as many parents as necessary. These differences often obscure the common principles. This podcast explores the interplay between the common principles and the system-specific constraints.

Variation Selection Inheritance is the first podcast funded by the NSF's BEACON Center for the Study of Evolution in Action. There are two podcasts devoted to artificial life (BiotaLive and Darwin@Home) and one to the creation/evolution debate (Evolution101, this is also a frequent topic on NPR's more general Science Friday broadcast/podcast). Additionally, NESCENT does a monthly podcast (Evolution in the News, 1-15 minutes) that covers only biological evolution. VSI is unique in being both primarily informational and interdisciplinary, comparing and contrasting how evolution works across systems and in layman's terms. The content will consist of interviews with scientists, artists, and entrepreneurs; evolution book and movie reviews, including science fiction as well as popular science nonfiction; interesting anecdotes from the history of evolution, and addressing listener e-mails. Interviews will focus on evolution, but also cover more personal "How I became a scientist" stories in order to increase the human dimension of science.

Visualization of Julia sets and its application in pattern designs

Elliott M. Betrand*1, Nailong Guo1 and Woon-Kwan Lam2. , 1Natural Sciences and Mathematics, Johnson C. Smith University and

A systematic and step by step procedure to apply Julia sets in pattern designs will be presented. Firstly, we use MATLAB to implement the iteration of complex function z2 + c and to generate and visualize a z plane related to Quadratic Julia sets. Secondly, we explore the aesthetic values of Julia sets by relating the different range of parameter c and other parameters used for visualization, such as escape condition, number of iterates, color mapping, with the characteristic shapes and colors of the images. Thirdly, we elaborately select different stylish images and use Photoshop to delete their background and/or catch the beautiful graphic elements. Finally, we use Illustrator to generate differently symmetric patterns. Our preliminary research and experiments have shown that this procedure is feasible and powerful.

Zebrafish (Danio rerio) gill ATPase gene expression response to oil dispersant exposure

Brett Schuchardt, Linda Niedziela, Elon University and Department of Biology

With the high frequency of oil spill accidents, the application of millions of gallons of dispersant chemicals entering the sea is potentially harmful to the marine environment. Previous studies have demonstrated significant toxicity of oil dispersants to the Na+/K+ ATPases (NKAs) in brine shrimp and damage to the skin and gills of marine organisms. ATPase enzymes are essential to maintaining osmoregulatory and electrolyte homeostasis. However, dispersants can disrupt ATPase function causing ionic and osmotic imbalances in the cell. Structural and functional miscues of dispersant-ATPase interactions have been proposed but not analyzed in detail. This study aims to determine if gene expression of NKAs is altered by oil dispersants. Adult zebrafish (Danio rerio) were exposed to DispersitTM for 48 hr and gill and skin tissues were excised. RNA was extracted and mRNA expression analyzed via reverse-transcriptase PCR. ATPase alpha subunit primers were used to amplify targeted atp1a1a (1,2,4,5) genes expressed in skin and gill ionocytes (Liao et al. 2000). Gene expression was compared between control and DispersitTM treated fish. Preliminary results show differential mRNA expression in atp1a1a.1 but atp1a1a.2 seems unaffected. Further testing of atp1a1a (4,5) will also be discussed. The present study hopes to provide further insight into the genetic mechanism by which oil dispersants damage ATPases in marine organisms. This information can then be used for risk assessment for other aquatic organisms or to develop less toxic formulations.

Tim Atkinson
Association of Southeastern Biologists
tim.atkinson@carolina.com

Callie Averette
Campbell University
claverette1023@email.campbell.edu

Chad Awtrey
Elon University
cawtrey@elon.edu

Jessica Bame
UNC Greensboro
jrbame@uncg.edu

Michael Baranski
Catawba College
mbaransk@catawba.edu

Tonya Bates
UNC Charlotte
tcbates@uncc.edu

Daniel Bates
Elon University
dbates2@elon.edu

David Beamer
Nash Community College
dbeamer@nashcc.edu

Stephanie Bellendir
UNC Chapel Hill
bellendi@email.unc.edu

Shilpa Beravolu
UNC Greensboro
s_beravo@uncg.edu

Seth Bernstein
Wake Forest University
bernsa8@wfu.edu

Linden Blaisus
Warren Wilson College
lblaisus@warren-wilson.edu

Andrew Blank
UNC Greensboro
ajblank@uncg.edu

Elizabeth Blue
Campbell University
blue@campbell.edu

Lisa Bonner
Peace College
lbonner@peace.edu

Katherine Braden
Nash Community College
1658691@nrms.org

Kim Briones
UNC Greensboro
kmbrione@uncg,edu

Kayla Britton
Peace College
KDBritton@peace.edu

James Brown
NC State University
james_brown@ncsu.edu

Michael Bruno
UNC Chapel Hill
mjbruno@email.unc.edu

Dale Burnside
Lenoir-Rhyne University
burnsided@lr.edu

Katrina Calder
Peace College
KLCalder@peace.edu

Andres Camacho
Lenoir-Rhyne University
andres.camacho@my.lr.edu

Sandra Camilleri
UNC Wilmington
sac3890@uncw.edu

Elisabeth Campbell
Lenoir-Rhyne University
campbelle@my.lr.edu

Mickael Cariveau
Mount Olive College
mcariveau@moc.edu

Lucas Carnohan
Lenoir-Rhyne University
carnohanl@my.lr.edu

Elizabeth Carrow
Wake Forest University
carrej8@wfu.edu

Nicole Cashwell
Peace College
LNCashwell@peace.edu

Justin Castellow
East Carolina University
ihprettiegirl@yahoo.com

Meghan Clark
Elon University
mclark14@elon.edu

Christopher Coburn
Western Carolina University
ccoburn@email.wcu.edu

Jeffrey Coker
Elon University
jcoker@elon.edu

Lindsay Comstock
Wake Forest University
comstolr@wfu.edu

Charles Cooke
Lenoir-Rhyne University
cooke@lr.edu

Jonathan Cranford
Duke University
jonathan.cranford@duke.edu

Francie Cuffney
Meredith College
cuffneyf@meredith.edu

Carrie DeJaco
Queens University of Charlotte
dejacoc@queens.edu

Elliott Diggs
Guilford College
diggsej@guilford.edu

Luke Dixon
UNC Greensboro
lrdixon@uncg.edu

Victoria Ellis
Campbell University
Vkellis0809@email.campbell.edu

Katelyn Eloshway
Mount Olive College
ELOSHWAYK09@students.ecu.edu

Herman Eure
Wake Forest University
eure@wfu.edu

Marsha Fanning
Lenoir-Rhyne University
fanning@LR.edu

Nicholas Faulkner
UNC Pembroke

Miriam Ferzli
NC State University
miriam_ferzli@ncsu.edu

Samuel Flake
Guilford College
flakesw@guilford.edu

Marcus Ford
Campbell University
mdford0605@email.campbell.edu

Nicholas Forman
Guilford College
formanns@guilford.edu

Angela Foster
Kaplan University
AFoster3@kaplan.edu

Jennifer Frick-Ruppert
Brevard College
jefrick@brevard.edu

John Furniss
Elon University
jfurniss@elon.edu

Kathy Gallucci
Elon
gallucci@elon.edu

Mariana Gattegno
Mount Olive College
MVG4795@moc.edu

Kalmus Gerhard
East Carolina University
Kalmusg@ecu.edu

Alan Goble
Bennett College
goble@bennett.edu

Alexis Gonzales-Black
Teach For America
alexis.gb@teachforamerica.org

Ethel Gordon
North Carolina Ag & Tec State University
ejgordon@ncat/edu

Alissa Gore
Warren Wilson College
agore@warren-wilson.edu

Morgan Gregg
Elon University
mgregg2@elon.edu

Nailong Guo
Johnson C. Smith University
nguo@jcsu.edu

Jose Gutierrez
Queens University of Charlotte
jlgc18s@yahoo.com

Alice Haddy
UNC Greensboro
aehaddy@uncg.edu

Christopher Hadley
Nash Community College
crhadley027@gmail.com

Greg Haenel
Elon University
haenel@elon.edu

Paul Hager
East Carolina University
hagerp@ecu.edu

Matthew Harrell
Campbell University
mbharrell1001@email.campbell.edu

James Harrington
North Carolina State University
jmharrin@ncsu.edu

Erica Harris
Bennett College
enharris@bennett.edu

Amanda Haungs
Guilford College
haungsam@guilford.edu

Randall Hayes
North Carolina Ag & Tech State University
rdhayes@ncat.edu

Kimberly Heck
Guilford College
heckka@guilford.edu

Charles Hendrick
Wake Forest University
hendce7@wfu.edu

Freddy Herrera
UNC Greensboro
f_herrer@uncg.edu

Joseph Hester
Wake Forest University
hestjm7@wfu.edu

Kelly Hines
NC State University
kmhines@ncsu.edu

Katherine Hlavinka
Elon University
khlavinka@elon.edu

Madison Holloway
Lenoir-Rhyne University
hollowaym@my.lr.edu

Chia-Chi Hsu
UNC Greensboro
c_hsu@uncg.edu

John Jacobs
Guilford College
jacobsjc@guilford.edu

Claire James
Elon University
vjames@elon.edu

Nicole Joyner-Powell
UNC Greensboro
nbjoyner@uncg.edu

Gerhard Kalmus
East Carolina University
kalmusg@ecu.edu

Elizabeth Killion
Guilford College
killionea@guilford.edu

Kathryn Kohl
UNC Chapel Hill
kkohl@med.unc.edu

Ryan Kuster
UNC Greensboro
ryan.kuster@gmail.com

Ia Lee
UNC Greensboro
i_lee@uncg.edu

Alec Lockhart
Nash Community College
Aleclockhart@hotmail.com

Mallory Lowder
Lenoir-Rhyne University
LowderM@my.lr.edu

Michelle Mabry
Lenoir-Rhyne University
michelle.mabry@lr.edu

Shannon McDermott
Duke University
srm19@duke.edu

Sandra Ingram
Winston Salem State University
ingramsw@wssu.edu

Janii James
Bennett College
janii.james@bennett.edu

Matt Jester
UNC Greensboro
mwjester@uncg.edu

David Judge
Gardner-Webb University
djudge@gardner-webb.edu

Lisa Kelly
UNC Pembroke
lisa.kelly@uncp.edu

Michael Kingston
Elon University
kingston@elon.edu

Erica Kosal
NC Wesleyan College
ekosal@ncwc.edu

Sara Lachance
Guilford College
lachancese@guilford.edu

Melanie Lee-Brown
Guilford College
mleebro@guilford.edu

Johnathan Locklear
UNC Pembroke
Locklearjr@gmail.com

Margo Lowe
Elon University
mlowe2@elon.edu

Mary Ann Massoglia
Bennett College
mmassoglia@bennett.edu

Karen McDougal
Lenoir-Rhyne University
mcdougalk@lr.edu

Kyla Jacobs
Warren Wilson College
kjacobs@warren-wilson.edu

Janii James
Bennett College
niedra.wilson@bennett.edu

Janna Joyner
Peace College
JAJoyner@peace.edu

Dean Kahl
Warren Wilson College
dkahl@warren-wilson.edu

Catherine Silver Key
NC State University
ckey@nccu.edu

Jessica Klaphaak
Guilford College and Wake Forest Univer-
klaphaakjm@guilford.edu

Leah Krieger
Elon University
lkrieger@elon.edu

Antonia Lamberth
Bennett College
alamberth@bennett.edu

Alma Libal
Guilford College

Karen Love
Brevard College
loveke@brevard.edu

Charles Lytle
NC State University
lytle_bio@ncsu.edu

Stephanie Matson
Elon University
smatson@elon.edu

John Mecham
Meredith College
mechamj@meredith.edu

Ryan Michalek
Duke University Medical Center
ryan.michalek@duke.edu

John Misenheimer
Campbell University
jcmisenheimer0302@email.campbell.edu

Yuko Miyamoto
Elon University
ymiyamoto@elon.edu

Ashley Moore
Winston Salem State Univeristy
ashrose.moore@gmail.com

Brittanie Morgan
Bennett College
bmmorgan@bennett.edu

Christopher Moss
Nash Community College
cmossmail@yahoo.com

Ben Mudrak
UNC Chapel Hill
bmudrak@med.unc.edu

Patrick Myer
Peace College
pmyer@peace.edu

Nasser Nahshal
Nash Community College
nas2roma@gmail.com

Brittany Nichols
NC Wesleyan College
bn155682@my.ncwc.edu

Linda Niedziela
Elon University
lniedziela@elon.edu

Beth Overman
NC State University
eloverma@ncsu.edu

Ivey Owens
North Carolina A&T State University
eewren@ncat.edu

Priyanka Patel
Campbell University
pppatel0912@email.campbell.edu

Morris Patton
Lenoir-Rhyne University
pattonmr@my.lr.edu

Alexandra Pedicone
Elon University
apedicone@elon.edu

Marilyn Pendley
Association of Southeastern Biologists
marilyngar@hotmail.com

Kelsey Penland
Guilford College
penlandks@guilford.edu

Kathleen Penrod
NC Wesleyan College
kp138141@my.ncwc.edu

Britney Phippen
Queens University of Charlotte
britney.phippen@qmail.queens.edu

Britney Phippen
Queens University of Charlotte
britney phippen@qmail.queens.edu

K.T. Piotrowski
Campbell University
ktpiotrowski0512@email.campbell.edu

Elise Post
Elon University
epost@elon.edu

Willem Prins
Elon University
kibbel@gmail.com

Sean Pulsfort
Warren Wilson College
spulsfort@warren-wilson.edu

Anna Queen
UNC Pembroke
aeq001@bravemail.uncp.edu

Denise Reaves
North Carolina Central University
dreaves@nccu.edu

Jason Reddick
UNC Greensboro
jjreddic@uncg.edu

Rachel Reed
UNC Greensboro
rareed@uncg.edu

Jesse Rickard
Warren Wilson College
jrickard@warren-wilson.edu

Alexandra Riebel
Elon University
ariebel@elon.edu

Skyy Rios
Warren Wilson College
srios@warren-wilson.edu

Maya Rios
Warren Wilson College
maya@rios.org

Caroline Ritchey
Gardner-Webb University
critchey@gardner-webb.edu

Jordan Rockensuess
Lenoir-Rhyne University
rockensuessj@my.lr.edu

Noelle-Erin Romero
UNC Chapel Hill
nromero@email.unc.edu

Julie Ronecker
Elon University
jronecker@elon.edu

Pake Rublee
UNC Greensboro
rublee@uncg.edu

Cordelia Sackey-Mensah
UNC Greensboro
c_sackey@uncg.edu

Mahmoud Saleh
Guilford College
salehmm@guilford.edu

Kara Salpeter
Elon University
ksalpeter@elon.edu

Maria Santisteban
UNC Pembroke
maria.santisteban@uncp.edu

Sophia Sarafova
Davidson College
sosarafova@davidson.edu

Jean-Luc Scemama
East Carolina University
scemamaj@ecu.edu

Brett Schuchardt
Elon University
bschuchardt@elon.edu

Stephen Scott
Lenoir Rhyne University
scott@lr.edu

Lori Seischab
Western Carolina University
lseischab@email.wcu.edu

Ashley Sherrill
Lenoir-Rhyne University
sherrilla@my.lr.edu

Ashley Shilling
Queens University of Charlotte
ashley.shilling@qmail.queens.edu

Lora Sigmon
Elon University
lsigmon2@elon.edu

Rebecca Smith
Lenoir-Rhyne University
smithrk@my.lr.edu

Roberta Smith-Uhl
Meredith College
smithuhl@email.meredith.edu

Octavia Sola
Warren Wilson College
osola@warren-wilson.edu

David Sommerville
Campbell University
dfsommerville0726@email.campbell.edu

Robert Sotak
NC State University
bob_sotak@ncsu.edu

Elizabeth Stapleton
Guilford College
stapletonel@guilford.edu

Kyle Starling
Lenoir-Rhyne University
starlingk@my.lr.edu

Andrew Steele
Lenoir-Rhyne University
steelea@lr.edu

Susan Stephenson
NCAS Office
sstephen@aol.com

Joshua Stokell
UNC Charlotte
jrstokel@uncc.edu

Lauren Stranahan
Elon University
lstranahan@elon.edu

Kimberly Stratford
NC A&T SU
eewren@ncat.edu

Bryan Strelow
Elon University
bstrelow@elon.edu

Brian Sullivan
Lenoir-Rhyne University
sullivanb@my.lr.edu

Gregory Swan
Davidson College
grswan@davidson.edu

Theophile Taminin
UNC Greensboro
t_tamini@uncg.edu

Michael Terribilini
Elon University
mterribilini@elon.edu

test test

Sarah Thalhamer
East Carolina University
thalhamers06@students.ecu.edu

Laurel Thwing
Warren Wilson College
lthwing@warren-wilson.edu

Tricia Tran
Peace College
TKTran@peace.edu

Jennifer Uno
Elon University
juno@elon.edu

Stephen Vance
UNC Greensboro
savancejr@hotmail.com

Taija Ventrella
Warren Wilson College
tventrella@warren-wilson.edu

Ryan Wagner
Wake Forest University
wagnrd8@wfu.edu

Amy Wagner
Warren Wilson College
awagner@warren-wilson.edu

Kaira Wagoner
UNC Greensboro
kaira.wagoner@gmail.com

Jennifer Warner
UNC Charlotte
jmwarner@uncc.edu

Gideon Wasserberg
UNC Greensboro
g_wasser@uncg.edu

Louise Weber
Warren Wilson College
lweber@warren-wilson.edu

LaTrice West
Campbell University

Laura White
UNC Greensboro
lmwhite2@uncg.edu

Danielle Whitman
Elon University
dwhitman3@elon.edu

Rob Whitnell
Guilford College
rwhitnel@guilford.edu

Davidson Wicker
East Carolina University
davidsonwicker@gmail.com

Kyja Wilburn
Warren Wilson College
kwilburn-hyde@warren-wilson.edu

Shaun Williams
Lenoir-Rhyne University
shaun.williams@lr.edu

Niedra Wilson
Bennett College
niedra.wilson2bennett.edu

Erin Witalison
Catawba College
ewitalis@catawba.edu

Amanda Withers
Lenoir Rhyne University
withersa@my.lr.edu

Joe Wolf
Peace College
jwolf@peace.edu

Zachary Wood
Guilford College

Sara Wrenn
Bennett College
swrenn@bennett.edu

Hollie Young
UNC Pembroke
hby001@bravemail.uncp.edu

Lei Zhang
Winston Salem State Univeristy
zhangl@wssu.edu