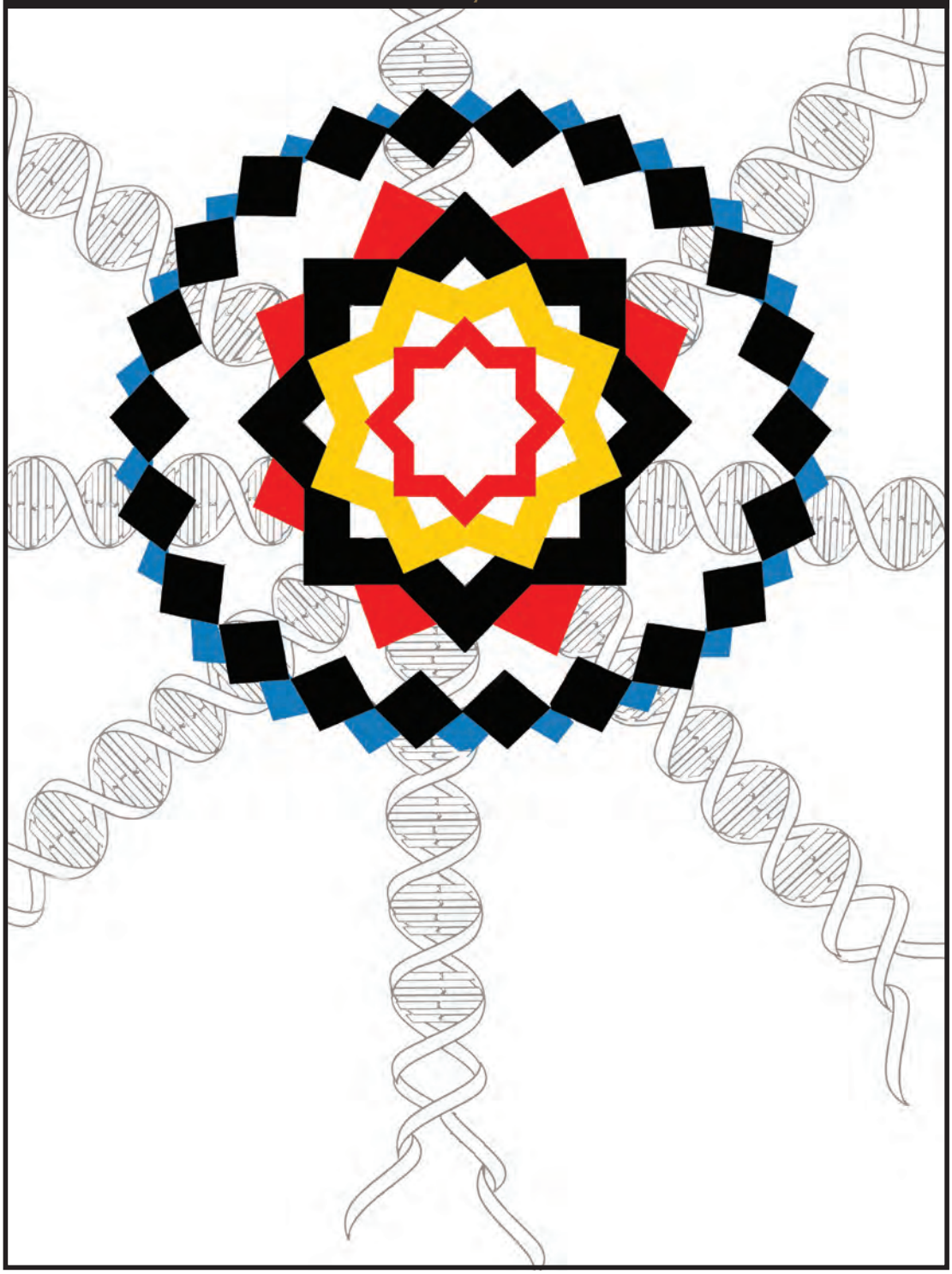
THE UNIVERSITY OF NORTH CAROLINA AT PEMBROKE

110th Annual Meeting

NC Academy of Science



125TH ANNIVERSARY 1887 2012 UNC PEMBROKE

April 5-6, 2013

North Carolina Academy of Science Since 1902

SCIENCE IN THE GENOMICS ERA

Dedication to

SUSAN L. STEPHENSON (1943-2012)

We dedicate this 110th annual meeting of the North Carolina Academy of Science to the memory of our colleague, botanist, and friend Susan L. Stephenson. Sue was a longtime member and supporter of the Academy and served for many years as our Executive Secretary and Office Manager (1986-2003). She later continued as an unpaid Office Manager until the time of her death on May 25, 2012. For Sue it was a labor of love. During her many years of service she was in many ways the voice and the public face of the Academy, serving the needs of members, answering inquiries, coordinating activities of the officers and board of directors, reminding us of important meetings and deadlines, keeping membership records, and handling journal subscriptions, all vital to the mission of the Academy. She was our institutional memory, helping connect current and future plans with past experiences. Through good times, and not so good times, she was the glue that kept the Academy together and functioning.

One small example of Sue's dedication took place in 2000 after the Academy was unable to find a replacement for the director of the Student Academy, the branch of the Academy that provides research experiences for hundreds of North Carolina middle and high school students. Unwilling to allow the Student Academy to languish or to expire, Sue took upon herself the responsibility of directing the Student Academy and organizing the annual state meeting and student research competition on the NC State campus in Raleigh allowing students from across the state to share the results of their research projects and keeping the Student Academy alive for one more year. The following year a former director of the Student Academy, impressed with her efforts, resumed that role in an attempt to ensure the future of that important branch of the Academy.

In addition to her long and faithful service as a member of the Academy of Science, Sue was an inspiration to us for her determination to continue an active and productive life despite a serious genetic condition that severely limited her mobility for most of her life. We are all grateful to our friend Sue Stephenson for her dedicated service and for being one of the Academy's most loyal supporters. She is sorely missed.

Welcome!

NCAS 2013 Local Arrangements Committee

On behalf of the 2013 Local Arrangements Committee, I would like to welcome you to the University of North Carolina at Pembroke. Your committee has thoughtfully planned this meeting to bring you exceptional speakers, workshops, and special sessions. With your participation in poster and oral presentations you are doing the rest to make this a memorable meeting. For some this conference will be a first, and we hope this experience will leave you with a lasting, positive impression. We hope all of you will go away invigorated and encouraged by the 110th Annual Meeting. Where possible, please take the opportunity to provide feedback to members of the Local Arrangements Committee. Thank them for their diligent work to bring you this event.

Let me know if there is anything I can do to assist you during the meeting.

Maria Santisteban, Chair, Local Arrangements Committee

2013 Local Arrangements Committee

Rita A. Hagevik
Deborah Hanmer
Rebecca Howell
Bonnie Kelley
Lisa Kelly
Tonya Locklear
Dennis McCracken
Brandi Norman
Lee Phillips
Robert Poage
Stephanie Presnal
Timothy Ritter
Maria Santisteban
Marilu Santos
Patricia Sellers
Rachel Smith
Sally Vallabha

NCAS President's Welcome

Welcome to the 110th Annual Meeting of the North Carolina Academy of Science and the first joint meeting with the NC Project Kaleidoscope Network on the campus of UNC Pembroke! The North Carolina Academy of Science held its first organizational meeting on March 21, 1902, presided by William L. Poteat, and we have been growing ever since!

We are very excited that you could join us as we discuss topics important to all North Carolinians, showcase the talents of the next generation of researchers, promote new collaborations and renew old friendships. Our annual meeting partially fulfills our mission to promote public appreciation of science, science education, scientific research and a meaningful role for science in public policy.

This year's event focuses on Science in the Genomics Era and will include a Keynote Address on "**Engineering Society: The American Eugenics Movement: by Mr. David Micklos, Executive Director of the DNA Learning Center at Cold Spring Harbor Laboratory,** a plenary address on **"The Human Genomics Landscape: Bringing Genomic Medicine into Focus"** by Dr. Eric Green, and many student and faculty research presentations. We hope that this meeting stimulates you to ask the important questions, become an active part of your community and know that through knowledge and understanding, you can make a difference in the world!

I would like to thank Dr. Kyle Carter, Chancellor of UNC Pembroke, for allowing us the opportunity to share your wonderful campus, and Dr. Ken Kitts, Provost, for his continued support to this event. I would also like to commend Dr. Mark Canada, Dean of Arts and Sciences for your outstanding leadership and the many others throughout the University who worked tirelessly to make the 110th Annual NCAS meeting a success.

Mickael Cariveau*, NCAS President 2012-2013*

UNCP Chancellor's Welcome

Dear Friends:

I am delighted to welcome you to the campus of UNC Pembroke, especially in this banner year—the 110th annual meeting of the North Carolina Academy of Sciences and the 125th anniversary of the founding of our university.

We are proud of our work promoting the study of science both in the classroom and the laboratory. From our RISE students conducting biomedical research to the Pembroke Undergraduate Research and Creativity Center promoting inquiry and scholarship, UNCP is committed to enhancing the study of science. And through our state-of-the-art Health Sciences Building, we are giving our nursing students the opportunity to translate scientific research in a clinical setting. As our understanding of genomics and epigenetics grows, I am confident that UNCP faculty and its students will be able contribute to this exciting research.

Thank you for taking part in this year's meeting of the North Carolina Academy of Science and thank you for allowing us to share in it.

Best wishes,

Kyle Carter, *Chancellor, University of North Carolina at Pembroke*

University of North Carolina at Pembroke

The University of North Carolina at Pembroke (North Carolina's Historically American Indian University) is a master's level degree-granting university and one of 17 schools that comprise the University of North Carolina system. With a total enrollment of 6,269, the university offers 41 bachelor's and 17 master's degrees.

With student-faculty ratio of 15:1 and the average class size hovering at 21 students, Pembroke occupies the enviable position of being able to treat each student as an individual. According to U.S. News and World Report, Pembroke is among the nation's most diverse universities.

On March 7, 1887, Croatan Normal School was established after legislation sponsored by Representative Hamilton McMillan of Robeson County was enacted by the General Assembly of North Carolina. The school was established to train American Indian teachers. A clapboard, two-story building was constructed by local Indians at a site about one mile west of the present location, and the school opened with 15 students and one teacher in the fall of 1887. For many years, the instruction was at the elementary and secondary level, and the first diploma was awarded in 1905.

The school was moved to its present location in Pembroke in 1909. The General Assembly changed the name of the institution in 1911 to the "Indian Normal School of Robeson County." The first four-year degrees were conferred in 1940. In recognition of its new status, the General Assembly changed the name of the school in 1941 to Pembroke State College for Indians. Between 1939 and 1953, it was the only state-supported four-year college for Indians in the nation.

The Board of Trustees approved the admission of white students up to 40 percent of the total enrollment in 1953, and, following the Supreme Court's school desegregation decision, opened the College to all qualified applicants without regard to race in 1954. In 1969, the General Assembly changed the name again to Pembroke State University and designated the institution a regional university.

Three years later, in 1972, the General Assembly established the 16-campus University of North Carolina with Pembroke State University as one of the constituent institutions. The Board of Governors approved the implementation of the Master of Arts in Education program by Pembroke State University in 1978. Since that time, additional baccalaureate programs have been added, including nursing, and master's level programs have been implemented in Business Administration, Public Administration, School Counseling, and Clinical Mental Health Counseling.

On July 1, 1996, Pembroke State University officially became The University of North Carolina at Pembroke.

Summary Schedule

Friday April 5th

1:00-2:00 Finance & Strategic Planning Committee Meetings, Chavis University Center, Rm 213

2:00-5:00 Board of Directors Meeting, Chavis University Center, Rm 213

5:00-6:00 Registration and Poster Setup, University Center Annex

5:30-6:00 Poster Judges Meeting, University Center Annex, Rm 203

6:00-7:30 Poster Session and Reception with Heavy Hors d'oeuvres, University Center Annex. Live Music: *UNCP Faculty Jazz Trio*

7:30-8:00 Poster Judges Meeting, University Center Annex, Rm 203

7:45-8:00 Welcome Remarks, **Givens Performing Arts Center Auditorium** (GPAC)

8:00-9:30 Plenary Address: Dr. Eric Green, Director of the NHGRI at the NIH, "The Human Genomics Landscape: Bringing Genomic Medicine into Focus", GPAC

9:45-11:45 CANCAS Social, University Center Annex *Sponsored by UNCP Biology Club and TriBeta Society*

Saturday April 6th

7:30-8:15 Judges & Session Moderators Meeting, **Health Sciences Building** (HS Building), Rm 101

7:30-8:30 Setup of Exhibitor & Vendor Tables and Student Academy Posters, HS Building Registration, HS Building Hallway Entrance. Breakfast, HS Building Food court

7:30-3:15 Practice rooms available to review slides: HS Building Rm 266, 268, and 270

8:30-1:30 Student Academy Posters: available for viewing, HS Building, Hallway ***Posters will be attended from 12:45-1:45***

8:30-5:00 Exhibits of Sponsors & Vendors, HS Building Halls

8:30-10:00 Panel: Preparing Students for College Science*, HS Building Rm 271

8:30-9:45 Oral Session I, HS Building, Rm 103, 107, 113, 117, 121

9:50-11:05 Oral Session II, HS Building, Rm 103, 107, 113, 117

8:00-5:00 Museum of the Native American Resource Center: open for viewing, Old Main, First Floor

10:00-11:00 Student Academy Brunch, Food Court in the HS Building

11:15-11:30 Welcome Remarks, GPAC

11:30-12:30 Keynote Speaker: Mr. David Micklos, Executive Director of the DNA Learning Center at Cold Spring Harbor Laboratory, "Engineering Society: The American Eugenics Movement", GPAC

12:30-1:45 Box Lunches, Food Court in the HS Building. *Tables and chairs will be available in the Food Court as well as under tents if you would like a place to sit outside during lunch*

12:45-1:45 Student Academy Posters Presented†, HS Building Hallway, Judges Meeting: *meet in Room 103 over lunch.*

1:45-3:00 Workshops (***select one of following options***)

- "The Human Microbiome Project: An opportunity for Student Learning", HS Building, Rm 117
- "Teaching Science for Global Citizenship", HS Building Rm 101
- "Human Cell Line Contamination: Denial, Acceptance, and Authentication", HS Building Rm 107
- Graduate/Professional School Workshop, HS Building Rm 113

3:00-3:15 Coffee Break, HS Building Food Court

3:15-4:30 Oral Session III, HS Building Rm 103, 121, 259, 261

4:30-5:30 Special Sessions (***select one of following options***)

- "Research and Outreach at the Nature Research Center: What Can We Learn About Human Health From Primate Genomics and Armpit Microbes?" HS Building Rm 117
- "iPlant Collaborative Project" HS Building Rm 107
- "Seed Industry Consolidation and Its Consequences" HS Building Rm 271
- "Beyond the Naked Eye: Scanning Electron Microscopy and Electron Probe Micro-Analyses" HS Building Rm 113

5:00-5:30 CANCAS Officers Award Preparation Meeting, University Center Annex, Rm 217

5:30-6:30 NCAS Business Meeting**, University Center Annex, Rm 203

5:30-6:30 CANCAS Business Meeting**, University Center Annex, Rm 217

6:30-8:30 Banquet & Awards Ceremony, University Center Annex. Live Music: Lakota John & Layla Locklear, Native Flute & Song

8:30-9:00 Board of Directors Meeting, University Center Annex, Rm 203

* These special sessions are geared toward high school teachers but open to all attendees.

** Everyone is eligible to participate in the business meetings. All participants are considered members of the NCAS or CANCAS because membership is included in the registration for those who were previously non-members.

† Student Academy members are in middle school or high school. Winners of the high school district competitions will present their posters as our guests.

Plenary Address

Dr. Eric Green

Director of the National Human Genome Research Institute at the National Institutes of Health (NIH), Bethesda, Maryland

Presentation: "The Human Genomics Landscape: Bringing Genomic Medicine into Focus"

Eric D. Green, M.D., Ph.D. is the Director of the National Human Genome Research Institute (NHGRI) at the National Institutes of Health (NIH), a position he has held since late 2009. NHGRI is the largest organization in the world solely dedicated to genomics research. Previously, he served as the NHGRI Scientific Director (2002-2009), Chief of the NHGRI Genome Technology Branch (1996-2009), and Director of the NIH Intramural Sequencing Center (1997-2009).

While directing an independent research program for almost two decades, Dr. Green was at the forefront of efforts to map, sequence, and understand eukaryotic genomes. His work included significant, start-to-finish involvement in the Human Genome Project.

Now, as Director of NHGRI, Dr. Green is responsible for providing overall leadership of the Institute's research portfolio and other initiatives; this requires significant coordination with other NIH components and funding agencies. In 2011, Dr. Green led NHGRI to the completion of a strategic planning process that yielded a new vision for the future of genomics research, entitled *Charting a course for genomic medicine from base pairs to bedside (Nature 470:204-213, 2011).*

Keynote Speaker

Mr. David Micklos

Executive Director, DNA Learning Center (DNALC) at Cold Spring Harbor Laboratory, New York

Presentation: "Engineering Society: The American Eugenics Movement"

David Micklos is founder and executive director of the DNA Learning Center (DNALC) at Cold Spring Harbor Laboratory. The nation's first science center devoted to public genetics education, the DNALC operates six teaching laboratories that provide hands-on science experiences to 30,000 students per year. The DNALC's Internet portal hosts 21 proprietary content and bioinformatics sites, which receive 7.4 million visitors annually.

Mr. Micklos is author of two popular textbooks, *DNA Science* and *Genome Science*. He received the 1990 Dana Award for Pioneering Achievement in Education, the 2011 Science Prize for Online Resources in Education, and the 2012 Genetics Society of America Award for Excellence in Education. He is the only CSHL staff member to receive an honorary doctorate from its Watson School of Biological Sciences.

Friday Schedule Details

Poster Session and Reception with Heavy Hors d'oeuvres ____

Friday Evening, University Center Annex
6-7:30 pm
Entertainment provided by the UNCP Faculty Jazz Trio

Poster Sessions & Titles

Biotechnology, Genomics, & Molecular Biology

1. *__Andersson, Emelie__, Andrey Sorokin, and Bradley Miller. *Endothelin-1 signaling via the adaptor protein p66 Shc in renal glomerular mesangial cells.*
2. *__Corona, Armando__, Heather Romine, Ebru Caba, Robert C. Elliott, Hsin-wei Wang, Charles Giardina, Don-Guk Shin, and Ben A. Bahr. *A model of brain damage to study early and delayed responses with focused opposing gene profiles that make up the brain's response to injury.*
3. *__Deve, Maya__, Manishi Pallavi, Scott Harrison, Gregory Goins, and Perpetua Muganda. *The SSBP2 gene promoter region contains binding sites for the tumor suppressor p53 protein: A bioinformatic analysis.*
4. __Draper, Bonnie__, Hannah Firth, Kali Cram, Samantha Cram, Amelia DiPillo, and Alexandra Fullerton. *A functional role for amino acids surrounding the ATP-sensor motif of a DNA packaging motor.*
5. *__Fata, Anthony F.__, Brett Schuchardt, Srikripa Chandrasekaran, and Linda M. Niedziela. *Effect of environmental stressors on molecular pathways that control ion homeostasis in* Saccharomyces cerevisiae *and* Danio rerio.
6. *__Goddard, Deborah__, Akamu Ewunkem, Scott Harrison, Greg Goins, and Perpetua Muganda. *The tumor suppressor p53 protein binds HIST2H2AA4 to the HIST2H2AA4 gene promoter region.*
7. *__Goodison, Brianna__. *Site-directed mutagenesis of the FMN riboswitch of* Photorhabdus luminescens.
8. *__Hafner, Sarah__, Uzoma S. Ikonne, Marsalis Smith, Meagan L. Wisniewski, Dennis J. Hoover, Kishore Viswanathan, Heather Romine, Dennis L. Wright, and Ben A. Bahr. *Development of non-peptidyl small molecules for positive lysosomal modulation and protection against protein accumulation disorders*
9. *__Iranloye, Oladoyin K.,__ Bryan T. MacDonald, Xinjun Zhang, and Xi He. *Generation of epitope tagged human Wnt proteins.*
10. *__Khan, Nawsheen__, Xiuli Dong, and Liju Yang. *The effect of antimicrobial treatment on* Baccillus anthracis *spores.*
11. __Newman, Robert H.__, Jianfei Hu, Hee-Sool Rho, Zhi Xie, Jin Zhang, Heng Zhu, and Jiang Qian. *Construction of a high-resolution map of human phosphorylation networks based on direct kinase-substrate relationships.*
12. __Sengupta, Dipendra__, Jharna Sengupta, Scott Funkhouser, Bryan Williams, and Carla Cortwright. *Periodicity in the intervals between primes and its application to determine CRISPR regions for genomic sequence of different bacteria.*
13. *__Sewell, Mycah__, Nigel Hirth, and Jeremy Sellers. *The distribution of* Solenopsis invicta *colony genotypes in the Coastal Plain of North Carolina.*
14. __Shah, Halley__ and Zhenquan J. *Protection of HepG2 cells against acrolein mediated cytotoxicity by CDDO-Im via induction of phase II detoxification enzymes.*

15. *Smink, Jordan A., Ebru Caba, Robert C. Elliott, Heather Romine, Hsin-wei Wang, Charles Giardina, Don-Guk Shin, and Ben A. Bahr. *A model of brain damage to study early and delayed responses with focused transcriptomics: Identifying opposing roles of the transcription factor NF-kB.*

16. *Taylor, Jordan D. and Mary Beth Hawkins. *Mutagenesis of estrogen receptor βa reveals novel role in binding of RU486.*

17. *Vannasane, Bobbee and Olav Rueppell. *Follow-up studies on QTL for ovary size: Evaluating sequence variation in two long non-coding RNA genes.*

Cell & Development, & Physiology

18. *Anderson, Grace, Emily Lehman, and Paul Steimle. *Cellular studies of* Dictyostelium *myosin II heavy chain kinase.*

19. *Bailey Vitarbo, Jacqueline, John A. Mecham, Javier Rivera Guzman, Christian Jobin, and Acharan Narula. *Effects of diosgenin in* Schistosoma mansoni*-infected transgenic NF-κB^{EGFP} mice.*

20. *Beeninga, Franklin Trent and Mary B. Hawkins. *Site-directed mutagenesis of a single amino acid in the ligand-binding domain of teleost ERba alters its binding affinity to RU486..*

21. Hatkevich, Talia and Yashomati Patel. *Targeting multiple proliferation pathways as a novel breast cancer treatment.*

22. Hlavinka, Katherine. *The role of reactive oxygen species in insulin resistance.*

23. *Kulkarni, Ameya S. and Mary Beth Hawkins. *Investigating the differential binding affinity of genistein to ERs α and β using site-directed mutagenesis of ERβb, an estrogen receptor subtype found in a teleost fish.*

24. *Nikouyeh, Jonah, Kyle Burgett, and Paul Steimle. *Studies of the cellular functions of diacylglycerol kinase and alpha kinase 1 in the social amoeba* Dictyostelium discoideum.

25. *Nogi, Allison L. *The effects of acrylamide (AA) ingestion on liver and sciatic nerve function.*

26. Shortt, Kelli A., Sarah E. Thalhamer, Tamatha Baxley, Margit Schmidt, John M. Lehman, Justin Arthur, Joseph M. Chalovich, and Jean-Luc Scemama. *Translocation of myopodin during differentiation in HT-29 cells.*

27. *St.Clair, Katelyn P., Ryan D. Weeks, and Karen Guzman. *Comparison of chondrocyte differentiation methods in the ATDC5 cell line as assessed by expression of a variety of chondrocyte markers including SOX9.*

28. Wingate, M. Jason, Betty L. Black, and Chris M. Ashwell. *Gene expression during development of the embryonic chick intestine.*

Microbiology

29. *Bowen, Matt K., Floyd L. Inman III, and Len Holmes. *Effect of simulated microgravity on the bacterial characteristics of nematode symbiont* Photorhabdus luminescens.

30. *Davis, Mac, Floyd L. Inman III, and Len Holmes. *Isolation of soil and soil cover nematodes from different locations surrounding UNC Pembroke*.

31. *Lawson, Jeffrey R., Ben Dyer, and Michelle S. Thomas. *Cloning and expression of the* Coxiella burnetii *macrophage infectivity potentiator gene into* Escherichia coli.

32. *Smith, Chris, Erin Byrd, Natalia Goh, Michelle Thomas, Erik Hill and Sharon Mason. *Isolating fluoroquinolone resistant gram-negative organisms from porcine fecal matter.*

33. *Somero, Jillian A. *The effects of an all-liquid diet on the gut microbiotia.*

34. *Zito-Wolf, Alexander R. *The microflora and neuroendocrine regulation in zebrafish.*

Botany & Zoology

35. *Avila, Jessica M., Brenten L. Bottoms, and David A. Beamer. *Morphological variation within mountain dusky lineages (*Desmognathus*).*

36. *Caine, LaShonda M., Jessica M. Avila, David A. Beamer, and Sean P. Graham. *Diversification of seepage salamanders across a complex geologic landscape.*

37. *Cannon, Thomas W., Nathaniel Akers, and Tamara Walker. *A genetically distinct population of three-lined salamanders,* Eurycea guttolineata*, in the Florida Parishes of Louisiana.*

38. Gaston, Jasmine. *Hemp seed flour raised* Tenebrio molitor *and susceptibility to insecticides.*

39. Giri, Bishwa Kiran. *Genomic basis of local adaptation to climatic differences: A controlled common garden experiment in* Arabidopsis lyrata *to identify QTL and genetic mechanisms associated with plant life history traits and adaptation.*

40. Locklear, Jared, Martin Farley, and James Mickle. *Palynological assessment of a Pleistocene age locality from southeastern North Carolina.*

41. *Sanford, Anna and Patricia Sellers. *Plankton diversity of Krinshaw Pond.*

42. *Stewart, Chantia M., LaShonda M. Caine, and David A. Beamer. *A phylogeographic profile of the salamander genus,* Pseudotriton.

43. Williams, Charlie. AMIS, The Michaux Society. *André Michaux's North Carolina travel routes.*

Ecology & Environmental Science

44. *Barber, Marlon R. and Constance Rogers-Lowery. *Effects of ocean acidification on growth of a marine hydroid.*

45. *Goodwin, Davon. *Student Conservation Association (SCA) Veterans Fire Corps.*

46. *Haughn, Betty, Lisa Kelly, Wm. Bruce Ezell, Lee Phillips, and Stephen Macko. *The trophic ecology of invasive fire ants in natural ecosystems of North Carolina.*

47. *Obinwanne, Vera, Natalia Van Duyn, and Richard Nass. *Identification and characterization of molecular modulators of methylmercury-induced toxicity and dopamine neuron degeneration in* C. elegans*.*

48. Rhodes, Sade, Jomani Cheeseman, Damian Canady, Porche Spence, Saundra Delauder, and Tonya M. Gerald-Goins. *Qualitative analysis of organic contaminants found in various local surface and drinking water samples using gas chromatography-mass spectrometry.*

49. Smith, McKenzie K., Parke A. Rublee, and Anne Hershey. *Methanogens and methane oxidizing bacteria in forested, urban impaired and urban restored streams.*

50. *Spiers, Lindsay. *Elevated temperature effects on the growth and toxicity of* Lyngbya confervoides *and* Lyngbya *sp.*

51. *Wiessner, Grace. *Measurement of soil respiration on Warren Wilson College campus.*

Chemistry & Physics

52. *Brown, Jessica, Shanna Harrelson, Roland Stout, and William Brandon. *Detection of cadmium in human hair using atomic absorption spectroscopy.*

53. *Griffin, Austin and Robert Wardel. *The role of negative feedback in stabilizing amplifiers.*

54. *Lamb, Robert, Cornelia Tirla, Kara Beal, Donella Hunt, and Christopher McKee. *Optimization conditions for the production of biodiesel.*

55. *Lloyd, William J. and Elizabeth D. Blue. *Microwave-assisted transesterification of (±)Menthol and Methyl-2-chloropropionate.*

56. *Musselwhite, Molly Catherine and Tiffany R. Scott. *Microgravity effects on the Cori cycle.*

Behavioral Sciences & Health Sciences

57. *Cole, Rachael and Freya Liu. *Handedness of wild capuchin monkeys in positioning events.*

58. Danala, Monica and Christopher Breivogel. *Anti-depressant activity of cannabinoid drugs on CB1 receptors is mediated by ß-arrestin2 binding and activation of MAPK cascade.*

59. *DeFelice, Dominick S., Caitlin Ross, Michael Simone-Finstroem, Prachaval Sukumalanand, and Olav Rueppell. *Geographic variation in polyandry of the eastern honey bee supports division of labour hypothesis for multiple mating in social insects.*

60. *Franco, Edwin. *Comparison of the iron content of different commercial iron supplement tablets using atomic absorption spectrophotometry.*

61. Rekulapally, Satish Pawar and Christopher Breivogel. *Role of ß-arrestin2 in development of tolerance to chronic THC treatment in female mice.*

62. *Vang, Pa Chia and Cayla Orders. *Generic drugs versus innovator: A study of the dissolution rates of generic and innovator formulations of aspirin and acetaminophen.*

63. *White, Jackie X., Denise S. Reaves, and Catherine Silver-Key. *The Effects of ascorbic acid on locomotion in silver nanoparticle inoculated* Drosophila melanogaster.

Science Education

64. Goins, Gregory, Mingxiang Chen, Dinitra White, Thomas Redd, and Dominic Clemence. *A Bioinformatics Learning Enhancement Network for Diversity (BLEND).*

65. Hayden, Jennifer, Justin Shaffer, Kelly Hogan, and Jean DeSaix. *Training graduate students and postdoctoral fellows to be effective mentors of undergraduate students.*

66. Lytle, Charles, Francie Cuffney, and Lisa Kelly. *Astronomy Days exhibits enhance NCAS role as a supporter of public interest in science and as a source of science expertise on matters of public interest in North Carolina.*

Plenary Address

Friday, Givens Performing Arts Center

7:45-8:00 **Welcome Remarks**

Dr. Maria Santisteban, Local Arrangements Committee Chair

Dr. Kyle Carter, Chancellor, UNC Pembroke

Dr. Mickael Cariveau, Mount Olive College, President of the NCAS

8:00-9:30 **Plenary Speaker: Dr. Eric Green, Director of the National Human Genome Research Institute at the NIH**

"The Human Genomics Landscape: Bringing Genomic Medicine into Focus"

CANCAS Social

Friday Evening, University Center Annex
9:45-11:45 pm
Sponsored by UNC Pembroke Biology Club and TriBeta Society

Saturday Schedule Details

HS Building or HSB indicates Health Sciences Building

Panel: Preparing Students for College Science

Saturday Morning, HS Building Rm 271
8:30 – 10 am

Panelists:

Jason Ezell, Campbell University

Scott Johnson, Wake Technical Community College

Tim Metz, Campbell University

Greg Neyhart, NC State University

Patricia Sellers, UNC at Pembroke

Oral Session I (CANCAS)

Saturday Morning, HS Building, specific rooms indicated below
8:30 – 9:45 am

Biotechnology & Molecular Biology

HSB Rm 113

8:30-8:45 *__Brown, Jazmine__, Fan Yuan, and Jianyong Huang. *Increasing the efficiency of pDNA transfection into mouse melanoma cells.*

8:45-9:00 *__Lucas, Agape__, Darwin Operario, and Eric Houpt. *Development of an efficient real-time PCR assay for* Rickettsia *and* Ehrlichia *bacteria using* Amblyomma americanum *DNA*

9:00-9:15 *__Smith, Marsalis__, Ben A. Bahr, Heather Walters-Romine, Sarah Hafner, Armando L. Corona, Jordan A. Smink, Elizabeth Metzger, Katharine Willoughby, Olivia Bullard, and Uzoma S. Ikonne. *Lysosome modulators reduce behavioral deficits in hAPP mouse models as well as in the Fischer rat model of age-related cognitive decline.*

9:15-9:30 *__Thompson, Marc__ and Chichia Chiu. *Comparison of gene expression data with mathematical data simulations using statistical analysis.*

Botany & Environmental Science

HSB Rm 117

8:30-8:45 *__Evans, Amanda.__ *Chromium and cadmium levels in soils in the vicinity of an industrial incinerator.*

8:45-9:00 *__Hoang, Hoa Thi__. *Can we find and culture the freshwater microbe Planctomycetes from the Guilford College Lake?*

9:00-9:15 *__Jamison, S__. and M. Brenner. *Effectiveness of* Pluerotus ostreatus *in degrading diesel fuel.*

9:15-9:30 *__Long, C.,__ Dommer, D.H., and Hughes, M. *Dam removal effects: Reed Canary Grass invasion.*

9:30-9:45 *__Podgorak-Lagro, Mary__ and Jay Bolin. *An evaluation of hybrid intermediacy in the germination ecology of Ashe's Sumac,* Rhus asheii *(*Rhus michauxii *X* Rhus glabra*).*

Cell & Development

HSB Rm 107

8:30-8:45 *__Lewis, Sarah__, Jennifer Floyd, Aldo Castillo, Ann Ballance, Lyndsey McIntyre, Cara Paxson, and April Tucker. *The response of differentiating colorectal cancer cells to the DNA topoisomerase II inhibitor, Etoposide.*

8:45-9:00 *__Pittman, Shonkela__ and Barry Williams. *The effect of clonal diversity on rates of adaptation.*

9:00-9:15 *__Swan, Greg A__. and Sophia D. Sarafova. *Identification of a novel, developmental-stage-specific enhancer in the Cd4 gene.*

Chemistry, Physics, & Science Education

HSB Rm 103

8:30-8:45 *__Butcher, E.__ and S. Cartier. *Toxicity of zirconium oxide (ZrO2) nanoparticles in nematode* Caenorhabditis elegans.

8:45-9:00 *__Fisher, Tamra J.__, W. Lin Coker, and Meredith T. Williams. *Using students' historical data as a predictor of success.*

9:00-9:15 *__Huff, Thomas G.__ and Michael J. Bruno. Bacillus subtilis *detergent resistant membrane composition dependence on growth conditions and squalene inhibition.*

9:15-9:30 *__Mangum, Nicholas__ and Jason Ezell. *Gamma ray emitting isotopes in the environment and their relative intensities.*

Ecology & Zoology

HSB Rm 121

8:30-8:45 *__Glass, Andrew D.__ *The effects of invasive* Akebia *on avian abundance, diversity, and habitat utilization in the Guilford College woods, Greensboro, NC.*

8:45-9:00 *__Hardison, Mary Catherine__, Wm. David Webster, and Amy M. Cherry Millis. *Differential sex migration in the silver-haired bat (*Lasionycteris noctivagans*) in North Carolina.*

9:00-9:15 *__Kay, C.__ and P. Bartels. *Sexual determination in freshwater jellyfish Medusae,* Craspedacusta sowerbii*, captured in Lake Fontana, North Carolina.*

9:15-9:30 *__Millinor, David Elliott__. *An examination of the effects of light on the symbiosis of green algae (*Oophila amblystomatis*) and the spotted salamander (*Amybstoma maculatum*).*

9:30-9:45 *__Wild, Kristoffer__ and John H. Roe. *Risk and response of box turtles to prescribed fire.*

Oral Session II (CANCAS) _____

Saturday Morning, HS Building, specific rooms indicated below
9:50 – 11:05 am

Botany & Environmental Science

HSB Rm 117

9:50-10:05 *__Orton, M.__ and D. Ellum. *Effectiveness of a mycofilter on reducing coliforms in agricultural runoff.*

10:05-10:20 *__Payne, Krystal T__., Ross A. McCauley, and J. Christopher Havran. *A preliminary phylogeny of the endemic Hawaiian genus* Nototrichium *(Amaranthaceae).*

10:20-10:35 *__Snyder, A.__ and J. Brock. *Migration of metals from a coal ash pond into the sediment of the French Broad River.*

10:35-10:50 *__Zaritsky, D.__ and A. Boyd. *The effect of water stress on sugar concentration in strawberry (*Fragaria × ananassa*) fruits.*

Chemistry, Physics, & Science Education

HSB Rm 103

9:50-10:05 *__Ndung'u, T.__ and S. Cartier. *Calorimetric detection and HPLC quantification of artemisinin based anti-malaria pharmaceutical drugs from Kenya.*

10:05-10:20 *__Reding, M.__ and D. Kahl. *Aflatoxins in peanut butter measured using enzyme linked immunosorbant assay (ELISA).*

10:20-10:35 *__Zheng, Chenkang__ and Patricia C. Dos Santos. *Insights into the mechanism of 4-thiouridine in tRNA biosynthesis in* Bacillus subtilis.

Health Sciences

HSB Rm 107

9:50-10:05 *__Fox, Grace Ellen__. *The Effect of Dobutamine on zebrafish (*Danio rerio*) embryos.*

10:05-10:20 *__Harrison, Amanda R.__, Amy M. Cherry Millis, and Wm. David Webster. *Occurrence of rabies in the tricolored bat (*Perimyotis subflavus*) in North Carolina from 1994-2011.*

10:20-10:35 *__Rhoney, Melissa__. *The effect of vitamin C (ascorbic acid) on the growth of* Escherichia coli.

10:35-10:50 *__Sigmon, Leah__. *The effect of vitamin E supplementation on the maintenance of tetanus antibody levels in* Equus caballus.

Microbiology

HSB Rm 113

9:50-10:05 *__Frazier, Mike__ and Melanie Lee-Brown. *A comparison of predatory behavior of* Ensifer adhaerens *under varying environmental conditions.*

10:05-10:20 *__Lusk, Niageria__. *Antimicrobial activity of hand sanitizers: A comparative study.*

10:20-10:35 *__Parks, Kristine Elizabeth__ and Janna Nicole Kukelhan.
Isolation and purification of nifN gene from Klebsiella pneumoniae.

Keynote Presentation

Saturday, Givens Performing Arts Center

11:15-11:30 **Welcome Remarks**

Dr. Maria Santisteban, Local Arrangements Committee Chair

Dr. David Zeigler, Department of Biology Chair, UNC Pembroke

Dr. Charlie Lytle, Emeritus Professor of Zoology, NC State University, will present a plaque to Janice Swab honoring the memory of Sue Stephenson, NCAS Office Manager

Introduction: Dr. Mark Canada, Dean of the College of Arts and Sciences, UNC Pembroke

11:30-12:30 **Keynote Speaker: Mr. David Micklos, Executive Director of the DNA Learning Center at Cold Spring Harbor Laboratory**
"Engineering Society: The American Eugenics Movement "

Student Academy Posters

Saturday Afternoon, HS Building, hallways
12:45-1:45 pm

Students will be presenting their posters during this time. Please stop by and chat with them while you enjoy one of our box lunches available in the Food Court. Tables and chairs will be available in the Food Court as well as under tents if you would like a place to sit outside during lunch.

***Bhagia, Ronak** "*Ketone Bodies: Possible Natural Remedy for Alzheimer's Disease*"

Carson, Krystyn "*Music's Effect on Studying and Testing*"

Lee, Jae "*A Novel Design of Electrode Surface Morphology to Improve Water Electrolysis Efficiency*"

***Lewis, Chase** "*Refugee Travois: Reengineering an Ancient Technology To Solve a 20th-Century Humanitarian Problem*"

***Liu, Alice** "*How Does Vitamin C in Orange Juice Degrade Over Time?*"

Lupo, Cody "*Development of an Effective Electrolysis System Powered by Hydroelectric Generators to Obtain Hydrogen as an Alternative Energy Source*"

McCreery, Kaitlin "*Investigation of Motility and Adhesion of* Batrachochytrium dendrobatidis *Zoospores*"

***Soderberg, Jacqueline** "*Before You Swim Check What's In*"

***Sutton, Danneka** "*Plop, Plop, Fizz Fast: The Effect of Temperature on Reaction Time*"

Student Academy members are in middle school (denoted with an asterisk) or high school. Today's poster presenters are winners of their high school district competitions and are presenting their posters as our guests.

Workshops

Saturday Afternoon, HS Building, specific rooms indicated below
1:45-3:00 pm
Select one of the 4 options

The Human Microbiome Project: An Opportunity for Student Learning

Dr. Anne Rosenwald, Assistant Professor of Biology, Georgetown University, Washington DC
HS Building, Rm 117

Human Cell Line Contamination: Denial, Acceptance, and Authentication

Dr. James Fuller, Director of DNA Identification Testing for the Laboratory Corporation of America, Burlington NC
HS Building, Rm 107

Teaching Science for Global Citizenship

Dr. Jeffrey Coker, Associate Professor of Biology, Elon University, Elon NC
HS Building, Rm 101

Graduate and Professional School

This session includes a panel discussion followed by breakout sessions.

Panelists: **Dr. Lawrence Reagan,** University of South Carolina School of Medicine, Columbia, SC
Tim Marks, Campbell University, Buies Creek, NC
Jennifer Mish, Physician Assistant Program Admissions and Administration, Director, Methodist University, Fayetteville, NC
Roy Charles, Director of Diversity, Recruitment, & Retention, The Graduate School, University of North Carolina at Chapel Hill, Chapel Hill, NC

HS Building, Rm 113

Fresh coffee will be available at 3pm

Oral Session III (NCAS)

Saturday Afternoon, HS Building, specific rooms indicated below
3:15-4:30 pm

Microbiology

HSB Rm 121

3:15-3:30 **K., Rinu,** Floyd L. Inman III, and Len Holmes. *A comparative analysis of entomoparasitic nematodes* Heterorhabditis bacteriophora *and* Steinernema carpocapsae.

3:30-3:45 **Upadhyay, Devang**, Rinu K., Sivanadane Mandjiny, Floyd L. Inman III, and Len Holmes. *In-vitro mass production of entomoparasitic nematode* Steinernema carpocapsae *utilizing a fed-batch culture process.*

3:45-4:00 **Inman III, Floyd L**. and Len Holmes. *The potential of antibacterial compounds produced by entomopathogenic bacteria for use as effective countermeasures against bacterial infections.*

4:00-4:15 **Holmes, Len,** Prasanna Belur, and Floyd L. Inman III. *Growth kinetics of* Photorhabdus luminescens *in batch fermentation.*

Cell & Development, Genomics, & Molecular Biology

HSB Rm 259

3:15-3:30 **Wilson, Mark R.**, Brittania Bintz, Erin Burnside, and Hilde Stawski. *Forensic human mitochondrial DNA analysis using emerging next generation DNA sequencing technologies.*

3:30-3:45 **Kassem, My Abdelmajid**, Masum Akond, Bobby Ragin, Richard Bazzelle, Stella K. Kantartzi, and Khalid Meksem. *Quantitative trait loci associated with moisture, protein, and oil content in soybean [*Glycine max *(L.) Merr.].*

3:45-4:00 **Akond, Masum**, Bazelle Richard, Bobby Ragin, Stella K. Kantartzi, Khalid Meksem, and My Abdelmajid Kassem. *Identification of quantitative trait loci associated with isoflavone contents in soybean seed.*

4:00-4:15 **Vaidya, Himani** and Karen S. Katula. *The WNT5A alternative promoter B is silenced by DNA methylation in osteosarcoma cells.*

4:15-4:30 **Porter-Kelley, J.**, DCG. Mayer, B. Hannible, K. Abernathy, D. Nichols, and, M. Woodard. *MicroRNAs in* Leishmania braziliensis.

Ecology, Environmental Science, & Zoology

HSB Rm 261

3:15-3:30 **Schwarz, Marcelo**, Gideon Wasserberg, and Brian Byrd. *Ecology of La Crosse Encephalitis (LACE) disease vectors along a forest-to-field ecotone in western North Carolina.*

3:30-3:45 **Kowalski, Michael P.** Charlotte, NC. *Water beetle community structure of an upland depression swamp.*

3:45-4:00 **Kharabsheh, Hamzah**. *Metabolism of Chlorpyrifos by* Pseudomonas aeruginosa *increases toxicity and acetylcholinesterase inhibition in adult zebrafish (*Danio rerio*).*

4:00-4:15 **Beamer, David A.** *How many species of* Desmognathus *occur in the coastal plain of the southeastern United States?*

4:15-4:30 **Guzman, David R.** and Gloria Amparo G de Olaya**.** *Application of macrophotography to document insect biodiversity in a tropical dry forest of Colombia, South America.*

Geosciences, Mathematics, & Physics

HSB Rm 103

3:15-3:30 **Rouse, L. Jesse** and Susan J Bergeron. *Maps, 3D worlds, and infographics: Geovisualization and scientific knowledge presentation.*

3:30-3:45 **Guo, Nailong**, Naima Naheed, and Woon-Kwan Lam. *An operations research model for the satisfactory highway cruising speed.*

3:45-4:00 **Zhang, Lei** and Sopori Bhushan. *Experimental verification of the influence of distributed microcracks on the strength of photovoltaic silicon wafers.*

4:00-4:15 **Brandon, W.D.** *The quantum physics of light emitting diodes.*

Special Sessions

Saturday Afternoon, HS Building, specific rooms indicated below
4:30 -5:30 pm
Select one of the 4 options

Research and Outreach at the Nature Research Center: What Can We Learn About Human Health from Primate Genomics and Armpit Microbes?

Dr. Julie Horvath, Director of the Genomics & Microbiology Research Laboratory at the Nature Research Center of the NC Museum of Natural Sciences, Raleigh, NC
HS Building, Rm 117

Seed Industry Consolidation and Its Consequences

Kristina Hubbard, Director of Advocacy and Communications, Organic Seed Alliance
This is a video-teleconference session moderated by Dr. Debby Hanmer, Assistant Professor of Biology, UNC Pembroke
HS Building, Rm 271

iPlant Collaborative Project

David Micklos, Executive Director of the DNA Learning Center at Cold Spring Harbor Laboratory, New York
HS Building, Rm 107

Beyond the Naked Eye: Scanning Electron Microscopy and Electron Probe Micro-Analyses

Dr. Lee Phillips, Associate Professor of Geology, UNC Pembroke, Pembroke NC
HS Building, Rm 113

Business Meetings

Saturday Afternoon, University Center Annex, specific rooms indicated below
5:30-6:30 pm
Everyone is eligible to participate in the business meetings. All participants are considered members of the NCAS or CANCAS because membership is included in the registration for those who were previously non-members.

NCAS Business Meeting, UC Annex, Rm 203

CANCAS Business Meeting, UC Annex, Rm 217

Banquet

Saturday Evening, University Center Annex
6:30-8:30 pm *Live Music: Lakota John & Layla Locklear, Native Flute & Song*

Board of Directors Meeting

Saturday Evening, UC Annex, Rm 203
8:30-9 pm

Workshop & Special Session Speakers

Workshop Speakers

Roy Charles, M.Ed
UNC Chapel Hill, The Graduate School, Chapel Hill, North Carolina

Workshop: Graduate and Professional School
(including a panel discussion followed by breakout sessions)

Roy Anthony Charles is currently the Director of Diversity, Recruitment, and Retention for The Graduate School, as well as a PhD Candidate in Educational Psychology at the University of North Carolina at Chapel Hill (UNC-CH). Roy's work in both roles focuses on understanding motivational factors affecting individuals in higher education and research careers. Prior to coming to UNC-CH Roy held several positions focused on the development and implementation of STEM initiatives. Prior to coming to UNC-CH, he was Assistant Dean for Graduate Students at the Massachusetts Institute of Technology (MIT).

Dr. Jeffrey S. Coker
Elon University, Elon, North Carolina

Workshop: Teaching Science for Global Citizenship

Dr. Jeffrey S. Coker is Associate Professor of Biology and the Director of General Studies at Elon University. He is the author of two new books, *Reinventing Life: A Guide to Our Evolutionary Future,* a book for the general public exploring how humans are driving evolutionary forces in the modern world, and *Exploring Plants: Inquiry-based Activities for Learning Plant Biology*, published by the American Society of Plant Biologists. Dr. Coker oversees general education programs at Elon and has led educational initiatives for several state and national scientific societies. His work is commonly used in high school and college classrooms.

Dr. James Fuller
Laboratory Corporation of America, Burlington, North Carolina

Workshop: Human Cell Line Contamination: Denial, Acceptance, and Authentication

Dr. James Fuller is a director of DNA Identification Testing for the Laboratory Corporation of America. He has reviewed over 35,000 DNA identification cases and been admitted as an expert witness on DNA testing in the state of North Carolina.

Dr. Fuller began his scientific odyssey in the 82nd Airborne Division with the groundbreaking insight that science is more fun than jumping out of airplanes. He followed his vision to East Carolina University and the University of North Carolina earning a M.S. and Ph.D. Dr. Fuller actively helps to develop the next generation of scientists by volunteering in activities ranging from kindergarten science demonstrations to leadership mentoring for undergraduates.

Mr. Tim Marks
Campbell University, Buies Creek, North Carolina

Workshop: Graduate and Professional School
(including a panel discussion followed by breakout sessions)

Tim Marks earned a B.S. in biology from Butler University ('03), where he was a 4-year varsity athlete in baseball and an Academic All-American in 2003. He earned a Professional Science Master's (PSM) from NC State ('10) in microbial biotechnology. The program combines microbiology, biotechnology, and business coursework. He did an internship in first generation biofuels at Novozymes in 2009. He has been working at Campbell University from July 2010 to the present as an instructor in the pharmaceutical sciences program. He has served on the Master of Science in Pharmaceutical Sciences admissions committee since 2010. He is currently working on a PhD in microbiology- research in a lab at Campbell for a PhD through NCSU.

Jennifer Mish
Methodist University, Fayetteville, North Carolina

Workshop: Graduate and Professional School
(including a panel discussion followed by breakout sessions)

Originally from Raleigh, NC, I earned my BS degree in 2002 and MBA in 2011 from Methodist University. From July 2002-May 2006, I worked in undergraduate admissions at Methodist University as the Assistant Director of Admissions. In May 2006, I assumed the role of the Director of Physician Assistant Admissions. Since 2006, my role within the PA program has evolved from working solely with admissions and recruiting to being more actively involved with our continuous accreditation, program development, grant writing and the expansion of the program.

Dr. Lawrence Reagan
University of South Carolina School of Medicine, Columbia, South Carolina

Workshop: Graduate and Professional School
(including a panel discussion followed by breakout sessions)

Lawrence Reagan received his PhD from the University of Pennsylvania and performed postdoctoral studies at The Rockefeller University. Dr. Reagan is currently an Associate Professor and Vice Chair in the Pharmacology, Physiology and Neuroscience Department at the University of South Carolina School of Medicine (USC SoM). Beyond research activities on the neuroplasticity of the hippocampus and amygdala, he also serves as the Director of the Neuroscience Focus Group at the USC SoM. In this capacity, Dr. Reagan has provided guidance regarding graduate school admission and life as a graduate student at regional meetings and on undergraduate campuses throughout the Southeast.

Dr. Anne G. Rosenwald
Georgetown University, Washington, DC

Workshop: The Human Microbiome Project: An Opportunity for Student Learning

Anne Rosenwald is a member of the Biology faculty at Georgetown Universityt. She earned her Ph.D. from the Johns Hopkins University, followed by post-doctoral training at the Carnegie Institution of Washington and the National Cancer Institute. Her research involves control of membrane traffic in *Saccharomyces cerevisiae* and the related pathogenic species, *Candida glabrata*. Support comes from NSF.

Dr. Rosenwald is a 2011 winner of the Georgetown College Dean's Teaching Award and a 2012 Bioscience Education Network Scholar. She is also co-director of Georgetown's innovative Biology of Global Health major. Currently, she is developing the Genome Solver project, funded by NSF, which seeks to train faculty in using data from the Human Microbiome Project for teaching and research (genomesolver.org).

Special Session Speakers

Dr. Debby Hanmer
UNC Pembroke, Pembroke, North Carolina

Special Session: Seed Industry Consolidation and Its Consequences

Dr. Debby Hanmer is an Assistant Professor and the Director of Undergraduate Studies for the Biology Department at the University of North Carolina at Pembroke. Dr. Hanmer received a bachelor's and a master's degree in nursing and worked for many years as a nurse practitioner. During that time she discovered a real passion for the plant world and eventually went back to school at the Ohio State University earning a Ph.D. in plant pathology. Dr Hanmer is currently teaching a variety of courses including botany, mycology, plant physiology and principles of sustainable agriculture. Her research area of interest revolves around the use of biochar (natural charcoal) as a soil amendment.

Dr. Julie Horvath
NCMNS, Nature Research Center, Raleigh, North Carolina, and NC Central University, Durham, North Carolina

Special Session: Research and Outreach at the Nature Research Center: What Can We Learn About Human Health From Primate Genomics and Armpit Microbes?

Dr. Julie Horvath is a comparative evolutionary genomicist interested in understanding the evolutionary forces that have shaped primate genomes and that cause human disease. Genetic and genomic comparisons between humans and our closest relatives, the primates, are crucial for understanding our own evolution and unique characteristics. The foundation of Dr. Horvath's research is based on species relationships, or phylogenies, which she first established for lemurs, and more recently, for all primates. These species relationships are applied to many of her research questions to investigate the connection between genotype (DNA sequence) and phenotype (traits/characteristics) that make flora and fauna unique.

Kristina Hubbard
Organic Seed Alliance, Port Townsend, Washington

Special Session: Seed Industry Consolidation and Its Consequences

Kristina Hubbard is the director of advocacy and communications for Organic Seed Alliance. She has worked for a decade as an organizer, researcher, and writer on projects involving agricultural biotechnology and antitrust issues in the seed industry. Hubbard is the co-author of Organic Seed Alliance's *State of Organic Seed* report and author of the National Family Farm Coalition's *Out of Hand: Farmers Face the Consequences of a Consolidated Seed Industry*. She serves on the board of directors for the Montana Department of Agriculture's Organic Commodity Advisory Council.

Mr. David Micklos
Executive Director, DNA Learning Center (DNALC) at Cold Spring Harbor Laboratory, New York

Special Session: iPlant Collaborative Project

David Micklos is founder and executive director of the DNA Learning Center (DNALC) at Cold Spring Harbor Laboratory. The nation's first science center devoted to public genetics education, the DNALC operates six teaching laboratories that provide hands-on science experiences to 30,000 students per year. The DNALC's Internet portal hosts 21 proprietary content and bioinformatics sites, which receive 7.4 million visitors annually.

Mr. Micklos is author of two popular textbooks, *DNA Science* and *Genome Science*. He received the 1990 Dana Award for Pioneering Achievement in Education, the 2011 Science Prize for Online Resources in Education, and the 2012 Genetics Society of America Award for Excellence in Education. He is the only CSHL staff member to receive an honorary doctorate from its Watson School of Biological Sciences.

Dr. Lee Phillips
UNC Pembroke, Pembroke, North Carolina

Special Session: Beyond the Naked Eye: Scanning Electron Microscopy and Electron Probe Micro-Analyses

Dr. Lee Phillips is an Associate Professor of Geology and the Director of the Pembroke Undergraduate Research Undergraduate Research and Creativity (PURC) Center at UNC Pembroke. He also serves as the Director of the Southeastern North Carolina Microanalytical and Imaging Consortium (SENCR-MIC), a collaborative research laboratory with Fayetteville State University. His research interests range from understanding climatic influences on the evolution of modern landscapes, to using isotopic and elemental geochemistry to interpret ancient climatic variability and sea level changes. The PURC Center is focused on providing students with opportunities for extracurricular, faculty-mentored scholarship. The SENCR-MIC strives to offer faculty, industry, and other users, state of the art microimaging and analytical facilities to carry out cutting edge, transformative research in a comfortable setting.

Abstracts

Abstracts arranged alphabetically. An asterisk by a name denotes a CANCAS presenter

Akond, Masum, Bazelle Richard, Bobby Ragin, Stella K. Kantartzi, Khalid Meksem, and My Abdelmajid Kassem. Department of Biological Sciences, Fayetteville State University, NC, and Department of Plant, Soil and Agricultural Systems, Southern Illinois University, Carbondale, IL. *Identification of quantitative trait loci associated with isoflavone contents in soybean seed.*

Isoflavone from soybeans namely genistein, daidzein, and glycitein have numerous human health benefits in reducing risk of cardiovascular disease, breast and prostate cancer, and menaupose symptoms of women. Localizing genes that contribute to isoflavone in a quantitative way should enable the exploitation of these genes in breeding through marker-assisted selection, and may lead to the discovery of gene identity and function. Fifty recombinant inbred lines of mapping population derived from a cross of soybean cultivars PI 438489B and Hamilton have been evaluated for isoflavone contents in two sites, Fayetteville and St. Pauls, North Carolina, in two seasons. A genetic linkage map with 1,536 Universal Soy Linkage Panel 1.0 of single nucleotide polymorphisms (SNP) markers has been used to identify (by composite interval mapping) quantitative trait loci (QTL) for the isoflavone contents. A total of 16 regions were identified which contained QTLs with LOD score ranged from 2.58 to 7.87. Two QTLs of each for daidzein and glycitein and three QTLs for genistein were identified in the seeds of soybean poulations grown at Fayetteville during 2010. Two QTLs of each for daidzein and glycitein glycitein and five QTLs for genistein were identified in the seeds of soybean poulations grown at St. Pauls during 2011. The QTLs were site specific may due to significant ($P<0.0001$) environmental effects were present for daidzein, glycitein and genistein contents in the populations over two seasons.

*Anderson, Grace, Emily Lehman, and Paul Steimle. Department of Biology, University of North Carolina at Greensboro. *Cellular studies of* Dictyostelium *myosin II heavy chain kinase.*

Dictyostelium is a simple eukaryote with a small genome (34Mb) that encodes many genes with structural and functional homologues in higher eukaryotes. Previous studies have shown that myosin II turnover via phosphorylation is regulated by at least three myosin heavy chain kinases (MHCKs) –A, -B, and –C; all of which share homologous catalytic and WD-repeat domains. A fourth kinase, MHCK-D, shares the ability to phosphorylate and drive myosin II filament disassembly in vitro; however, the localization properties of MHCK-D, its ability to affect myosin II turnover in vivo, and its effects on *Dictyostelium* slug activity have not been explored. Our studies using fluorescence microscopy to examine live cells expressing GFP-tagged MHCK-D revealed that the kinase undergoes robust translocation to the cell cortex in response to stimulation with the chemoattractant cyclic-AMP. Our findings from cell fractionation studies indicate the MHCK-D indeed plays a role in myosin II filament turnover in vivo, especially during the early stages of multicellular development. Further studies revealed that a cell line lacking MHCK-D expression, while still able to form slugs, exhibited a measurable increase in migration towards light (phototaxis). Taken together, our data indicate that MHCK-D, presumably through its ability to drive myosin II disassembly in the cell, plays a central role in controlling the tightly regulated and highly specific changes in shape required for the movement of cells in the contexts of chemotaxis and slug migration.

*Andersson, Emelie, Andrey Sorokin, and Bradley Miller. Department of Biological and Physical Science, Mount Olive College, and Kidney Disease Center, Medical College of Wisconsin. *Endothelin-1 signaling via the adaptor protein p66 Shc in renal glomerular mesangial cells.*

Endothelin-1 (ET-1), is a vasoactive peptide secreted by renal glomerular mesanigal cells (GMC). It is known that excessive ET-1 stimulation of GMC increases the risk of glomerular damage leading to proliferative glomerulonephritis. ET-1 binds to G-protein coupled receptors and modulates shc1 gene expression. A product of the Shc1 gene known as p66 Shc is associated with ET-1 signaling. To elucidate the role of ET-1 in proliferative glomerulonephritis, primary GMC isolated from rats with targeted modification of the Shc1 gene. We studied the role of signaling via p66 Shc in ET-1-mediated activation of Pyk2, a calcium-dependent cytoplasmic protein tyrosine kinase, and the Extracellular Signal-Regulated Kinases (ERKs), proteins important for cell contraction (Pyk2) and proliferation (ERKs). ET-1-mediated activation of Pyk2 was investigated in three cultures of primary GMC: wild type (WT), p66 Shc knockout (M4), and N-terminus truncated p66 Shc mutant (M3). Cells were treated with ET-1 and activation of Pyk2 was evaluated by immunoblotting. Phosphorylation of Pyk2 was only observed in WT 2 and 4 minutes after ET-1 stimulation, whereas M3 and M4 showed no Pyk2 phosphorylation suggesting that ET-1 signals via p66 Shc to activate Pyk2. Similarly, ERKs were phosphorylated 2, 4, and 6 minutes after ET-1 stimulation in WT, M4, and S36A cells, but not M3 cells, indicating that the N-terminus of p66 Shc is necessary for ET-1-induced ERK activation. Our data suggest that ET-1 signaling in GMC is mediated by p66 Shc activation of Pyk2. The absence of ET-1-induced ERKs activation in M3 GMC requires further investigation.

*Avila, Jessica M., Brenten L. Bottoms, and David A. Beamer. Department of Mathematics and Science, Nash Community College. *Morphological variation within mountain dusky lineages (*Desmognathus*).*

Desmognathus are medium sized lungless salamanders distributed across the Appalachian Mountains. Historically, there has been debate about how many species of *Desmognathus* there are. Currently there are six recognized species of *Desmognathus*: *ochrophaeus, orestes, carolinensis, apalachicolae, ocoee,* and *abditus.* These six species were recognized in part, based on molecular data. To date, there has not been a comprehensive range wide molecular phylogeny for *Desmognathus*. Here, we present a range wide molecular phylogeny that reveals the relationships of the six recognized *Desmognathus*, as well as several, apparently unnamed, lineages. To understand the morphological variation within these lineages we have photographed and measured specimens from twenty one localities. For each of these localities we sequenced ~1,700bps of mitochondrial DNA. In the 1960's Martof and Rose collected over 4,000 *Desmognathus* from twenty one localities and made twelve different measurements for the specimens. To leverage their large morphological date set, we collected a series of thirty salamanders from the same localities. We made the same measurements and used our data to supplement their existing data. Here we demonstrate considerable levels of morphological homoplasy in Mountain Duskies.

*Bailey Vitarbo,[1] Jacqueline, John A. Mecham,[1] Javier Rivera Guzman,[2] Christian Jobin,[2] and Acharan Narula.[3] [1]Department of Biological Sciences, Meredith College, [2]Department of Medicine and Center for Gastrointestinal Biology and Disease, University of North Carolina at Chapel Hill, [3]Narula Research, Chapel Hill. *Effects of diosgenin in* Schistosoma mansoni*-infected transgenic NF-κB^{EGFP} mice.*

BACKGROUND: Digenetic trematodes of the genus *Schistosoma* are complex multicellular pathogens that proliferate in the human host despite the development of a pronounced immune response. Nuclear Factor-κB is a pivotal transcription factor in chronic inflammatory diseases and immune responses. It regulates inflammation in all organs, is universally activated, and therefore provides a strong basis for studying the pathology of this disease. Diosgenin (DIO), a natural compound, has previously been shown to have gastro- and hepatotropic activity, and its protective efficacy was investigated in *Schistosoma mansoni*-infected transgenic NF-κBEGFP mice. METHODS: Infected NF-κBEGFP mice were fed either a control diet or a diet containing 1% DIO for 4½ wks. At 6 wks post-infection, both the liver and intestines were excised, and swiss rolls were made using murine distal ileums to colons. Schistosome ova were quantified in both the liver and the intestinal wall, and NF-κB activity was measured through macrofluorescent imaging. RESULTS: DIO-fed mice displayed a decrease in ova deposition in the liver compared to the control mice as well as a decrease in hepatic NF-κB activity. In contrast, histological analysis of the intestinal wall revealed that schistosome egg deposition was the same in both groups. CONCLUSIONS: These results suggest that diosgenin displayed protective effects in the liver reducing both NF-κB activity and *S. mansoni* hepatotropic infection.

*Barber, Marlon R. and Constance Rogers-Lowery. Department of Biology, Catawba College. *Effects of ocean acidification on growth of a marine hydroid.*

Levels of atmospheric CO_2 have been rising: this is a well known problem with far reaching consequences. The oceans of our planet absorb approximately 1/3 of the carbon dioxide, altering the chemistry of sea water and affecting the biota inhabiting the delicate salt-water ecosystem. For example, coral exposed to acidified seawater exhibits reduced growth and skeleton formations. The current study examines how rising CO_2 levels affect *Hydractinia symbiolongicarpus*, a small Atlantic hydroid normally found on the shells of hermit crabs. Explanted colonies were exposed to increased levels of CO_2 and temperature. Each week for 7 weeks, growth and the number of polyps produced each week were measured. It is hypothesized that increased levels of CO_2 and temperature will result in lower surface area growth and lower number of polyps produced.

Beamer, David A. Department of Math & Sciences, Nash Community College. *How many species of* Desmognathus *occur in the coastal plain of the southeastern United States?*

The coastal plain of the southeastern United States has long been recognized as a species rich region for amphibians. Most of these species are anurans and while generic diversity of salamanders is relatively high, salamander species richness is low. Recent surveys of the coastal plain have uncovered considerable cryptic salamander diversity. For a long time only a single dusky salamander species, *Desmognathus auriculatus*, was reported to occur in the coastal plain. Beamer and Lamb (2008) reported the results of a molecular phylogenetic reconstruction of coastal plain dusky salamanders. They found several independent lineages of salamanders within those populations recognized as *D. auriculatus*. Here I report the results of additional sampling that provides greater resolution of the distribution of these lineages as well as the presence of additional lineages that were not sampled in previous studies.

*Beeninga, Franklin Trent and Mary B. Hawkins. Department of Biology, North Carolina State University. *Site-directed mutagenesis of a single amino acid in the ligand-binding domain of teleost ERba alters its binding affinity to RU486.*

Estrogenic compounds act as hormones that regulate cell growth and function in several key systems of the body including the reproductive, cardiovascular, and bone maintenance systems. Estrogenic ligands bind to estrogen receptors within target cells, forming complexes that bind to DNA and regulate gene transcription. Teleost fish have three distinct estrogen receptors, ERα, ERβa, and ERβb, each with its own spectrum of ligand affinities. For example, the antiprogestin RU486 binds to Atlantic croaker (ac) ERβa with a higher affinity than to acERα or acERβb. These differences in binding affinity are attributed in part to amino acid substitutions in the ligand-binding domain of teleost ERs. To better understand the nature of RU486 interactions with ERs, we mutated the acERβa Phe396 amino acid to the corresponding Met found in ER alphas (human ERα Met421) and performed competition binding assays using bacterially-expressed ERβa(F-M) fusion proteins. The relative binding affinity of RU486 for acERβaF-M was shifted towards that for acERα. This shift in binding affinity after changing a single amino acid suggests a critical role for this position in the interaction of RU486 with teleost ERs. These data agree with findings for human ERs where RU486 has a higher affinity for ERβ than ERα. Further investigations into the role of the human ERβ substitution of Ile at the equivalent position to acERβa(Phe396) are needed to elucidate its possible role in the differential binding of human ERs to RU486.

*Bowen, Matt K., Floyd L. Inman III, and Len Holmes. Sartorius stedim Biotechnology Laboratory, Biotechnology Research and Training Center, University of North Carolina at Pembroke. *Effect of simulated microgravity on the bacterial characteristics of nematode symbiont* Photorhabdus luminescens.

In this study, the insect disease causing bacterium *Photorhabdus luminescens* will be used as a model organism to determine if exposure to simulated microgravity affects bacterial characteristics. *P. luminescens* is a Gram-negative bacterium that is symbiotically associated with the beneficial nematode *H. bacteriophora*. Bioluminescence, antimicrobial production, and pigment production are all characteristics of the phase I variant of *P. luminescens* and can be utilized to monitor the status of the phase variant in culture. Transition of the phase I variant to the phase II variant is often attributed to non-favorable environmental conditions. It is worth mentioning that phase variation has also been observed in human pathogens (e.g. *Escherichia coli* O157:H7, *Salmonella enteritidis*, *Shigella dysenteriae*) where these bacteria utilize phase variation to evade any immune responses. Effects of microgravity on microbial growth should be studied because phase variation in any microbe may become problematic for humans during space travel.

Brandon, W.D. Department of Chemistry and Physics, University of North Carolina at Pembroke. *The quantum physics of light emitting diodes.*

UNCP undergraduate physics students have investigated various experimental techniques to measure the quantized energy emission associated with light emitting diodes (LEDs) based on the Planck-Einstein relation (eV=hf). Conventional theoretical treatments using the concepts of effective charge and effective mass, those embracing the notion of the "exciton", promote a widely accepted view that this simple electroluminescent quantum energy relation is inadequate to characterize LED behavior. I will show that this relation is indeed satisfied for all LEDs except those which are comprised of material doping ratios falling into the so-called "green gap" family. For most LEDs defining the forward voltage, V as the voltage at which the relative output efficiency is maximized leads to satisfactory agreement with the simple Planck-Einstein relation. I will attempt to convey why such a phenomenological definition is without ambiguity, in contrast to conventional LED characterization. In addition to this simple observation, I will define an electroluminescent Stokes shift – analogous to the well-known photoluminescent Stokes shift. Finally, I predict that the "green gap" LED family will eventually obey the simple electroluminescent quantum energy relation within the next 5 to 10 years as the material doping ratios underlying direct gap green laser diodes find their way into the dye material associated with the production of mass market green family of LEDs.

*Brown,[1] Jazmine, Fan Yuan,[2] and Jianyong Huang.[2] [1]Department of Biomedical Engineering, North Carolina A & T State University and [2]Duke University, Department of Biomedical Engineering. *Increasing the efficiency of pDNA transfection into mouse melanoma cells.*

Electroporation is a process where short, strong electric pulses are applied to cells that cause the cell membrane to break down and pores to form. These pores allow for the delivery of drugs and genes. The problem with electroporation is that it is not efficient. There are four major components to the electroporation process: the pulse magnitude, the pulse duration, the number of pulses, and the interval between pulses (or pulse frequency). In our study, we investigated effects of pulse parameters on DNA delivery into cells suspended in a medium. We hypothesized that the delivery would be more efficient by increasing the interval between pulses. Three different parameters were used in the experiment: 1) A 170 volt pulse with a pulse duration of 10 milliseconds, 2) A 180 volt pulse with a pulse duration of 5 milliseconds and 3) a 160 volt pulse with a pulse duration of 15 milliseconds. One set of each parameter was exposed to an interval of one-second and another set was exposed to an interval of ten-seconds. Images were collected using Image Pro computer software. Analysis of the images from

all three of these parameters showed that the cells exposed to the pulses with longer intervals had a greater amount of transfected DNA than those exposed to the pulses with the shorter interval. Future research will be done to test the accuracy of these results as well as to test this process *in vivo* to see how the body responds.

*Brown, Jessica, Shanna Harrelson, Roland Stout, and William Brandon. Department of Chemistry and Physics, University of North Carolina at Pembroke. *Detection of cadmium in human hair using atomic absorption spectroscopy.*

Cadmium (Cd) is a toxic heavy metal with no known metabolic function. It can be found in soil, cigarette smoke, water, and even in food. Research in detecting trace levels of Cd in human subjects is the subject of growing interest due to industrial effects on the environment and on those employed by certain industries. Cd concentration in hair may prove to be a reliable indicator of past (perhaps chronic) ingestion. In this work we will review existing literature to determine if there exists any established toxicity levels of Cd in hair. In addition, we will address sample preparation methods, particularly those problematic issues related to sample variation. In the meantime we shall establish, via statistics, the limit of detection (LOD) for a Varian Atomic Absorption Spectrometer (model number –55B and specified LOD (Cd) – 10 ppb) and determine if trace levels of Cd may indeed be detected from hair samples of selected individuals.

*Butcher, E. and S. Cartier. Department of Chemistry, Warren Wilson College. *Toxicity of zirconium oxide (ZrO2) nanoparticles in nematode* Caenorhabditis elegans.

Toxicity of zirconium oxide nanoparticles in *C. elegans* was assessed by exposing the nematodes to different concentrations of nanoparticles dispersed in water. The particles used for exposure ranged in size from 20-30 nm as reported by the manufacture (SkySpring Nanomaterials). Original testing methods were chronic treatments exposing the *C. elegans* to the zirconium oxide nanoparticles in a liquid media for only 30 minutes before pouring the entire liquid media onto NGM plates. The worms were then counted every 12 hours over the course of 72 hours. This method did not yield nematode death, and currently data are being collected using a liquid media. The liquid media consists of sterilized deionized water with no added salts, and different concentrations of ZrO2 particles. Approximately 30 nematodes were added to each ZrO2 concentration, and a small pellet of *E. coli* that the *C. elegans* feed on. The number of living nematodes was counted every 12 over the course of 72 hours. After data collection is completed, a two-way ANOVA statistical analysis will be performed.

*Caine, LaShonda M., Jessica M. Avila, David A. Beamer, and Sean P. Graham. Department of Mathematics and Sciences, Nash Community College, and Pennsylvania State University. *Diversification of seepage salamanders across a complex geologic landscape.*

The seepage salamander, *Desmognathus aeneus*, occupies many distinct physiographic regions and several independent river drainage basins. Within this range, seepage salamander populations tend to be localized and most are apparently disjunct. The disjunct nature of these populations coupled with a complex geological and ecological history of the region occupied by these salamanders provides conditions which are conducive to lineage diversification. During the course of a range wide survey of seepage salamander, we visited nearly every historical site from which this species has been reported; in addition we discovered many previously unknown populations. Here we report the first phylogeographic survey of these minute salamanders. A Bayesian phylogenetic reconstruction of both mitochondrial DNA and eight nuclear genes reveals the presence of several well supported, distinct evolutionary lineages. The presence of multiple lineages within seepage salamanders has important conservation implications. The results of this survey provide a strong case for the importance of molecular systematic techniques in revealing the biodiversity of the southeastern United States.

*Cannon, Thomas W., Nathaniel Akers, and Tamara Walker. Department of Mathematics and Sciences, Nash Community College. *A genetically distinct population of three-lined salamanders,* Eurycea guttolineata*, in the Florida Parishes of Louisiana.*

The three-lined salamander, *Eurycea guttolineata*, is a wide-ranging lungless salamander in the southeastern United States. We have sampled eighty-four populations spanning the entire distribution of the three-lined salamander. We have amplified, purified, and sequenced 900 base pairs of the mitochondrial gene Cty-b and used these data to reconstruct the evolutionary history of three-lined salamanders. Our Bayesian phylogenetic reconstruction reveals a pattern of extreme genetic homogeneity across the range of three-line salamanders. However, in the Florida Parishes of Louisiana, we found that populations are highly differentiated genetically from adjacent areas. Here we examine potential biogeographic barriers that may explain this pattern of differentiation.

*Cole, Rachael and Freya Liu. Behavioral Sciences, University of North Carolina at Pembroke. *Handedness of wild capuchin monkeys in positioning events.*

Nonhuman primate tool use is interesting to study because it can inform us about the evolution of tool use in the human lineage. Nut cracking is a form of complex percussive tool use found so far only in humans, wild chimpanzees, and wild

capuchin monkeys (*Sapajus libidinous*; Fragaszy et al. 2004). Studying features of nonhuman primate tool use may reveal evolutionary significant features that were important in the evolution of human tool use. For example, high level of brain lateralization was probably preceded by division of labor between the two hands (handedness) in complex tasks and may also have given rise to language in early human ancestors. Most studies involving handedness in capuchins were conducted in a laboratory setting. This study aims to examine manipulation and handedness in wild capuchins in spontaneous nut cracking behavior. For this study, hand use in positioning of the nut on the anvil was coded from field videos (12 hours, 684 nut cracking episodes, and 11 monkeys). We found that five monkeys showed a left hand bias, three monkeys used both hands, and the other three monkeys showed a right hand bias. In conclusion, even though nut-cracking behavior is very strenuous and capuchins have to use both hands to lift the heavy stone tool, they do show handedness in positioning events throughout a nut-cracking episode. Thus, capuchins serve as a unique reference point in the study of evolutionary origins of tool use by ancestral hominids.

*Corona,[1] Armando, Heather Romine,[1] Ebru Caba,[2] Robert C. Elliott,[3] Hsin-wei Wang,[4,5] Charles Giardina,[6] Don-Guk Shin,[4,5] and Ben A. Bahr.[1,4,7] [1]Biotechnology Research and Training Center, William C. Friday Laboratory, University of North Carolina at Pembroke, Pembroke, North Carolina; [2]Vertex Pharmaceuticals, 130 Waverly Street, Cambridge, Massachusetts; [3]Department of Neurology, Beth Israel-Deaconess, Harvard Medical School, Boston, Massachusetts; [4]Bioinformatics and Biocomputing Institute, University of Connecticut, Storrs, Connecticut; [5]Department of Computer Science and Engineering, University of Connecticut, Storrs, Connecticut; [6]Department of Molecular and Cell Biology, University of Connecticut, Storrs, Connecticut; [7]Department of Pharmaceutical Sciences and the Neurosciences Program, University of Connecticut, Storrs, Connecticut. *A model of brain damage to study early and delayed responses with focused opposing gene profiles that make up the brain's response to injury.*

During excitotoxic injuries, genes are activated in the hippocampus (brain section dealing with memory) that involve degenerative and protective pathways. First, hippocampus slices placed in a dish were exposed to NMDA mimicking excitotoxic events (such as stroke) for 20 min. Next, total RNA was isolated in a 1 h to 24 h time interval using an Affymetrix neurobiology-focused array gene chip. Finally, informatics methods (storing, retrieving, organizing and analyzing biological data) were used to test for opposing gene expression. Interestingly, after excitotoxic exposure, two groups of 22 and 27 genes showed expression during the first hour and 24 h after exposure. Among these genes, Egr-1 and NOR-1 expressed biphasic responses in which both exhibited early induction and late suppression. Soon after excitotoxic mimicking, 14 genes linked to pathogenesis showed up-regulation and 9 pro-survival up-regulated 1 h after exposure creating responses that oppose pathogenesis. In comparison, at 24 h post insult, delayed degenerative response consisted of 5 up-regulated pathogenic genes and 9 down-regulated pro-survival genes. In addition, delayed opposed pathogenesis responses included 6 up-regulated pro-survival genes and 4 down-regulated pathogenic genes. Overall, these data show the importance of identifying the pathways that will help differentiate the stages in brain injuries. In conclusion, understanding the expression of genes during excitotoxic events may lead to finding new ways to treat stroke and other brain injuries.

Danala, Monica and Christopher Breivogel. Department of Pharmaceutical Sciences, Campbell University. *Anti-depressant activity of cannabinoid drugs on CB1 receptors is mediated by ß-arrestin2 binding and activation of MAPK cascade.*

Depression is a common mental illness associated with the mood catacholemine theory. Previous studies suggested that cannabinoids at low doses are potent antidepressants and the action is mediated through cannabinoid 1 receptors. The hypothesis of my study is 'Anti-depressant effects of cannabinoid drugs on CB1 receptors is mediated through ß-arrestin2 binding to the receptor and activation of MAPK cascade, thereby elevating phospho-ERK1/2 levels in the hippocampal and prefrontal cortex. C57BL/6 ß-arrestin2 wildtype and knockout male mice were injected with cannabinoids: Δ9 tetrahydrocannabinol (4 mg/kg), CP55940 (0.06mg/kg) or a vehicle control and subjected to Spontaneous activity assay and Forced swim test (FST) to determine their antidepressant. This will be followed by the brain isolation studies involving western blots to determine the relative amounts of pERK in wildtype and knockout mice. Results: ß-arrestin2 knock out mice showed a decrease in the time spent immobile in FST compared to the vehicle treated ones with CP55940 (0.06mg/kg) treatment but the wildtype mice did not. This suggested that CP55940 showed anti depressant activity in KO mice. THC (4mg/kg) treatment has no anti-depressant effects in either strains. The results contradict from the hypothesis. This might be due to the continuos activation of CB1 receptor due to the absence of ß-arrestin2 thereby activation of MAPK cascade through other mechanisms or due to the involvement of ß-arrestin1 protein. Further studies involve Tail suspension test (TST) to evaluate the anti-depressant activity of drugs and western blots to analyze the relative amounts of Phospho ERK and ERK.

*Davis, Mac, Floyd L. Inman III, and Len Holmes. Sartorius stedim Biotechnology Laboratory, Biotechnology Research and Training Center, University of North Carolina at Pembroke. *Isolation of soil and soil cover nematodes from different locations surrounding UNC Pembroke.*

Nematoda is the second most biodiverse phyla of the animal kingdom with the first being Insecta. Nematodes are non-segmented roundworms that inhabit many different niches in aquatic and terrestrial environments. These organisms exhibit

different lifestyles that include free-living, parasitizing or predaceous. *Heterorhabditis* spp. and *Steinernema* spp. are beneficial nematodes that are equipped with necessary biological adaptations that allow them to parasitize crop insect pests (i.e. entomoparasitic). These two nematode species are commonly isolated from soil (*Heterorhabditis* spp.) and soil cover (*Steinernema* spp.) To analyze the quantity and species of insect-parasitic nematodes found within Pembroke, North Carolina, a nematode isolation protocol is employed. The isolation protocol is centered on the usage of a Baermann funnel apparatus. Samples consist of various soils and soil covers ranging in depths from 0-20 cm. Soil pH is measured with a laboratory pH meter. pH is determined by properly mixing one portion of soil to five portions of water. Filtrate generated by the Baermann funnel apparatus is microscopically examined after two days to detect the presence of viable nematodes. Soil samples from multiple locations in Pembroke are continuously taken. Sampling areas include forests, agricultural fields, animal pastures, wetlands, and the campus of UNC Pembroke. As isolation techniques improve, further research will be performed to determine the species of insect-parasitizing nematodes found within the Pembroke area.

*DeFelice, Dominick S., Caitlin Ross, Michael Simone-Finstroem, Prachaval Sukumalanand, and Olav Rueppell. Department of Biology, The University of North Carolina at Greensboro, and Chiang Mai University. *Geographic variation in polyandry of the eastern honey bee supports division of labour hypothesis for multiple mating in social insects.*

Background: The repeated evolution of extreme polyandry in advanced social insects is explained by multiple coexisting hypotheses based on disease resistance, division of labour, kin selection, and inbreeding effects. All hypotheses are supported by some experimental data, prompting the question of their relative importance in natural populations. Geographic variation in mating behaviour of social insects has not sufficiently been studied but is useful for testing predictions based on these hypotheses in an evolutionarily relevant context. Findings: By microsatellite genotyping worker offspring, this study demonstrates significant variation in the mating frequency of queens of the Eastern Honey Bee (*Apis cerana* Fabr.) among three local populations from Thailand. Mating frequencies decreased from a northern, more seasonal environment to a southern tropical population and were lowest in a tropical island population.
Conclusions: These results favour the hypothesis that the evolution of polyandry is mainly due to its benefits on division of labour, instead of increasing resistance to pathogens or decreasing the risk of diploid drone production or kin conflict. Furthermore, our study suggests that queen mating behaviour is responsive to local conditions and that data from several populations are needed for reliable estimates of species-specific mating numbers.

*Deve, Maya, Manishi Pallavi, Scott Harrison, Gregory Goins, and Perpetua Muganda. Department of Biology, North Carolina Agricultural and Technical State University. *The SSBP2 gene promoter region contains binding sites for the tumor suppressor p53 protein: A bioinformatic analysis.*

Single-stranded DNA-Binding Protein 2 (SSBP2) is a recently discovered tumor suppressor functioning in maintenance of genome stability. The p53 protein is a transcription factor that regulates a variety of cellular processes, including genome stability. The SSBP2 gene was found to be down-regulated four-fold in a p53-dependent manner in human lymphoblasts exposed to 10 μM diepoxybutane, a potent metabolite of the carcinogen butadiene. SSBP2 is not known to be a transcriptional target of p53. Thus, in order to begin to test the hypothesis that p53 regulates the expression of the SSBP2 gene, we conducted an in-silico study to determine if p53 binds within the SSBP2 promoter region. Using the bio-informatic software p53-scan, p53 consensus binding sites were found within the SSBP2 promoter region at -6.55,-3.378,-3.378, and -1.823, relative to the transcription start site. To deduce the functional environment of p53, these sites were mapped on the SSBP2 promoter region using MATLAB; other known transcription factor binding sites were also mapped on the SSBP2 gene promoter region, within the vicinity of the p53 binding sites. The map will be useful in determining regions of the promoter to be cloned in order to directly assess the role of p53 in the regulation of the SSBP2 gene. This is the first report to describe the existence of consensus p53 binding sites within the SSBP2 promoter. This finding supports the hypothesis that SSBP2 might serve as a transcriptional target of p53, thus explaining the down-regulation of SSBP2 in human lymphoblasts exposed to diepoxybutane.

Draper, Bonnie, Hannah Firth, Kali Cram, Samantha Cram, Amelia DiPillo, and Alexandra Fullerton. Natural Sciences Department, St. Andrews University. *A functional role for amino acids surrounding the ATP-sensor motif of a DNA packaging motor.*

The bacteriophage T4 DNA packaging motor protein is used as a model system to understand how chemical ATP energy is coupled to physical work, i.e. DNA movement. The well-defined catalytic motifs and known structure of the protein (Sun et al. 2008 Cell 135: 125-62) allow specific mutations to be designed in silico and tested in vitro for effects on specificity, rate, and efficiency. Characterizing such mutants may provide details of the precise energy coupling mechanism which wild-type or dead mutants have not. While not directly participating in ATP binding or hydrolysis, several residues near the Walker A and B motifs contribute to structural interactions that are important for full activity (Tsay et al. 2010 JBC 285: 24282-9). To determine if residues surrounding other motifs participate in similar structural interactions, a conserved lysine residue adjacent to the sensor motif was selected for mutagenesis. Structural analyses indicate that this residue forms several interactions with

the Walker B beta strand, shaping the ATP pocket. Site-directed mutagenesis with degenerate primers was done to change lysine to all possible amino acids. Characterization of the mutants is currently underway—structural modeling suggests that amino acids of similar length and hydrogen bond potential (Arg, Gln, Asn) will be tolerated. However, the specific shape/charge of these amino acids may create subtle differences in the microenvironment of the ATP pocket which are sufficient to alter activity. Thus, the sequence motif may be extended to include those residues which determine structural position.

*Evans, Amanda. Lenoir-Rhyne University. *Chromium and cadmium levels in soils in the vicinity of an industrial incinerator.*

The Caldwell Systems Incorporated (CSI) incineration unit was operational in Caldwell County, North Carolina, from 1977 to 1988. There were concerns regarding environmental and health risks that led to several investigations from local, state, and federal organizations; however at that time the EPA did not regulate cadmium and chromium. Therefore, we examined levels of chromium and cadmium in soils near the incinerator. It was hypothesized that 1) concentrations of chromium and cadmium would be higher closer to the incinerator than farther from the incinerator and 2) chromium and cadmium accumulated in the soil along dominant wind directions more than in control directions. If these hypotheses were supported, then soil samples would show the highest levels of chromium and cadmium along dominant wind directions and closest to the incinerator. Soil samples were prepared using the methods of the NC Department of Agriculture and Consumer Services, followed by determination of the levels of chromium and cadmium in the leachate using atomic absorption spectroscopy.

*Fata, Anthony F., Brett Schuchardt, Srikripa Chandrasekaran, and Linda M. Niedziela. Department of Biology, Elon University. *Effect of environmental stressors on molecular pathways that control ion homeostasis in* Saccharomyces cerevisiae *and* Danio rerio.

Environmental stressors affect growth and division of cells, and trigger signaling pathways, which enable survival of organisms in the presence of stress. An essential mechanism responsible for adaptation to osmotic stress is maintaining ion homeostasis. Employing the yeast model, *Saccharomyces cerevisiae*, we are analyzing the involvement of the H+ homeostasis pathway in osmoregulation. We have established the dose of salt and oil dispersants, two osmotic stressors, which induce partial lethality in yeast. Preliminary data indicate that yeast harboring mutations in Pma 2, an H+-ATPase, are incapable of adapting to osmotic stress. We plan to study the localization of GFP-PMA 2 in yeast cells subject to stress, to establish the mechanism that offsets the adverse effects of osmotic stressors. Another facet of our study is to determine how marine organisms adapt to the presence of oil dispersants in the environment. Using the model organism, *Danio rerio* (zebrafish), we have determined that the expression of several isoforms of the skin and gill Na+/K+ pump, sodium Potassium ATPase (NKAs), is altered in the presence of oil dispersants. This was determined by comparing transcript levels of the atp1a1 family of genes, which constitute the NKAs, between fish subject to increasing doses of oil dispersants, and control fish. We have also established that the NKA activity is increased when zebrafish encounter oil dispersants, as determined by an assay that measured Na+/K+ ATPase enzyme activity. Our studies indicate that different types of ion homeostasis are crucial to enable organisms to tolerate osmotic stress.

*Fisher, Tamra J., W. Lin Coker, and Meredith T. Williams. Department of Chemistry and Physics, Campbell University, and Department of Mathematics and ITS, Campbell University. *Using students' historical data as a predictor of success.*

Campbell University offers two General Chemistry courses, the first of which is CHEM 111. These courses provide an understanding of core principles in chemistry which are required for upper level chemistry courses. Preparatory Chemistry, CHEM 100, is a course designed to prepare students to take the General Chemistry sequence. Historically, students take Preparatory Chemistry because they feel unprepared for college chemistry or have failed CHEM 111. It was previously discovered that students with a math SAT score below 450 were at risk of not passing General Chemistry, and have thus been encouraged to take CHEM 100 before attempting CHEM 111. The purpose of this work was two-fold. The first intent was to further study the relationships between student success in CHEM 111 and indicators such as SAT scores, high school GPA, and year classification (i.e., freshman, sophomore, junior, senior). The second purpose was to evaluate the effectiveness of CHEM 100 in preparing students to take General Chemistry. Student information from the past 10 years was collected and analyzed using statistical procedures. SAT scores were established to be a clear predictor of a student's success in General Chemistry. No evidence that success depends on classification was found. It was shown that those who take the Preparatory Chemistry course increase their CHEM 111 grade by an average of one letter grade. Overall, this study conclusively shows that taking the Preparatory Chemistry course increases student success in General Chemistry.

*Fox, Grace Ellen. Department of Biology, Lenoir-Rhyne University. *The Effect of Dobutamine on zebrafish (*Danio rerio*) embryos.*

Due to the average age of pregnant women increasing, the need for drug treatment during pregnancy rises. Cardiovascular drugs are frequently given to pregnant women with heart conditions or diseases. Dobutamine is a cardiovascular drug that

stimulates beta1 receptors in the heart, which causes an increase in heart rate and strength at which the heart beats. Although Dobutamine is a widely used drug, only a limited amount of research has been done to show its effects on organisms other than humans. Several studies have shown that exposure to Dobutamine increases the heart rate of chicken embryos. However, no such studies have utilized zebrafish (*Danio rerio*) as model organisms. In consideration of this, zebrafish were used for this study. Zebrafish embryos were placed in solutions of Dobutamine for 1 hour at 48hpf. Heart rate and growth rate were determined. The present study found a correlation between exposure to Dobutamine and heart rate, but no correlation between exposure to Dobutamine and growth rate.

*Franco, Edwin. Department of Chemistry, Lenoir-Rhyne University. *Comparison of the iron content of different commercial iron supplement tablets using atomic absorption spectrophotometry.*

Nutraceuticals are a 100 billion dollar industry worldwide, and this industry is essentially unregulated by the national regulatory agencies, such as the Food and Drug Administration (FDA). A critical parameter concerning a nutraceutical formulation is the dosage level of the active pharmaceutical ingredient (API). Because of the lack of regulatory oversight, there is little guarantee that the product delivers the label claim dosage, or that individual tablets from the same bottle are delivering the same dosage. In this study, multiple brands of an iron supplement were tested for label claim (the amount of iron claimed to be delivered per tablet) and content uniformity (the consistency at which individual tablets deliver the label claim dosage). The formulations tested were three over-the-counter (OTC) brands commonly found in pharmacies, and one that was prepared at a compounding pharmacy. The iron content of the tablets was determined using atomic absorption spectrophotometry. Data will be presented on the tablet-to-tablet and brand-to-brand differences in iron content, and to the accuracy of the iron content label claims for the various products investigated.

*Frazier, Mike and Melanie Lee-Brown. Department of Biology, Guilford College, and University of Ohio at Akron. *A comparison of predatory behavior of* Ensifer adhaerens *under varying environmental conditions.*

Ensifer adhaerens is a Gram-negative, facultative predator of the phylum α-proteobacteria. These ubiquitous soil bacteria have been recovered from samples collected deep inside oligotrophic limestone caves. This study compares optimum growth conditions for *Ensifer adhaerens* under nutrient-rich and starved (simulated cave environment) conditions and its affect on predatory behavior. Cells were grown in full-strength Brain Heart Infusion (BHI) broth (rich) and 1/100 BHI (starved) and growth was measured by UV absorbance. Preliminary data show a significantly longer doubling time for *E. adhaerens* in1/100 strength BHI as compared to full strength BHI at pH 7. To determine the optimal pH for growth in starved and rich conditions, cells will be grown in 1/100 and full strength BHI in a pH range of 5.0-9.0. Readings will be recorded every 20 minutes for 72 hours at 30 ℃ with constant agitation. These optimal growth conditions will be used as a baseline for preparing predation behavior assays between *E. adhaerens* and *Micrococcus luteus.* It is hypothesized that environmental factors, such as pH, will affect the predatory behavior of *E. adhaerens* by limiting predation under starved conditions.

Gaston, Jasmine. Fayetteville State University. *Hemp seed flour raised* Tenebrio molitor *and susceptibility to insecticides.*

Past research studies have shown that hempseed products can alter the development of insects. Considering hempseed's effect on development, *Tenebrio molitor* larvae raised on hempseed were exposed to chlorpyrifos, an insecticide. This was done to determine if the hemp would increase the insect's susceptibility to the insecticide. Three groups of larvae were tested, each group raised on different amounts of hempseed flour (hempseed flour, regular all-purpose flour, half hempseed flour and half all-purpose flour). Biological assays were carried out on 10 larvae from each group using a dip technique. The larvae were dipped into 20mg/L chlorpyrifos acetate solution for 30 seconds. In addition AChE assays were conducted using a modified Ellman's assay. The larvae raised on hemp exhibited greater symptoms than the control treatments with CPF at 20mg/L. Corresponding AChE inhibition was also observed. The results indicate that hemp may increase susceptibility of organophosphate insecticides.

Giri, Bishwa Kiran. University of North Carolina at Greensboro. *Genomic basis of local adaptation to climatic differences: A controlled common garden experiment in* Arabidopsis lyrata *to identify QTL and genetic mechanisms associated with plant life history traits and adaptation.*

Our research focuses on identifying the genetic basis of local adaptation in model plant organism *A. lyrata*, which is an outcrossing perennial and has a circumpolar distribution on northern hemisphere with different locally adapted population. These locally adapted populations exhibit contrasting variations in life history traits (viz. apical dominance, flowering time, shoot architecture, etc.) and resource allocation patterns (survival vs. reproduction) due to the processes of divergent selection. However, we have limited information on developmental basis of trait variation and adaptation, which is the subject of interest. We plan to establish F2 hybrids from crosses of parental populations from North Carolina and Norway which represent contrasting environmental types in terms of temperature and light hours, and subject F2 hybrids to selection in those environmental conditions to identify QTL affecting fitness. We hypothesize that QTL affect fitness by determining the apical

dominance patterns and thus resource allocation strategy. We also hypothesize that QTL respond differently in these two environmental conditions due to QTL-environmental interaction. Understanding the underlying genetic mechanisms of adaptation is important to gain insights into how the genetic architecture and the associated traits help in local adaptation. It will also be informative in understanding the genetic basis of how species will respond to changing climate where range shifts/migration are associated not just with temperature adaptation but changes in light hours at the mean time.

*Glass, Andrew D. Biology Department, Guilford College. *The effects of invasive* Akebia *on avian abundance, diversity, and habitat utilization in the Guilford College woods, Greensboro, NC.*

Invasive species of plants are known to modify the ecology of forests and other ecosystems, although specific effects of different invasives on wildlife are not completely understood. *Akebia*, a vine that covers ground and the lower trunks of trees, is one such species that changes the understory structure of southeastern forests. This study will examine the effects that *Akebia* has on avian abundance, diversity, and habitat use in the Guilford College Woods in Greensboro, NC, and will take place from January to April 2013. I will use the point count method to assess bird abundance and foraging behavior. I have established six different plots with varying *Akebia* coverage: two plots of 80-100% cover, two plots of 30-50% cover, and two plots of no cover. The plots will be surveyed alternatingly at dawn, mid-morning and in the afternoon. Data will be analyzed using species richness, Simpson's Diversity Index and $\chi 2$ tests.

*Goddard, Deborah, Akamu Ewunkem, Scott Harrison, Greg Goins, and Perpetua Muganda. Department of Biology, North Carolina Agricultural and Technical State University. *The tumor suppressor p53 protein binds to the HIST2H2AA4 gene promoter region.*

The p53 protein is a transcription factor that regulates a variety of cellular processes, including genome stability. Histone Cluster 2 (HIST2H2AA4) is a histone variant. The HIST2H2AA4 gene was found to be up-regulated 3.9-fold in a p53-dependent manner in human lymphoblasts exposed to 10 μM diepoxybutane, a potent metabolite of the carcinogen butadiene. HIST2H2AA4 is not known to be a transcriptional target of p53. In order to begin to test the hypothesis that p53 regulates the expression of the HIST2H2AA4 gene, we conducted chromatin immunoprecipitation-quantitative PCR assays to determine the existence of p53 binding sites within the HIST2H2AA4 promoter region. Furthermore, we confirmed the presence of these sites using the p53-scan bioinformatics tool. We found and confirmed p53 binding sites at -0.7626, -4.392, and -2.999 relative to the transcription start site within the HIST2H2AA4 promoter region. To view the functional environment of p53, these binding sites were mapped on the HIST2H2AA4 promoter region using MATLAB; other known transcription factor binding sites were also mapped, within the vicinity of the p53 binding sites. The map will be useful in determining regions of the promoter to be cloned in order to directly assess the role of p53 in the regulation of the HIST2H2AA4 gene. This is the first report to describe the existence of p53 binding sites within the HIST2H2AA4 promoter. This supports the hypothesis that HIST2H2AA4 might serve as a transcriptional target of p53, thus explaining the up-regulation of HIST2H2AA4 in human lymphoblasts exposed to diepoxybutane.

Goins, Gregory, Mingxiang Chen, Dinitra White, Thomas Redd, and Dominic Clemence. Department of Biology, North Carolina A & T State University. *A Bioinformatics Learning Enhancement Network for Diversity (BLEND).*

Although biology and mathematics programs at Historically Minority Universities (HMUs) have consistently produced high numbers of STEM baccalaureate degrees, more innovative programs are needed to increase the number of undergraduates who go on to earn the Ph.D. The challenge is to bring together a critical mass of interdisciplinary research collaborations and partnerships that address basic root origins of achievement gaps for underrepresented minorities in mathematics and biology. The Bioinformatics Learning Enhancement Network for Diversity (BLEND) project at North Carolina A&T State University was conceptualized by an interdepartmental alliance of faculty who are early adopters of transformational change required to prepare students for bioinformatics-related graduate study at the interface of biology and mathematics. The BLEND project supplies both a physical and virtual intellectual setting where students may find a sense of identification, belonging, responsibility, and most importantly, achievement that prepares them for roles of leadership and service in bioinformatics-related research careers. The overall goal of the BLEND project is to produce undergraduate students outstandingly prepared for the interdisciplinary nature of bioinformatics research. To accomplish this goal, the BLEND project (1) links research and classroom experiences, (2) provides joint-mentoring at the interface of mathematics and biology, and (3) broadens the appeal to bioinformatics training and research. Our Core Genomics Research Cluster provides a natural opportunity for students to explore, learn, and engage problems in biology from a mathematical and computational perspective while gaining deeper insight into bioinformatics and genomics related research.

*Goodison, Brianna. Department of Microbiology, Guilford College. *Site-directed mutagenesis of the FMN riboswitch of* Photorhabdus luminescens.

A riboswitch is an RNA control mechanism that regulates the transcription and translation of genes. The Flavin mononucleotide (FMN) riboswitch regulates the production of enzymes in the synthesis of Flavin Adenosine dinucleotide (FAD), an essential cofactor for bacteria including *Photorhabdus luminescens*. When sufficient FMN (a precursor to FAD) is present, FMN binds to the riboswitch causing a conformational change that prevents transcription of downstream genes in the rib operon encoding the FMN biosynthetic enzymes. In this experiment, two constitutive mutants, one in the "on" configuration and one in the "off" configuration, will be inserted into the genome of *P. luminescens* to observe the effect on virulence. This information can used to evaluate the use of riboswitches as a potential antibiotic target.

*Goodwin, Davon. Department of Biology, University of North Carolina at Pembroke. *Student Conservation Association (SCA) Veterans Fire Corps.*

Improving ecosystem health, rangeland conditions, wildlife habitat and reducing the threat of fire are critical issues in the Wildland Urban Interface (WUI). The Student Conservation Association (SCA), in partnership with the Kaibab and Coconino National Forests, deployed Veterans Fire Corps (VFC) teams to address these WUI issues. Further, this provided recent-era military veterans with training, credentials, and experience needed to competitively pursue wildland fire and/or forestry careers. Our VFC team received training at the Black Hills National Forest located in Custer, South Dakota. This proved invaluable in the development of outdoor leadership skills and contributed greatly to the safety and efficiency of wildland firefighting in the field. While working in northwestern Arizona, we experienced a diverse set of training opportunities and challenges. Collectively, the team navigated acres of rugged terrain, drainage crossings, heavy rains, and heat. All the while, we successfully maintained a safe work environment, even while fighting two forest fires. This presentation is the collective work of the team's methods, experiences, and accomplishments from their hard work and effort this season.

*Griffin, Austin and Robert Wardel. Department of Chemistry and Physics, University of North Carolina at Pembroke. *The role of negative feedback in stabilizing amplifiers.*

The purpose of this study is to gain an understanding of the role of negative feedback in the context of electronic amplifiers. A question of particular interest is why adding negative feedback to an amplifier makes it behave more linearly. We examine the question conceptually, mathematically and experimentally. Experiments done using both single transistor amplifiers and op-amps with various operating conditions and amounts of feedback are compared against a theoretical analysis. The study ends with how a better understanding of negative feedback in this context can be used for general problem solving and troubleshooting in designing systems of all types, amplifiers included.

Guo, Nailong, Naima Naheed, and Woon-Kwan Lam. Department of Mathematics and Computer Science, Benedict College, Columbia, SC. *An operations research model for the satisfactory highway cruising speed.*

Due to the impracticality of optimal highway cruising speed for fuel economy, based on the speed versus MPG curve and data, an operations research model is established to find the satisfactory highway cruising speed of vehicles. This satisfactory speed is an optimal balance between fuel economy and highway speed limit.

Guzman, David R. and Gloria Amparo G. de Olaya. Entomopixel LLC and Universidad Surcolombiana, Neiva, Colombia. *Application of macrophotography to document insect biodiversity in a tropical dry forest of Colombia, South America.*

"La Tribuna" is a tropical dry forest preserve in southwestern Colombia that is used for environmental studies and is managed by Universidad Surcolombiana and Ecopetrol, the Colombian state oil producing organization. Environmental and biodiversity studies are performed in this reserve to help understand the impact of human activity on the overall ecosystem. As part of this effort, we surveyed the local insect fauna and documented commonly seen insects and recorded their presence by macro-photographic techniques. Modern photography provides the ability to document the geographical distribution of insect species and is becoming complementary to collecting insects. Over 100 species of insects were photographed within approximately 8 hours of survey through the reserve's walking trails. Data will be presented showing the relative abundance of the main insect orders and families found.

*Hafner,[1] Sarah, Uzoma S. Ikonne,[1] Marsalis Smith,[1] Meagan L. Wisniewski,[1] Dennis J.Hoover,[2] Kishore Viswanathan,[3] Heather Romine,[1] Dennis L. Wright,[2-3] and Ben A. Bahr[1-3]. [1]Biotechnology Research and Training Center, University of North Carolina at Pembroke, [2]Synaptic Dynamics Inc., Farmington, Connecticut, [3]Department of Pharmaceutical Sciences and the Neurosciences Program, University of Connecticut. *Development of non-peptidyl small molecules for positive lysosomal modulation and protection against protein accumulation disorders.*

A crucial function of lysosomes is the clearance of misfolded and aggregating proteins, however lysosomal function can become less effective due to effects of age, disease, and environmental stresses on neurological processes. The accumulation of misfolded and aggregate proteins has been linked to several neurological diseases including Alzheimer's disease, Parkinson's disease, and other dementias. Recent studies have demonstrated that lysosomal enzymes can be upregulated to compensate for neurological deficits in proteolytic clearance that comprise risk factors for Alzheimer's and Parkinson's disease. Z-Phe-Ala-diazomethylketone (PADK) increases lysosomal cathepsin levels in the hippocampus and other brain regions, enhancing protective clearance of neurological aggregates including PHF-tau and Aβ42 (Buter *et al.* 2011, *PLoS One*; Bahr *et al.* 2012, *Rejuvenation Res*). Clearance of Aβ intercellularly was associated with plaque reduction in Alzheimer's disease transgenic mouse models and the corresponding amelioration of synaptic and behavioral deficits suggest that lysosomal enzyme enhancement provides protection at various stages in Alzheimer's disease development. From the successful PADK model, effective lysosomal modulators have been developed without the cathepsin inhibitory properties of PADK. Compounds SD1002 and SD1003 up-regulate levels of cathepsin B. SD1002 displayed improvement of effectiveness in lysosomal modulation, and offered protection against chloroquine-induced PHF-tau aggregation in hippocampal slice cultures, a model that exhibits excessive tau accumulation, microtubule alteration, transport failure, and compromise of synaptic integrity. The cathepsin B modulation by synthesized SD1002 isomers was determined to be stereo-selective. In addition, protection against Alzheimer's disease pathology was evident in a transgenic mouse model treated with SD1002. Development of cathepsin B modulatory agents will advance drug discovery in an effort to provide protection against protein accumulation pathology, such as Alzheimer's and Parkinson's diseases which disrupt synaptic integrity and lead to cognitive decline.

*Hardison, Mary Catherine, Wm. David Webster, and Amy M. Cherry Millis. Department of Biology and Marine Biology, University of North Carolina Wilmington. *Differential sex migration in the silver-haired bat (*Lasionycteris noctivagans*) in North Carolina.*

The silver-haired bat (*Lasionycteris noctivagans*) is thought to migrate out of North Carolina during the warmer parts of the year. The objectives of this study were to document its migratory patterns in the state and to see if patterns differed between males and females. A total of 524 museum specimens from North Carolina were grouped by month, gender, and physiographic region to complete this study. Our data indicate that the silver-haired bat is most abundant in December (18.7%), January (27.1%), and February (17.2%). There was a significant difference (Chi-square 116.0; P<0.0001) between the number of males (n=376) and females (n=133) represented in our sample; the sex was not known in 15 individuals. Additionally, males and females migrate out of North Carolina during the warmer months, with males leaving one month later (June), and arriving one month earlier (September) than do females. Furthermore, there is significant variation (Chi-square 339.2; P<0.0001) in the number of individuals from the three physiographic regions of the state – coastal plain (n=15), Piedmont (n=357), and mountains (n=152) – the monthly distributions of the two sexes in the Piedmont and mountains did not differ from the overall pattern; the coastal plain sample size was too small for statistical analysis.

*Harrison, Amanda R., Amy M. Cherry Millis, and Wm. David Webster. Department of Biology and Marine Biology, University of North Carolina Wilmington. *Occurrence of rabies in the tricolored bat (*Perimyotis subflavus*) in North Carolina from 1994-2011.*

We determined the incidence of rabies in the tricolored bat (*Perimyotis subflavus*) in North Carolina over a period of 18 years (1994-2011). Bats were tested for the presence of rabies at the NC State Laboratory of Public Health and then deposited in the UNCW Natural History Collections, where this study was conducted. Of the 181 bats submitted, 127 were females (70.2%), 50 were males (27.6%), and four (2.2%) were of unknown sex. The incidence of rabies was 16.9% in females (n=21 of 124 tested) and 16.0% in males (n=8 of 50 tested), and 33.3% in unsexed bats (n=1 of 3 tested). The results for the other six specimens were inconclusive. The incidence of rabies is not statistically different between the sexes, nor was there a significant difference in the incidence of rabies among months. However, the occurrence of rabies varies seasonally, occurring from April-September in females and from July-September in males. This coincides with parturition and nursing by females (April-July) and courtship behavior in both sexes (July-September).

Hatkevich, Talia and Yashomati Patel. Department of Biology, University of North Carolina at Greensboro. *Targeting multiple proliferation pathways as a novel breast cancer treatment.*

Estrogen receptor alpha positive (ER+) breast cancer cells proliferate and survive utilizing multiple pathways. By inhibiting several proliferation pathways, combination chemotherapies may be used to decrease ER+ breast cancer cell density.

Tamoxifen, an estrogen antagonist, has been used for over 30 years to inhibit ER+ breast cancer proliferation. Naringenin, a flavonoid, has been shown to reduce the proliferation of ER+ breast cancer cells by inhibiting the phosphorylation of mitogen-activated protein kinase (MAPK) and phosphatidylinositol 3 –kinase phosphoinositide 3-kinase (PI3K) proteins. In our studies, we have investigated the potential benefits of a combination of tamoxifen and naringenin on MCF-7 ER+ breast cancer cells. We show that tamoxifen and naringenin significantly inhibit cellular proliferation and viability greater than either treatment alone by flow cytometry analysis. Proliferation was inhibited by the reduction of phosphorylation of both the downstream target of PI3K, AKT, and extracellular signal-regulated kinases 1/ and 2 (ERK1/2) as determined by immunoblot analysis. Taken together, our results suggest that a combination treatment of naringenin and tamoxifen is more effective in inhibiting cell proliferation than either alone in ER+ breast cancer. This combination treatment has the potential to improve the efficacy of breast cancer chemotherapy regimens.

*Haughn,[1] Betty, Lisa Kelly,[1] Wm. Bruce Ezell,[1] Lee Phillips,[2] and Stephen Macko.[3] [1]Department of Biology and [2]Department of Geology and Geography, University of North Carolina at Pembroke, and [3]Department of Environmental Sciences, University of Virginia. *The trophic ecology of invasive fire ants in natural ecosystems of North Carolina.*

As a generalist consumer, the red imported fire ant (*Solenopsis invicta* Buren) may act as both a competitor and predator at multiple trophic positions. Further, the trophic ecology of this invasive species could change seasonally and in response to quantity and quality of food resources. In a pilot study, based on stable isotopes of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$), fire ants became more enriched in nitrogen from summer to autumn, and fire ants in disturbed sites occupied higher trophic positions than ants from nature preserves. To further test seasonal and environmental effects, we collected fire ants, non-ant arthropods and dominant vegetation in four nature preserves and in several disturbed sites (roadsides and green spaces in urbanized and developed areas) during summer and fall 2012. The nature preserves supported a rich fauna and flora, including rare species. Carbon and nitrogen isotopic ratios will be measured from dried, whole body samples of ants and non-ant arthropods and from representative plant tissues. We will estimate diets and trophic positions of fire ants by comparing isotopic ratios of fire ants, non-ant arthropods (herbivores, predators, and omnivores), and plants. Here we report on the taxa of plants and the taxa and trophic positions of the non-ant arthropods.

Hayden, Jennifer, Justin Shaffer, Kelly Hogan, and Jean DeSaix. Microbiology and Immunology Department, The University of North Carolina at Chapel Hill, and Biology Department, UNC-Chapel Hill. *Training graduate students and postdoctoral fellows to be effective mentors of undergraduate students.*

Undergraduate research experiences have been shown to increase students' interest in pursuing doctoral degrees and careers in STEM fields. Furthermore, students who have effective mentors report more positive outcomes. In order to improve undergraduates' research experiences, we have organized and facilitated a mentoring workshop for graduate students and postdoctoral fellows who mentor undergraduate researchers. Targeting graduate students and postdoctoral fellows will hopefully allow the workshop to have far-reaching effects, as this population is just beginning to mentor others. The participants can then continue to implement their new skills for the rest of their careers. The workshops were adapted from "Entering Mentoring: A Seminar to Train a New Generation of Scientists" by Handelsman, Pfund, Lauffer, and Pribbenow. The discussion-based workshop has been separately offered three times and met weekly for six weeks. Approximately 100 graduate students and postdoctoral fellows have participated, yet demand for the workshops has continued. New facilitators are identified from the pool of past participants, keeping the workshop self-sustaining. The main topics of the workshop included establishing expectations, maintaining effective communication, elements of a good research project, evaluating student understanding, identifying and resolving common mentoring challenges, teaching ethical behavior, and encouraging diversity. As an ongoing activity, participants wrote mentoring philosophies, which were peer-evaluated. Overall, participants reported that discussions on communication and how to approach common problems were the most helpful parts of the workshop. When asked to evaluate their mentoring abilities across several categories, participants indicated improvement in every skill as a result of participating in the workshop.

Hlavinka, Katherine. Department of Biology, The University of North Carolina at Greensboro. *The role of reactive oxygen species in insulin resistance.*

Insulin resistance and type II diabetes mellitus are significant health issues in the U.S. that are strongly correlated with obesity. Multiple risk factors play into the development of insulin resistance; two major factors are hyperglycemic conditions and an increase in reactive oxygen species (ROS). As oxygen radicals accumulate in adipocytes from increased glucose oxidation, they interfere with insulin signaling molecules and ultimately inhibit insulin stimulated glucose uptake. We have observed that ROS levels are consistent, but oscillate, after adipocytes become insulin resistant. To lower the ROS levels we used dietary antioxidants, ascorbic acid and α-tocopherol. We will determine if insulin sensitivity can be prolonged by lowering ROS levels by assaying key signaling molecules, IRS-1 and AKT, in the insulin signaling pathway. Lipid accumulation and glucose uptake will also be determined to further understand the role ROS play in the development of insulin resistance. Identification of

factors that interfere with insulin signaling, and thus type II diabetes, can lead to the development of possible therapeutic treatments.

*Hoang, Hoa Thi. Department of Biology, Guilford College. *Can we find and culture the freshwater microbe Planctomycetes from the Guilford College Lake?*

Planctomycetes is a distinct phylum within the Domain Eubacteria. Members of this phylum are pleomorphic; displaying varying shapes from ovoid, flagellated swarmer cells to sessile, stalked, reproductive cells. Members of this phylum lack the typical cell wall structure of most bacteria and replace peptidoglycan with glutamate-rich glycoproteins. They also possess an intracellular, sometimes double, membrane compartmentalization typical of eukaryotic cells. Species of Planktomycetes are normally found in fresh water and marine habitats. This study will focus on the potential collection and culturing of freshwater Planctomycetes from the Guilford College Lake. Collection will include vacuum filtration of environmental samples of the sediment and lake water and enrichment culturing. Identification methods will include cell and colony morphology,16S rDNA analysis and metabolic tests.

Holmes, Len, Prasanna Belur, and Floyd L. Inman III. Sartorius stedim Biotechnology Laboratory, Biotechnology Research and Training Center, University of North Carolina at Pembroke. *Growth kinetics of* Photorhabdus luminescens *in batch fermentation.*

Photorhabdus luminescens, a bioluminescent, Gram-negative bacterial symbiont of the entomoparasitic nematode, *Heterorhabditis bacteriophora*, was cultured in a 10 Liter bioreactor. Cell density and bioluminescence was recorded; whereas the volumetric oxygen transfer coefficient and oxygen transfer rates were determined during the batch process. The maximum specific growth rate of *P. luminescens* was determined to be 0.34 h^{-1} utilizing an enriched protein production medium. Luminosity of the culture peaked within 21 hours (maximum saturation) and was maintained until the end of the. The specific oxygen uptake rate was high during lag and early logarithmic phase and reached a stable value of 0.33 mmol $g \cdot h^{-1}$ during the stationary phase. Maintaining 200 rpm agitation and 10 $L \cdot min^{-1}$ aeration gave a k_La value of 39.5 h^{-1} and is adequate to meet the oxygen demand for 14.4 g L^{-1} biomass.

*Huff, Thomas G. and Michael J. Bruno. Department of Chemistry, Guilford College. Bacillus subtilis *detergent resistant membrane composition dependence on growth conditions and squalene inhibition.*

The lipid composition of the *B. subtilis* membrane varies significantly with growth condition and phase. The conditions of the culture environment may also affect the composition of lipid rafts in *B. subtilis*. Membrane rafts, typically studied in eukaryotic membranes, are associated with higher levels of cholesterol or other sterols. *B. subtilis* has no mechanism for producing cholesterol, but some evidence has been shown which suggests that *B. subtilis* biofilm formation is dependent on membrane raft integrity. Specifically, nystatin-surfactin induced biofilms have been shown to depend on the phosphorylation of Spo0A by histidine kinase KinC, a membrane protein. It has also been shown that the inhibition of the gene product of YisP with zaragozic acid also inhibits biofilm formation, and inhibition of DOXP synthase with clomazone has a similar effect. This research considers the dependence of detergent resistant membrane composition on squalene synthesis. We focus on qualitative variations of lipid classes identified in detergent resistant membranes and their dependence on growth environment and DOXP inhibition.

Inman III, Floyd L. and Len Holmes. Sartorius stedim Biotechnology Laboratory, Biotechnology Research and Training Center, University of North Carolina at Pembroke. *The potential of antibacterial compounds produced by entomopathogenic bacteria for use as effective countermeasures against bacterial infections.*

Most antibacterials are commonly found to be secreted by many species of bacteria found within both aquatic and terrestrial environments. These antibiotics along with others have significant medical applications in treating a spectrum of bacterial infections; however, due to the increase of bacterial resistance to these antibiotics, researchers are trying to discover new antibacterials that are more effective in treating diseases. Consequently, for antibacterial discovery, new environments must be explored. These environments may be closer to you than you think (i.e. home gardens and flower beds). Such environments support nematodes (*Heterorhabditis* spp. and *Steinernema* spp.) that parasitize commonly encountered crop insect pests. These insect-parasitizing nematodes will penetrate the insect host and release deadly symbiotic bacteria (*Photorhabdus* spp. and *Xenorhabdus* spp., respectively) from their gut. Upon proliferation, these bacterial symbionts secrete a series of toxins and enzymes that kill and bioconvert the insect host for nutrition. Additionally, these bacteria produce and secrete antibacterial compounds that protect the insect cadaver from putrification and thus providing an environment fit for nematode growth and reproduction. Current and past research has classified some of these bioactive metabolites. The compound classes identified include: peptides, xenocoumacins, indole-derivatives, dithiolopyrrolones, polyketides, xenorhabdins, hydroxystilbenes, and anthraquinones. With an array of secreted compounds, entomopathogenic bacterial symbionts are excellent new sources of antibacterials that have great potential to treat bacterial infections of both humans and animals.

*Iranloye, Oladoyin K., Bryan T. MacDonald, Xinjun Zhang, and Xi He. Department of Biology, North Carolina Central University, and SHURP-Division of Medical Sciences at Harvard Medical School, Boston, MA. *Generation of epitope tagged human Wnt proteins.*

The Wnt signaling pathway plays essential roles in cell proliferation and cell differentiation during organism development and in adult stem cell renewal and regeneration. As a result, mutations in the Wnt pathway frequently result in developmental disorders and cancer. Wnt ligands bind to two distinct families of cell surface receptors, the seven transmembrane Frizzled (Fz) receptor and the LDL receptor-related protein 5 and 6 (LRP5/6), to activate what is known as the canonical pathway through the stabilization of β-catenin, a transcriptional coactivator which travels to the nucleus to activate target genes. There are 19 different Wnt genes in the human genome providing a great diversity of Wnt ligands, some of which bind poorly to the LRP5/6 receptors and preferentially activate the non-canonical Wnt pathways. Mature secreted Wnt proteins are 350-400 amino acids in length and contain 22 conserved cysteines thought to participate in disulfide bonds. Wnts also possess multiple post-translational modifications, including glycosylations and a key lipidation required for Frizzled receptor binding. Due to the post-translational modifications, it is very difficult to develop epitope tag Wnts while retaining their biological activity. To test the biological activity we will use the Wnt responsive TOPFLASH luciferase reporter assay to analyze canonical Wnt signaling. Our results show that our refined carboxyl terminal epitope preserves much of the biological activity. These new epitope tagged Wnt constructs will be a valuable tool for future studies of the Wnt pathway.
*Funded by NSF REU grant 1004542

*Jamison, S. and M. Brenner. Department of Environmental Studies, Warren Wilson College. *Effectiveness of* Pluerotus ostreatus *in degrading diesel fuel.*

Mycoremediation is a type of bioremediation that utilizes fungi to degrade contaminants in the environment. Harnessing natural processes is an ecologically sound approach and reduces the need for manufactured chemical surfactants. The focus contaminant in this study, diesel fuel, is a common soil and water pollutant. In agricultural or silvicultural settings, contamination can easily occur through spills or leaks from heavy equipment. The objective of this study was to determine the effectiveness of oyster mushroom (*Pleurotus ostreatus*) in degrading diesel fuel. The experiment followed a two-way factorial design; filter papers saturated with either diesel or water were placed in jars filled with either mycelium-colonized straw or non-colonized straw. After six weeks of incubation, the filter papers were removed and placed in petri dishes. Seeds of a species known to be inhibited by diesel -- Cowpea (*Vigna unguiculata*)-- were introduced and the resulting germination and radicle growth rates were used to determine the effectiveness of the mycoremediation. A two-way analysis of variance of mean radicle lengths by treatment found significant interaction between diesel and mycelium ($p < 0.001$). A t-test showed significant difference in mean radicle growth between the diesel treatments with mycelium and those without ($p < 0.01$). The presence of mycelium lowered mean radicle growth in treatments without diesel, but increased it in diesel treatments. This study strongly suggests that mycoremediation with oyster mushrooms is a viable option for degrading diesel fuel to trace levels.

K., Rinu, Floyd L. Inman III, and Len Holmes. Sartorius stedim Biotechnology Laboratory, Biotechnology Research and Training Center, University of North Carolina at Pembroke. *A comparative analysis of entomoparasitic nematodes* Heterorhabditis bacteriophora *and* Steinernema carpocapsae.

Heterorhabditis bacteriophora and *Steinernema carpocapsae* are microscopic entomoparasitic nematodes (EPNs) that are used as effective biological agents for controlling crop insect pests. These nematodes evolved to bear adaptations that enable them to "parasitize" insect hosts. EPNs do not feed upon the insect hosts they parasitize, but feed upon their proliferated bacterial symbiont. EPNs are solely dependent on their bacterial symbionts (*Photorhabdus luminescens* and *Xenorhabdus nematophila*, respectively) for survival. Bacterial symbionts are housed within the gut of the respective nematode and are regurgitated into the insect "blood" upon nematode entry. Similar characteristics of EPNs are seen with their life cycle; which, in general, is analogous to each other in that the life cycle consists of five developmental stages. Nematode reproduction, however, is a more complex ordeal and varies between species. Other differences between EPNs include insect host ranges, nematode development, population growth rates, specificity of a bacterial phase variant, and mass production yields just to name a few. This presentation will highlight the importance of nematode biology and bacterial symbiosis and how this information has a great impact on mass production of EPNs in liquid media.

Kassem,[1] My Abdelmajid, Masum Akond,[1] Bobby Ragin,[1] Richard Bazzelle,[1] Stella K. Kantartzi,[2] and Khalid Meksem.[2] [1]Plant Genomics & Biotechnology Lab, Department of Biological Sciences, Fayetteville State University, Fayetteville, NC 28301, and [2]Department of Plant, Soil, and Agricultural Systems, Southern Illinois University, Carbondale, IL. *Quantitative trait loci associated with moisture, protein, and oil content in soybean [*Glycine max *(L.) Merr.].*

The objectives of this study were to detect quantitative trait loci (QTL) for moisture, protein, and oil content in soybean grown in two plant density environments. Soybean recombinant inbred lines (RIL), obtained from a cross between cultivars PI 438489B and Hamilton, were used. Thirty one linkage groups were obtained from high density genetic linkage maps

constructed by 1,536 Universal Soy Linkage Panel 1.0 of single nucleotide polymorphisms (SNP) markers. For the lines cultivated in higher plant density (25 cm row space), ten QTLs were mapped in A2, B2, C2, D1a, M and O linkage groups for moisture, protein, and oil. Two QTLs for moisture, two QTLs for protein and six QTLs for oil explained 0.09, 15.36 and 3.54% of the phenotypic variation of moisture, protein, and oil respectively. For the lines cultivated in lower density (50 cm row space), three QTLs for each of moisture and protein were mapped in linkage groups A2, C1, D1b, L and O; QTLs for moisture and protein explained 0.96 and 10.63% of the phenotypic variation respectively. These QTL will facilitate the implementation of MAS for moisture, protein and oil content in soybean-breeding programs.
Key words: Soybean seed, SNP, QTL, moisture, protein, oil, PI 438489B, and Hamilton.

*Kay, C. and P. Bartels. Department of Biology, Warren Wilson College. *Sexual determination in freshwater jellyfish Medusae,* Craspedacusta sowerbii*, captured in Lake Fontana, North Carolina.*

The freshwater jellyfish *Craspedacusta sowerbii* is one of three species of *Craspedacusta* with a worldwide distribution in freshwater habitats. Since its discovery, only three collections of the species have been found with mixed male and female medusa populations. To date, there is no current explanation as to why mixed genders are not commonly found together in the same population. The objective of this study was to determine variation in the sex ratio of multiple populations of *Craspedacusta sowerbii* in selected regions of Lake Fontana, North Carolina. In September 2012 two populations of *C. sowerbii* were collected for gender determination. Bell diameter was measured to assess sexual dimorphism in size, and limnological variables and zooplankton tows were collected for comparison of environmental factors. The first population from site 1 consisted of 56 females and 27 males with an average bell diameter of 11.69 mm for females and 9.67 mm for males. The second population collected from site 2 consisted of 83 females with an average bell diameter of 12.08 mm. This study is the fourth one since 1926 to record mixed gender medusae of *Craspedacusta sowerbii* in a single population and provides information for further exploration into the natural history of *C. sowerbii*.

*Khan, Nawsheen, Xiuli Dong, and Liju Yang. Department of Biology and Department of Pharmaceutical Sciences, North Carolina Central University. *The effect of antimicrobial treatment on* Baccillus anthracis *spores.*

Carbon nanotubes (CNTs) are allotropes of carbon that can ultimately produce cylindrical nanostructures. Their unique structural properties lend themselves to applications in varied fields ranging from nanotechnology to medicine, among others. In this project, the effectiveness of single-walled carbon nanotubes (SWCNTs) on the inactivation of *Bacillus anthracis* spores was studied. The effects of L-alanine and SWCNT concentration on the inactivation of *Baccillus anthracis* spores will be presented.

Kharabsheh, Hamzah. Department of Biological Sciences, Fayetteville State University. *Metabolism of Chlorpyrifos by* Pseudomonas aeruginosa *increases toxicity and acetylcholinesterase inhibition in adult zebrafish (*Danio rerio*).*

Chlorpyrifos (CPF) is a commonly used insecticide and belongs to a diverse family of chemicals called organophosphates (OPs). Due to the efficacy of OPs against crop pests, growers have used them on a large scale. Such broad use has resulted in concern about public health and impacts on the ecosystem. Bioremediation is one strategy that involves biological organisms to reduce toxicants in the environment. Toward the goal of reducing toxicants in the environment, the present study has examined the efficacy of *Pseudomonas aeruginosa*, a specific bacterial species, in degrading CPF. Results showed that after 5 days *P. aeruginosa* degraded CPF completely primarily to its primary metabolites, CPF-oxon and 3,5,6-trichloro-2-pyridinol (TCP), based on High Performance Liquid Chromatography analysis. Compared to control and CPF-only treated groups, mortality increased in zebrafish adults following the addition of *P. aeruginosa*. Our findings suggest that bacterial species such as *Pseudomonas aeruginosa* do not appear to serve as optimum bioremediation agents; rather, this species metabolizes CPF to more toxic metabolites, increasing mortality in fish.

Kowalski, Michael P. Charlotte, NC. *Water beetle community structure of an upland depression swamp.*

Water beetles were collected from a 0.75 ha upland depression swamp located in southwestern Mecklenburg Co., NC, from 1997 to 2005. In most years, the hydroperiod lasted from early January to late May, but the swamp did not flood during the peak drought years of 2000 and 2001, allowing for a comparison of pre- and post-drought community structure. Null model analysis suggests that the water beetle community is the result of niche selection and not interspecific competition.

*Kulkarni, Ameya S. and Mary Beth Hawkins. Department of Biology, North Carolina State University. *Investigating the differential binding affinity of genistein to ERs α and β using site-directed mutagenesis of ERβb, an estrogen receptor subtype found in a teleost fish.*

Estrogen receptors (ER) are intracellular proteins that promote gene transcription when activated by binding to estrogen. ERs play critical roles in the development and function of many tissues, including those of the reproductive, cardiovascular, and

nervous systems. There are multiple ER subtypes (ERa, ERb) in vertebrates, with differential binding affinities and transactivation properties for estrogens and estrogenic compounds. Genistein is an estrogenic compound found in soy that binds to ERb subtypes with a higher affinity than ERa. It has been proposed that the amino acid change of Met421 in the ligand-binding domain (LBD) of human ERato Ile in ERβ may be responsible for this difference. Fish have three estrogen receptors, ERα, and two ERβ subtypes, ERβa and ERβb. Like mammalian receptors, fish ERβs have an amino acid substitution at Met421 and a higher binding affinity for genistein. To examine the role of this amino acid position in the binding of genistein to ERs, we mutated the Ile at the equivalent position in the Atlantic croaker ERβb (acERβb) to Met and performed competition binding assays using bacterially-expressed acER mutant proteins. Mutation of acERβb Ile to Met did not change the binding affinity of acERβb for genistein. This finding does not support the hypothesis that the change of Met to Ile on the a face of the ER binding cavity accounts for the differential binding of genistein to ER subtypes.

*Lamb, Robert, Cornelia Tirla, Kara Beal, Donella Hunt, and Christopher McKee. Department of Chemistry & Physics, UNC Pembroke. *Optimization conditions for the production of biodiesel.*

With the cost of petroleum-based fuels steadily rising, and a limited supply slowly dwindling, there is an ever-increasing push toward creating renewable, "green" sources of energy and fuel. The main goal of this project is to yield a cost-effective means of biodiesel production from alternative feedstock, such as used vegetable oil, without using corrosive catalysts such as potassium hydroxide. This goal is being pursued by testing the efficiency of two phase-transfer catalysts on the reaction: tetramethylammoniun hydroxide (TMAH) and choline hydroxide. Optimization conditions are being determined for each catalyst's individual effect on reaction efficiency. These results are confirmed with NMR and GC spectroscopy. The immediate goal for this portion of the project is to determine whether a single catalyst or a combination of catalysts will produce a more efficient reaction.

*Lawson, Jeffrey R., Ben Dyer, and Michelle S. Thomas. Department of Biological Sciences, Campbell University. *Cloning and expression of the* Coxiella burnetii *macrophage infectivity potentiator gene into* Escherichia coli.

C. burnetii causes Q fever, an acute flu-like illness, and is listed as a category B bioterrorism agent. *C. burnetii's* intracellular lifestyle and disease pathogenesis resembles that of *Legionella pneumophila*, the causative agent of Legionnaire's disease. *C. burnetii*, *L. pneumophila*, and another intracellular pathogen, *Chlamydia trachomatis* have all been shown to carry the macrophage infectivity potentiator (mip) gene. *C. burnetii's* Mip protein (CbMip) might have some of the same characteristics, such as peptidylprolyl cis/trans isomerase activity, existing on the bacterial surface, and granting the bacteria with adherence to extracellular matrix material. Complementation assays performed in *Legionella* and in the heterologous host, *Escherichia coli*, have appropriated the earlier described characteristics. In this study, the *C. burnetii* mip gene, from a phase II strain, will be cloned in the p-TriEx vector and expressed as protein in *E. coli*. Protein expression will be confirmed with Western blotting. Future studies can then be performed to test the hypothesis that CbMip in *E. coli* will have similar characteristics as provided by LpMip. When completed, these studies will provide a better understanding of the pathogenesis of *Coxiella burnetii*, a largely ignored and still prevalent disease-causing pathogen.

*Lewis, Sarah, Jennifer Floyd, Aldo Castillo, Ann Ballance, Lyndsey McIntyre, Cara Paxson, and April Tucker. Department of Biological and Physical Sciences, Mount Olive College. *The response of differentiating colorectal cancer cells to the DNA topoisomerase II inhibitor, Etoposide.*

Mammalian cells are constantly exposed to agents that cause DNA damage. Exposure to ultraviolet radiation and the normal byproducts of cellular metabolism, such as reactive oxygen species, are toxic to DNA. If these lesions are not repaired, they can lead to mutations and wide scale genomic damage that threaten cellular viability. The cells ability to process damaged DNA is mediated by a concise series of signaling events that culminate in activation of cell cycle checkpoints or initiation of apoptosis. These events are thought to vary depending on the differentiation status of the cell. The Caco-2 cell line is an immortalized colorectal adenocarcinoma cell that displays two distinct phenotypes in culture and can be induced to differentiate into normal enterocyte-like cells upon confluence or exposure to Na-Butyrate. We have investigated the sensitivity of differentiated and undifferentiated Caco-2 cells to the DNA damaging agent Etoposide, a topoisomerase-II inhibitor that blocks DNA repair. We have used Hoecsht stain to visualize both mitotic and apoptotic cells, and preliminary studies have demonstrated that differentiated cells are more sensitive than undifferentiated cells to this topoisomerase II poison. We are using the TUNEL assay to further verify the apoptotic response in these cells and cyclic voltammetry will allow us to measure any changes in the redox state, a common event in the apoptotic process. These data should provide a better understanding of the role that cell differentiation plays in responding to DNA damage.

*Lloyd, William J. and Elizabeth D. Blue. Department of Chemistry and Physics, Campbell University. *Microwave-assisted transesterification of (±)Menthol and Methyl-2-chloropropionate.*

Biocatalysts are often used to facilitate reactions that do not occur under normal conditions. The published esterification reaction of (±)Menthol and Methyl-2-chloropropionate using a lipase catalyst requires twenty-four hours and gives low yields. Microwaves have been increasingly used because they are able to generate a large amount of focused heat to directly heat reactions, offering higher yields in shorter reaction times. This experiment investigates the use of the microwave heating in place of the lengthy lipase-catalyzed esterification reaction. Our results suggest that this microwave-assisted process drastically reduces the reaction time and requires no lipase to facilitate.

Locklear, Jared, Martin Farley, and James Mickle. North Carolina State University and University of North Carolina at Pembroke. *Palynological assessment of a Pleistocene age locality from southeastern North Carolina.*

A recently discovered locality in an open aggregate mine pit owned by the Martin Marietta Corporation near Wilmington, North Carolina (34° 22. 368' N, 77 ° 50.356' W), has produced abundant macrofossil remains that show a wide range of diversity. The exact environmental setting is uncertain, but appears to be channel-fill or lacustrin deposit based on the matrix. A palynological assessment of the sediment shows a wide range in diversity. Pollen types found include, but are not limited to *Pinus*, Taxodiaceous types, *Picea*, *Alnus*, *Liquidambar*, *Betula*, *Quercus*, *Ilex*, Monolete Fern types, *Ambrosia* spp., and other Compositae. Fungal, diatom, and protozoan palynomorphs are also present, which presents evidence of a wetland or riverine setting. The locality lacks *Isoetes* spores, which indicates an interglacial period. Little is known of the Pleistocene macrofossil flora of the southeastern United States and few complete interglacial floras of North Carolina. An analysis of this locality adds to our knowledge of this time period in this region.

*Long, C., Dommer, D.H., and Hughes, M. Environmental Science, Mount Olive College, and Environmental Science, Oregon Institute of Technology. *Dam removal effects: Reed Canary Grass invasion.*

While dams provide many benefits for local inhabitants, they greatly impact the downstream ecology of rivers and significantly influence the reproductive cycle of anadromous fish. Few dam removal projects have been accompanied by conclusive scientific studies, and both the short and long term effects of dam removal on river morphology and the interface with riparian habitat have been conducted. Studies demonstrated that dam removal causes increased turbidity, erosion, sediment deposition, and decreased water levels which increase surface area of newly exposed, unexploited riparian habitat. Following dam removal, two transects along the Rogue and Sprague Rivers in Oregon were studied to explore possible colonization cycles in newly exposed habitat. We hypothesized that Reed Canary Grass (RCG) would be the most likely candidate for rapid colonization, due to its prevalence in upstream areas, ability to invade moist open soils, high nitrogen fixing capacity, transportation of seeds from upstream areas, and growth inhibition of other plants by RCG sod. We surveyed topography of the landscape between quadrates, and recorded density and vegetation type along transects of both rivers. Results indicated that there was a substantial increase in the density and presence of RCG across many quadrants of both study sites, supporting the hypothesis. Findings from this research indicate that use of, or invasion by a rapid colonizer with similar properties to RCG may help to prevent rapid erosion shown to follow dam removal. Further research may help to understand how conservation management efforts could minimize the impact of dam removal on river ecology.

*Lucas,[1] Agape, Darwin Operario,[2] Eric Houpt,[2] [1]Department of Biology, North Carolina A&T State University, [2]Division of Infectious Diseases and International Health, University of Virginia Health System, *Development of an efficient real-time PCR assay for* Rickettsia *and* Ehrlichia *bacteria using* Amblyomma americanum *DNA.*

Lone Star ticks (*Amblyomma americanum*) transmit diseases like Spotted Fever Rickettsia and Ehrlichiosis in humans. Ehrlichiosis is often misdiagnosed for Rocky Mountain Spotted Fever because of their similarities in symptoms. When a tick-bite is suspected the common tests that are requested for Lyme disease and Rocky Mountain Spotted Fever. Often tests for Ehrlichiosis are available, they are less requested. The goal of this study was to develop an efficient target-specific and sensitive multiplex real-time PCR assay that can be used to detect the following bacterial targets in Lone Star ticks: *Rickettsia rickettsii* (RMSF), *Rickettsia amblyommii*, *Rickettsia parkeri*, *Ehrlichia chaffeensis*, *Ehrlichia ewingii*, and Panola Mountain Ehrlichia. Singleplex tests for these targets were developed first, and then combined to form a multiplex test. The singleplex and multiplex PCR data were compared by analyzing Ct (cycle threshold) values. For 5 out of 6 targets (*R. amblyommii*, *R. parkeri*, *E. chaffeensis*, *E. ewingii*, and Panola Mountain Ehrlichia) the Ct values were approximately equal between the singleplex and multiplex assays, indicating similar sensitivity. However, for *R. rickettsii* the Ct value for the singleplex was higher than the multiplex, indicating that the Multiplex test was more sensitive than the singleplex test, which is not considered the normal association. Only the positive controls were utilized and the results obtained are preliminary. In conclusion, a target-specific and sensitive multiplex real-time PCR assay was developed and can now be used to test Lone Star ticks for Rickettsias and Ehrlichias.

*Lusk[1], Niageria, [1]Department of Biology, North Carolina A&T State University, Kendra Bradford[2], Louis McIntyre[2], and Nirupama Mohapatra[2], [2]Department of Biology, Robeson Community College, *Antimicrobial activity of hand sanitizers: A comparative study.*

The use of hand sanitizer has gained popularity as a quick and easy way of disinfecting hands, has become an alternative to hand washing via soap and water. The objective of this study was to test the effectiveness of different hand sanitizers in the market in inhibiting bacterial growth. A modified version of the Kirby-Bauer method was used to test the effectiveness of six name brand sanitizers in slowing the growth of one strain of gram positive bacteria (*S. aureus*) and two strains of gram negative bacteria (*E. coli* and *P. aeruginosa*). The bacteria were inoculated on Tryptic Soy nutrient agar plates and incubated at 37°C for 24 h. Each plate was divided into 5 segments and 50 µL of the specific hand sanitizer were directly spotted onto the pre-incubated bacteria culture. Hydrogen Peroxide, 70% ethanol, and 70% isopropanol were used as positive controls. The bacteria plates were incubated at 37°C for an additional 24 h, after which the diameter of the clearing zones showing inhibition of bacteria growth were measured. Two-way ANOVA was used for statistical analysis, with Bonferroni post-test pairwise comparisons. Compared to Germ-X, SensorFoam significantly inhibited the growth of *s. aureus* ($p<0.001$). Compared to Assured, SensorFoam inhibited the growth of *S. aerus* more effectively ($p<0.05$). No significant differences were observed between the rest of the sanitizers in inhibiting bacteria growth. However, most of the sanitizers were significantly less effective in inhibiting bacteria growth when compared to the positive controls tested.

Lytle, Charles,[1] Francie Cuffney,[2] and Lisa Kelly.[3] [1]Department of Biology, North Carolina State University, [2]Department of Biology, Meredith College, and [3]Department of Biology, University of North Carolina at Pembroke. *Astronomy Days exhibits enhance NCAS role as a supporter of public interest in science and as a source of science expertise on matters of public interest in North Carolina.*

The Academy's participation in the Astronomy Days celebration at the NC Museum of Natural Sciences over the past several years has encouraged public interest in science and highlighted the importance of critical scientific issues of public interest. Our exhibit at the annual celebration, the largest event of its type in the nation, which brings thousands of people to the Museum, has engaged hundreds of children in science activities and informed them, their parents and other attendees about climate change, natural gas exploration, nuclear energy, human and animal health, and other science-related matters of public interest. Volunteer members of the Academy, aided by students from the Collegiate and Student sections, have presented varied exhibits featuring Academy programs, science activities for children, and information on important science issues. Among the recent popular activities for children was making unusual paper airplanes while learning some basic principles of flight. Another was having children search a supply of newspapers and magazines for science-related articles and mounting them on posters while discussing the articles. These exhibits have brought important recognition of the Academy as a significant source of authentic science information for the citizens and leaders of our state and for our work in promoting public understanding of science.

*Mangum, Nicholas and Jason Ezell. Department of Physics, Campbell University. *Gamma ray emitting isotopes in the environment and their relative intensities.*

This presentation introduces the general concepts of gamma ray spectroscopy, presents an in-depth experiment that involved the detection and identification possible gamma emitting radio-isotopes in the air surrounding Campbell University, and offers a relative intensity comparison for the identified isotopes. Explanation for the presence of the specific isotopes found in the environment is also given in the form of possible decay pathways. The research was completed over the course of the 2012 fall semester and involved data analysis in various locations surrounding Harnett County including the Sharon Harris Nuclear Power Plant.

*Millinor, David Elliott. Department of Biology, Lenoir-Rhyne University. *An examination of the effects of light on the symbiosis of green algae (*Oophila amblystomatis*) and the spotted salamander (*Amybstoma maculatum*).*

This study examined the impact of various wavelengths of light on embryonic development of *Ambystoma maculatum* and oxygen production of *Oophila amblystomatis*. Egg masses of *A. maculatum* inhabited by *O. amblystomatis* were kept in an aquarium on a light/dark cycle of 18L/6D hours at ambient temperatures of 17/12 °C, respectively. Measurements and observations included temperature, pH, dissolved oxygen, and embryonic development characteristics. Controls were exposed to full spectrum light and complete darkness while test groups were assigned a specific wavelength of colored light. It was expected that groups receiving the largest amounts of light energy would show increased rates of development and produce greater quantities of oxygen.

*Musselwhite, Molly Catherine and Tiffany R. Scott. University of North Carolina at Pembroke. *Microgravity effects on the Cori cycle.*

With increased explorations into the outer realms of space, astronauts are put under new and unexplored stresses. Although there has been significant research conducted to investigate the effects of microgravity on many human biological mechanisms, there has been very little research conducted to better understand the effects of microgravity on the Cori cycle. The Cori cycle is responsible for the conversion of lactic acid in the muscle to pyruvate by way of the liver, which causes the production of the Adenosine Triphosphate (ATP). ATP is used by muscle cells as an energy source for muscular contraction during muscular activity. We will observe the reaction between pyruvate and Nicotinamide Adenine Dinucleotide (NADH) in the presence of Lactate Dehydrogenase (LDH) to form lactate and NAD+. Preliminary 1-g measurements of the reaction have been conducted in the laboratory and will be compared to measurements made in 0-g on board NASA's microgravity research aircraft. Our hypothesis is that in 0-g the conversion rate of pyruvate to lactate will lower, leading to weakened muscles. The microgravity data collected will be taken as part of NASA's Microgravity University Program. This highly competitive program provides select undergraduate students the opportunity to fly experiments on their "0-g" aircraft. The team will travel to Houston, Texas in May 2013 to conduct our experiment on board NASA's microgravity research aircraft. We present the current status of our investigation as well as future plans.

*Ndung'u, T. and S. Cartier. Department of Chemistry, Warren Wilson College. *Calorimetric detection and HPLC quantification of artemisinin based anti-malaria pharmaceutical drugs from Kenya.*

Each year, approximately 300 to 500 million people in Africa and Asia contract *Plasmodium falciparum* malaria and in 2010, between 655,000 and 1.24 million people died from malaria. Prescription of counterfeit and substandard anti-malarial drugs is a contributing factor in the high number of malaria related deaths. Use of fake anti-malarial medicines also increases development of drug resistance. Malaria resistance to artemisinin based therapy has been observed in Asia and is likely to spread to Africa. About 23 samples were collected from Kisumu City, Nyallenda and Kondele in, Nyanza Province, Kenya. Of the 23 drug samples, 6 (26.09%) failed the packaging test (expiry dates, drug company logo, etc). All samples had detectable artemisinin derivative demonstrated by development of yellow color in Fast Red Dye Test and absorbance at 420nm. Quantification of artemether is in progress. Counterfeit and substandard anti-malaria drugs remain a public health concern in Kenya and other malaria endemic areas. Elimination of counterfeit drugs is crucial in slowing the spread of malaria resistance to artemisinin derivatives, which are the only potent drugs in treatment of complicated and non-complicated malaria. The number of malaria related deaths may also decrease since effective therapy will be administered.

Newman, Robert H., Jianfei Hu, Hee-Sool Rho, Zhi Xie, Jin Zhang, Heng Zhu, and Jiang Qian. North Carolina A&T State University and Johns Hopkins University. *Construction of a high-resolution map of human phosphorylation networks based on direct kinase-substrate relationships.*

The landscape of human phosphorylation networks has not been systematically explored, representing vast, unchartered territories within cellular signaling networks. Although a large number of in vivo phosphorylated residues have been identified by mass spectrometry-based approaches, assigning the upstream kinases to these residues requires biochemical analysis of kinase-substrate relationships (KSRs). Here, we developed a new strategy, called CEASAR, based on functional protein microarrays and bioinformatics to experimentally identify substrates for 289 unique kinases, resulting in 3,656 high-quality KSRs. We then generated consensus phosphorylation motifs for each of the kinases and integrated this information, along with information about in vivo phosphorylation sites determined by mass spectrometry, to construct a high-resolution map of phosphorylation networks that connects 230 kinases to 2,591 in vivo phosphorylation sites in 652 substrates. The value of this dataset is demonstrated through the discovery of a new role for PKA downstream of Btk during B cell receptor signaling. Overall, these studies provide global insights into kinase-mediated signaling pathways and promise to advance our understanding of cellular signaling processes in humans. In the future, information about the molecular determinants of kinase-substrate interactions will be used to construct genetically-encodable fluorescent biosensors to track changes in kinase activity in living cells, adding a crucial spatiotemporal component to these phosphorylation networks.

*Nikouyeh, Jonah, Kyle Burgett, and Paul Steimle. Department of Biology, University of North Carolina at Greensboro. *Studies of the cellular functions of diacylglycerol kinase and alpha kinase 1 in the social amoeba* Dictyostelium discoideum.

In *Dictyostelium discoideum*, four related myosin II heavy chain kinases (A, B, C, and D) regulate myosin II-mediated contraction of actin filaments during cell division (cytokinesis) and cell migration. In addition, there is evidence suggesting that two other proteins, diacylglycerol kinase (DgkA) and alpha kinase I (AK1), may also function in regulating myosin II filament turnover in the cell. DgkA phosphorylates diacylglycerol to produce phosphatidic acid, a potential regulator of signal transduction pathways in the cell. Our localization studies indicate that DgKA translocates to the cell cortex in response to chemoattractant (cyclic-AMP) stimulation of *Dictyostelium* cells. We also found that forced over-expression of DgkA has no effect on the ability of *Dictyostelium* cells to divide, indicating that DgKA does not regulate myosin II activity during

cytokinesis. In contrast to DgkA, the AK1 protein shares sequence homology with the catalytic domains of the MHCK family, and thus may also play a role in regulating myosin II function in the cell. To explore this possibility, we have engineered a recombinant plasmid for the inducible expression of the AK1 catalytic domain in bacterial cells. Protein expression has been confirmed by SDS-PAGE/Western blot analysis and attempts are being made to purify the AK1 protein for biochemical studies. Collectively, these studies have the potential to impact our understanding of the basic cellular functions of these two novel proteins in a variety of cellular contexts, including cell division and cell migration, both of which are impaired in cancer cells that exhibit uncontrolled multiplication and metastasis.

*Nogi, Allison L. Department of Biology, Elon University. *The effects of acrylamide (AA) ingestion on liver and sciatic nerve function.*

Acrylamide (AA), a common food carcinogen, has recently been found to impair cellular function through increased oxidative stress; however, habitual exercise might attenuate its effects. In this study, cellular function post acrylamide intake and exercise were analyzed through lactate dehydrogenase (LDH) levels in the liver and total lipid peroxidation in the sciatic nerve. An animal model was created that consisted of four groups of eight (48 total) *Rana pipiens*, a species of frog. The groups consisted of AA consumption only, AA consumption with exercise, no known AA exposure, and no known exposure with exercise. The frogs in the AA consumption groups ingested one cricket per week that was coated with 0.0025g of AA. Exercise sessions consisted of frogs swimming back and forth in a large tank for seven minutes. LDH and lipid peroxidation levels were analyzed every two weeks following dissection. The liver was analyzed using a Max Discovery LDH Color Cytotoxicity Assay Kit to determine LDH levels. Through this assay, AA ingestion demonstrated a significant increase ($p=0.05$) in LDH. Exercise diminished the concentration of LDH overtime. The sciatic nerve was analyzed through a BCA assay kit to determine total lipid peroxidation. Frogs that had ingested AA had significantly more lipid peroxidation ($p=0.05$). Exercise significantly ($p=0.05$) reduced lipid peroxidation between the AA and AA Exercise groups. These data suggest that increased LDH and lipid peroxidation are correlated with abated liver and sciatic nerve function. The effects of AA and the levels of LDH and lipid peroxidation were minimized through exercise.

*Obinwanne, Vera, Natalia Van Duyn, and Richard Nass. Department of Biology, North Carolina Central University, and School of Medicine, Indiana University. *Identification and characterization of molecular modulators of methylmercury-induced toxicity and dopamine neuron degeneration in* C. elegans.

Methylmercury (MeHg) exposure from occupational, environmental, and food sources is a significant threat to public health. MeHg poisonings in adults may result in severe psychological and neurological deficits, and in utero exposures can confer embryonic defects and developmental delays. Recent epidemiological and vertebrate studies suggest that MeHg exposure may also contribute to dopamine (DA) neuron vulnerability and the propensity to develop Parkinson's disease (PD). A novel *Caenorhabditis elegans* (*C. elegans*) model of MeHg toxicity that shows that low, chronic exposure confers embryonic defects, developmental delays, decreases in brood size and animal viability, and DA neuron degeneration has been developed. Toxicant exposure results in the robust induction of specific glutathione-S-transferases (GSTs) that are largely dependent on the PD-associated phase II antioxidant transcription factor SKN-1/Nrf2. SKN-1, a protein previously localized to a small subset of chemosensory neurons and intestinal cells in the nematode, is also expressed in the DA neurons, and a reduction in SKN-1 gene expression increases MeHg-induced animal vulnerability and DA neuron degeneration has also been demonstrated. A number of suppressors of MeHg-induced toxicity from a genome-wide reverse genetic screen have been identified. The characterization of several of the genes identified in this screen, and determining the role they may be playing in MeHg-induced DA neuron toxicity will be presented.

*Orton, M. and D. Ellum. Department of Environmental Studies, Warren Wilson College. *Effectiveness of a mycofilter on reducing coliforms in agricultural runoff.*

As the human population has grown, the sources and amounts of pollution have increased similarly. Bioremediation techniques use various types of living organisms to remove pollutants from soil and water, and mycofiltration is one of the newest methods. Mycofiltration has been used to remove metals and other toxins from water. Due to the antimicrobial and antibacterial properties of fungal mycelium, it also has the potential to inactivate pathogens in water. The objective of this study was to assess whether a mycofilter eliminated pathogens from agricultural runoff. This experiment tested the number of *E. coli* and total coliforms upstream and downstream of a mycofilter collecting runoff from an agricultural field. On each day of collection, three samples were taken each upstream and downstream of the mycofilter. Samples were taken on seven separate days from April 2012 to August 2012. The coliforms were enumerated by using the Coliscan EasyGel method. The p-value for a two-tailed parametric t-test comparing average number of *E. coli* colonies upstream vs. downstream was 0.4917, indicating no significant difference between the sites. Similarly, the p-value for the average number of total coliform colonies upstream vs. downstream of the mycofilter was 0.1696. This suggests that the mycofilter is ineffective at reducing these types of bacteria from agricultural runoff. These results do not mean that a mycofilter is entirely ineffective. A design flaw, such as low retention time or fungi better suited to a different set of environmental conditions, may have limited the scope of functionality.

*Parks, Kristine Elizabeth and Janna Nicole Kukelhan. Department of Biology, Meredith College. *Isolation and purification of nifN gene from* Klebsiella pneumoniae.

Klebsiella pneumoniae is a unique member of the Enterobacteriaceae in that it can fix nitrogen. However, *K. pneumoniae* does not participate in symbiotic nitrogen fixation with leguminous plants, making it of particular interest. There are 20 *nif* genes responsible for *K. pneumoniae's* nitrogen fixation ability. The *nifN* gene has been identified as a gene that controls the assembly of the enzyme nitrogenase. The purpose of this project was to isolate and purify the *nifN*gene from *K. pneumoniae* and ultimately attempt to clone this gene into plants to enhance nitrogen fixation within these organisms. DNA primers complimentary to the *nifN* gene were designed for PCR using Primer 3 software. DNA was extracted from a *K. pneumoniae* sample using a Promega Wizard Genomic DNA Purification Kit and used as a template for PCR. The PCR product was cloned in the pGEM T-Easy Vector from Promega. Transformation of the pGEM T-Easy Vector into *E.coli* was done, and verified with a restriction enzyme digestion. Future work will include cloning the *nifN* into an expression vector and transforming the new construct into plants for study.

*Payne, Krystal T., Ross A. McCauley, and J. Christopher Havran. Department of Biological Sciences, Campbell University, Buies Creek, NC, and Department of Biological Sciences, Fort Lewis College, Durango, CO. *A preliminary phylogeny of the endemic Hawaiian genus* Nototrichium *(Amaranthaceae).*

The genus *Nototrichium* (Amaranthaceae) contains three species of shrubs to small trees endemic to the Hawaiian archipelago. Previous molecular studies have shown that *Nototrichium* is closely related to the widespread genus *Achyranthes.* Some researchers have hypothesized that the Norfolk Island endemic *Achyranthes arborescens* represents a taxon sister to *Nototrichium* due to similarities in floral morphology and woody habit. To date no molecular studies have been conducted that have investigated the origin of *Nototrichium* with respect to *Achyranthes*. The goal of our research was to analyze the biogeography and evolutionary history of *Nototrichium* through the construction of a phylogeny of *Nototrichium* and Pacific *Achyranthes*. DNA from all species of *Nototrichium* occurring on each Hawaiian island and four species of Pacific *Achyranthes* was extracted from leaf materials obtained from field collections, herbarium specimens, and DNA libraries. The Internal Transcribed Spacer sequences were amplified and sequenced. Maximum Parsimony and Maximum Likelihood analyses were used to estimate the phylogenetic relationships among species of *Nototrichium* and *Achyranthes*. Our results demonstrated that *Nototrichium* represents a monophyletic lineage derived from within *Achyranthes*. From our current data we show that *Achyranthes japonica*, a species with invasive tendencies distributed across East Asia, and not *Achyranthes arborescens*, is sister to *Nototrichium*. Within the genus *Nototrichium* our results show that the widespread *Nototrichium sandwicense* is paraphyletic with respect to other species in the genus. Additional gene regions and species will be investigated in future research to further elucidate the relationships among the species of *Nototrichium*.

*Pittman,[1] Shonkela and Barry Williams.[2] [1]North Carolina A & T State University and [2]Michigan State University. *The effect of clonal diversity on rates of adaptation.*

The genetic basis of adaptation for asexual organisms is complex because mutations altering the fitness of one clone will 'compete' against mutations from other clones, because recombination does not combine mutations together within one genome, and is termed clonal interference. Moreover, clonal interference among clones that harbor otherwise homogeneous genomes, may be further complicated by competition among unrelated clones, which occurs during infections with heterogeneous populations of pathogens. However, little is known about the potential interactions between clonal interference and competition. The focus of this experiment is to determine if increasing competition among a diversity of asexual microbes alters rates of adaptation. Here we developed natural haploid strains of *Saccharomyces cerevisiae* that were isolated from three ecological conditions, and are thus unrelated. We evolved various combinations of related versus unrelated strains asexually in one novel environmental condition. Fluorescent markers were used to visualize the relative abundance of each strain within the evolving populations in order to determine the degree of clonal interference. Growth rates in the evolved populations, relative to the starting ancestor, were determined in order to compare rates of adaptation among treatments. Prospective differences in rates of adaptation will help elucidate the dynamics of host adaptation in cases of multiple-strain infections.

*Podgorak-Lagro, Mary and Jay Bolin. Department of Biology- Botany, Catawba College. *An evaluation of hybrid intermediacy in the germination ecology of Ashe's Sumac,* Rhus asheii *(*Rhus michauxii *X* Rhus glabra*).*

The federally endangered shrub *Rhus michauxii* hybridizes with the common small tree *Rhus glabra* to produce the apparently fertile hybrid *Rhus asheii*. This hybrid may outcompete the parent plants and therefore threaten the long term persistence of *R. michauxii* populations. There is very little information on the germination ecology of *R. michauxii* or the hybrid *R. asheii*. Thus, we evaluated the germination ecology of *R. asheii*, *R. glabra*, and *R. michauxii* collected from the sandhills of Ft. Bragg, North Carolina. We applied dry heat treatments, simulating modest heat from wildfire, to seeds of the three species at 60, 80, and 100°C for five minutes. In addition to control groups, we also evaluated the effect of endozoochory by Northern Bobwhite Quail (*Colinus virginianus*) to test for their effect on the germination of *R. asheii, R. glabra*, and *R. michauxii* seeds.

Germination data from this study on the hybrid plant *R. asheii* and its parents should provide important information for the effective management *of R. michauxii*.

Porter-Kelley, J., DCG. Mayer, B. Hannible, K. Abernathy, D. Nichols, and, M. Woodard. Department of Life Sciences, Winston Salem State University, and Department of Biology, Manhattan College. *MicroRNAs in* Leishmania braziliensis.

mRNAs have been described in most organisms from worms to human and more recently in protozoans. miRNAs are a group of small RNAs that regulate gene expression post-transcriptionally in a complex process of binding to mRNA in a perfect complement or almost perfect complement that cleave mRNAs or inhibit their translation. Gene expression in *Leishmania* is not well understood, however, it is known to be post-transcriptionally regulated. Argonaute-like and Dicer-like protein, the machinery needed for the processing of miRNAs have been shown to exist computationally in *Leishmania braziliensis*. Our hypothesis is that miRNAs regulate gene expression in *L. braziliensis*. We have shown by computational data analysis that there are miRNAs in *L. braziliensis*. Here we show the continuation of our study showing the experimental verification of miRNAs in *L. braziliensis.*

*Reding, M. and D. Kahl. Department of Chemistry, Warren Wilson College. *Aflatoxins in peanut butter measured using enzyme linked immunosorbant assay (ELISA).*

Aflatoxins are carcinogenic secondary metabolites produced by the fungus Aspergillus. Aflatoxins are commonly found in crops such as peanuts, tree nuts, and corn. In this study the levels of aflatoxins in two different types of peanut butter, freshly ground, organic peanut butter, and Jif brand peanut butter, were analyzed. Analysis was performed using a commercial Enzyme Linked Immunosorbant Assay (ELISA) kit. The concentrations of aflatoxin present in the samples were determined based on visual comparison to standards with known aflatoxin levels. Results were analyzed using a two-tailed, unpaired t-test. No significant difference in the levels of aflatoxin was found between the two treatments. All the samples contained less than 20 ppb, meeting US regulatory restrictions on aflatoxin levels. Most of the samples also complied with the more rigorous European standard of 4 ppb. The results suggest that there is minimal risk associated with eating peanut butter from these samples, as all concentrations were well below the legal limits. Moreover other research suggests that the overall risk of developing liver cancer from aflatoxin contaminated peanut products in the US is quite small.

Rekulapally, Satish Pawar and Christopher Breivogel. Department of Pharmacy, Campbell University. *Role of ß-arrestin2 in development of tolerance to chronic THC treatment in female mice.*

Cannabinoid CB_1 receptors are widely distributed in CNS and are involved in mediation of many CNS actions of cannabinoid compounds. Cannabinoid compounds act on CB_1 receptors and show catalepsy, analgesia, decrease in spontaneous activity and body temperature, and memory disruption. CB_1 receptors are G-protein coupled receptors and are coupled to $G_{\alpha i}$ and/or $G_{\alpha o}$. ß-arrestin2 regulates the activity of these cannabinoid receptors by desensitization, internalization of GPCRs and other signaling mechanisms. Hypothesis: ß-arrestin2 proteins are required for developing tolerance against chronic THC treatment. Methods: Female C57BL/6 beta-arrestin2 knockout (KO) and littermate wild-type (WT) mice were treated with either vehicle or 50 mg/kg THC for four days and the behavioral effects such as spontaneous locomotor activity (n=11), latency to tail withdrawal (n=12) and decrease in rectal temperature (n=12) after acute (day 1) and chronic treatments (day 4) with THC. The statistical differences were determined by two-way ANOVA and analyzed for development of tolerance in both genotypes after chronic THC treatment. Results: On day 1 (after acute THC treatment): Treatment with THC resulted in reduction in locomotor activity, reduction in rectal temperature and increased analgesia (as shown by %MPE) in wild type mice as well as in knockout mice. Deletion of ß-arrestin2 genes did not result in any changes. On day 4: (after chronic THC treatment): The effects observed on day 1 (i.e. reduction in locomotor activity, reduction in rectal temperature and increased analgesia) were blocked after chronic THC treatment. There was no difference between the genotypes. Conclusion: ß-arrestin2 proteins are not required for developing tolerance against chronic THC treatment.

Rhodes, Sade, Jomani Cheeseman, Damian Canady, Porche Spence, Saundra Delauder, and Tonya M. Gerald-Goins. Department of Chemistry, North Carolina Central University. *Qualitative analysis of organic contaminants found in various local surface and drinking water samples using gas chromatography-mass spectrometry.*

Monitoring the levels of organic contaminants (OCs) in local streams and drinking water sources is essential for sustaining healthy ecosystems and communities. The literature states that OCs found in drinking water sources are suspected of disrupting normal biological pathways, by acting like the steroid hormone estrogen on target organs (endocrine disruptor compounds - EDCs). For example, prenatal exposure to EDCs is associated with a predisposition to breast cancer in adult woman. Endogenous estrogens can bind to intracellular estrogen receptors (Kd = 10-9 M), while EDCs affinities for these macromolecules can vary from weak (Kd = 10-3 M) to strong (Kd = 10-8 to 10-10 M). Therefore, the purpose of this research is to analyze water samples collected from streams located in the city of Durham, NC, and water fountains located around North Carolina Central University campus for the presence of OCs. We used liquid-liquid extraction (n-heptane: diethyl ether

(80:20 v/v) to extract the OCs from the water samples. Preliminary gas chromatography-mass spectrometry (GC-MS) results of the organic extracts suggest 10-12 M range of OCs present in the various drinking water samples. These OCs include phenol, 2, 4-bis (1,1-dimethylethyl), the hormonally active form of vitamin D 1,25-dihydroxyvitamin D3 (calcitriol) and the most common, the detergent, 1-heptatriacotanol. Some of these OCs contain phenolic and methyl substituent groups which are necessary for binding estrogen receptors. Further evaluation of OCs in drinking water sources will involve the treatment of immortal cell lines to determine long-term effects on gene products.

*Rhoney, Melissa. Biology Program, Lenoir-Rhyne University. *The effect of vitamin C (ascorbic acid) on the growth of* Escherichia coli.

Escherichia coli is a common mutalistic inhabitant of the human intestines; it is important to human health in several ways, including: blood clotting, antioxidant properties, and antipathogenic actions. Vitamin C, an essential nutrient absorbed by the intestines, is the most commonly supplemented vitamin, often taken in megadoses (750 mg or more) to boost immunity. Because of the potential for these high doses to interact with the microbiota of the intestines, the effect of vitamin C on the growth of *E. coli* was studied. Nutrient broth containing varying concentrations of vitamin C (0, 0.1, 0.2, 0.3, 0.4%) was inoculated with *E. coli*. Samples were incubated at 37°C and growth was measured spectrophotometrically at 440nm approximately every 6 hours for 48 hours. It appears that higher concentrations of vitamin C, when adjusted for pH, increased the initial growth of *E. coli* (over the first 24 hours). While the exact mechanisms for this growth effect are not known, it is speculated that it could be caused by the bacteria's use of vitamin C as an additional energy source.

Rouse,[1] L. Jesse and Susan J Bergeron.[2] [1]Department of Geology and Geography, University of North Carolina at Pembroke, and [2]Department of Politics and Geography, Coastal Carolina University. *Maps, 3D worlds, and infographics: Geovisualization and scientific knowledge presentation.*

Scientific results have traditionally been used to support further scientific inquiry, and knowledge representation has been focused on an expert audience. Recently there has been a shift to provide results from scientific work through methods that are more accessible to the general public. This trend has led to an explosion in visual informatics or infographics technologies to convey information in new ways. Leading this trend is the use of mapping techniques. Awareness of Geography and cartography has risen dramatically through the development and uptake of Geographic Information Systems (GIS) in a wide range of disciplines and, more recently, through web mapping and virtual globe technologies. These technologies have built, and built upon, 2D and 3D visualization techniques. These techniques can range from maps being used through the social and physical sciences; using GIS to map, graph, and chart information; and expanding 2.5D/3D visualization capabilities to move off of the printed page and take advantage of the interactive nature of computer technologies. This paper will look at the role that both longstanding and new geovisualization techniques can play in presenting scientific results to a broad/general audience.

*Sanford, Anna and Patricia Sellers. Department of Biology, University of North Carolina at Pembroke. *Plankton diversity of Krinshaw Pond.*

A survey of the plankton in Krinshaw Pond (Hamlet, NC) was conducted in the fall of 2012. Plankton nets were towed just below the surface of the pond during 15 sampling events. Four genera of the cladocerans and two of the copepods were among the zooplankton identified. Thirty-five genera were among the phytoplankton identified. Most species were imaged using a digital camera attached to a light microscope. This presentation will display lists and proportions of genera, many of which will be accompanied by photographs. This presentation exposes the biodiversity of the plankton in Krinshaw Pond. Featured will be *Chydorus bicornutus*, a cladoceran that has not been reported for the Southeast and is presumed to be restricted to more northern latitudes.

Schwarz, Marcelo, Gideon Wasserberg, and Brian Byrd. Department of Biology, University of North Carolina at Greensboro, and Western Carolina University. *Ecology of La Crosse Encephalitis (LACE) disease vectors along a forest-to-field ecotone in western North Carolina.*

Introduction. LACE is a pediatric disease which has seen a recent emergence in the number of reported cases in the Appalachia region. This increase may be due to improved reporting, population growth and increased encroachment, leading to greater LACE vector exposure, and to introduction of invasive vectors, facilitated by anthropogenic disturbance. Goal: Evaluate the effect of landscape structure and artificial containers on the distribution and abundance of LACE vectors along a forest-to-field ecotone. Hypotheses: We hypothesized a difference in the distribution of mosquitoes along this ecotone, with native sylvatic species mainly inhabiting the forest while the invasive antropopholic species inhabiting the more open field or edge habitats. Introducing artificial containers into the field is expected to pull native species further into the field, whereas containers in the forest should pull invasive species into the forest. Methods: We ran 2 parallel transects per site (6 sites total), each 200 meters in length, 15 oviposition traps per transect. These traps were distributed evenly across forest, edge, and field habitats (5 traps in

each habitat). We also deployed traps for gravid and resting mosquitoes. We incorporated 9 tires in each experimental plot: 2 sites received treatment in the field, 2 sites in the forest, and 2 sites served as control. Results: Preliminary results suggest habitat associations with invasive species found in all habitats and the native species more abundant in the forest-edge habitats but also found in the field. Artificial container introduction appeared to result in increased oviposition activitiy in forest treatments.

Sengupta, Dipendra, Jharna Sengupta, Scott Funkhouser, Bryan Williams, Carla Cortwright. Department of Mathematics & Computer Science, Elizabeth City State University. *Periodicity in the intervals between primes and its application to determine CRISPR regions for genomic sequence of different bacteria.*

We consider the uniquely determined positive intervals among the first prime numbers as a probe of the global nature of the sequence of primes. A statistically strong periodicity is identified in the counting function giving the total number of intervals of a certain size. The nature of the periodic signature implies that the sequences of intervals spanning fixed numbers of gaps repeat quasi-cyclically. From the distribution of intervals we extract also the characteristic period of the repetition, which increases with n in a step-wise manner between consecutive primorial numbers and coincides almost universally with the most common occurring interval size. Applying the concept of most common occurring intervals we determine an interesting section of genome such as CRISP region through MATLAB programming. Clustered Regularly Interspaced Short Palindromic Repeat (CRISPR) are genomic features of many bacterial and archael species.

*Sewell, Mycah, Nigel Hirth, and Jeremy Sellers. Department of Biology, University of North Carolina at Pembroke. *The distribution of* Solenopsis invicta *colony genotypes in the Coastal Plain of North Carolina.*

The red imported fire ant (*Solenopsis invicta*) exhibits two distinct social forms: polygyne, multi-queen, and monogyne, single-queen colonies. On a genetic level, polygyne and monogyne colonies can be distinguished from one another by examining their genotype with regard to alleles of the Gp-9 gene. Members of monogyne colonies are homozygous for the Gp-9^B allele, while members of polygyne colonies are heterozygous, bearing a Gp-9^B and a Gp-9^b allele. The goal of this survey is to compare the distribution of the two social forms in disturbed and natural environments of the NC Coastal Plain. Disturbed environments are characterized by evidence of significant human activity, including pesticide use. Natural environments are those that have not been significantly impacted by recent human activity. In particular, we wish to explore whether proximity of pesticide use affects the distribution of the two social forms. For this, an allele specific multiplex PCR assay was applied to DNA samples of multiple colonies from disturbed and natural locations. Colony genotype was then determined by analyzing the electrophoretic mobility of the PCR amplified products on agarose gels. Based on the number of visible bands from each sample in the gel, the genotype of each colony surveyed was determined to be either polygyne or monogyne. Conclusions drawn from this survey about human impact on fire ant colonies can be used to develop better techniques and strategies for pest population control and possibly decrease the use of pesticides if gene regulation were included in new population control techniques.

Shah, Halley and Zhenquan J. Biology Department, University of North Carolina at Greensboro. *Protection of HepG2 cells against acrolein mediated cytotoxicity by CDDO-Im via induction of phase II detoxification enzymes.*

Acrolein is one of the major sources of smoke released from incomplete combustion of organic matter. Several studies showed that exposure to acrolein can lead to liver damage. We studied whether induction of endogenous antioxidative/phase II enzymes by a novel triterpenoid CDDO-Im can afford protection against acrolein-mediated oxidative hepatotoxicity. In this study, we showed that treatment of HepG2 cells with CDDO-Im resulted in a significant increase in the levels of reduced glutathione, a critical cellular defense to detoxify free radical species. Furthermore, pretreatment of the cells with CDDO-Im was found to afford remarkable protection against the cytotoxicity elicited by acrolein. We also identified the protein damage, and cell death pathways in HepG2 cells on exposure to acrolein. In summary, this study may provide understanding on the molecular action of acrolein which is important to develop novel strategies for the prevention of acrolein-mediated toxicity.

Shortt, Kelli A., Sarah E. Thalhamer, Tamatha Baxley, Margit Schmidt, John M. Lehman, Justin Arthur, Joseph M. Chalovich, and Jean-Luc Scemama. Department of Biology, East Carolina University. Department of Biochemistry & Molecular Biology, Brody School of Medicine, East Carolina University, and Department of Pathology, Brody School of Medicine, East Carolina University. *Translocation of myopodin during differentiation in HT-29 cells.*

Synaptopodin 2, also known as myopodin, is an actin-binding protein. Largely unfolded, synaptopodin 2 possesses the characteristics of a hub protein and has multiple binding partners. Synaptopodin 2 undergoes rapid polymerization of G-actin in a Ca2+ calmodulin dependent manner. Since actin polymerization rates are important for the reorganization of the cytoskeleton, synaptopodin 2 may also play a role in cell cycle progression. Association with alpha-actinin also has been found to promote the translocation of synaptopodin 2 from the cytoplasm to the nucleus, where it is thought to be involved with the chromatin-remodeling complex and transcriptional activity. While synaptopodin 2 has four isoforms generated by alternative

splicing from a single gene on chromosome 4q26, little is known about the function of these individual isoforms. Using a prepared antibody against the C-terminus that recognizes isoform B and the truncated form called myopodin, we observed immunological staining in several cell lines showing intense staining in irregular areas within the nucleus as well as at the nuclear periphery of the cells. A strong synaptopodin 2 staining pattern was observed when cells were stained with a commercial antibody against nucleolin and counterstained with DAPI. To test the nucleolar localization of synaptopodin 2, Actinomycin D was used to inhibit transcription and the nucleolar stain disappeared. When HT-29 cells were forced to differentiate with sodium butyrate, the synaptopodin 2 antibody revealed a re-localization of the protein into the cytoplasm. RT-PCR analysis further showed that HT-29 cells lacked Synaptopodin 2B, but contained the smaller isoform, myopodin.

*Sigmon, Leah. Biology and Chemistry Programs, Lenoir-Rhyne University. *The effect of vitamin E supplementation on the maintenance of tetanus antibody levels in* Equus caballus.

Studies suggest that as horses age, they suffer a decline in overall immune function. In order to prevent this decline, vitamin E supplementation has been suggested. In this study, horses who had all been vaccinated against tetanus at approximately the same time were tested for tetanus antibodies to see whether vitamin E supplementation would help maintain antibody production. Sixteen horses were split into two groups, one group receiving an oral vitamin E supplement and the other serving as the control. Blood was collected via jugular venipuncture from all horses at two week intervals, with the serum analyzed via indirect ELISA for antibodies against tetanus. Although the two groups had significantly different antibody levels before supplementation, by the end of the experiment, both groups had the same level of antibodies. This suggests that vitamin E supplementation did not have an effect on maintaining high antibody levels in the supplemented horses.

*Smink,[1] Jordan A., Ebru Caba,[2] Robert C. Elliott,[3] Heather Romine,[1] Hsin-wei Wang,[4,5] Charles Giardina,[6] Don-Guk Shin,[4,5] and Ben A. Bahr.[1,4,7] [1]Biotechnology Research and Training Center, William C. Friday Laboratory, University of North Carolina - Pembroke, Pembroke, North Carolina; [2]Vertex Pharmaceuticals, 130 Waverly Street, Cambridge, Massachusetts; [3]Department of Neurology, Beth Israel-Deaconess, Harvard Medical School, Boston, Massachusetts; [4]Bioinformatics and Biocomputing Institute, University of Connecticut, Storrs, Connecticut; [5]Department of Computer Science and Engineering, University of Connecticut, Storrs, Connecticut; [6]Department of Molecular and Cell Biology, University of Connecticut, Storrs, Connecticut; [7]Department of Pharmaceutical Sciences and the Neurosciences Program, University of Connecticut, Storrs, Connecticut. *A model of brain damage to study early and delayed responses with focused transcriptomics: Identifying opposing roles of the transcription factor NF-kB.*

Stroke and traumatic brain injuries activate both degenerative and protective pathways in vulnerable brain regions. Damaging effects resulting from brain injury stem from an equation of induced pathogenic pathways and compensatory pathways. *N*-methyl-D-aspartate (NMDA) exposure was used to mimic over activation of NMDA type glutamate receptors that occurs in a stroke in order to observe early and delayed gene response. Experiments using hippocampal slice cultures were maintained in culture eliminating problematic systemic variables. Total RNA was isolated 1 and 24 h post exposure for comparison to control hippocampal slices using Affymetrix neurobiology-focused arrays. To confirm the identification of opposing pathways that converge on a single response element, NF-κB activation was blocked since this transcription factor is implicated to have dual roles in survival and cell death (Perkins, *Trends Biochem Sci*, 25, 434-440, 2000). Cultures were exposed to NMDA causing excitotoxicity, in the presence or absence of NF-κB inhibitor. This approach led to the identification of opposed signaling networks involving the biphasic activation of NF-κB. Genes were assessed for whether its promoter has a binding site for NF-κB. Only two genes expressed opposing biphasic responses: early response factor-1 (Egr-1) and the neuron-derived orphan receptor-1 (NOR-1), both transcription factors. NF-κB does not appear to be involved in early induction of Egr-1 and NOR-1. Unexpectedly, down regulation was blocked or reversed. Pathway analyses are being conducted to explain this unexpected result. Learning what dictates the pro-survival vs. pro-death actions of NF-κB could lead to novel insight into possible avenues of therapy after excitotoxicity.

*Smith, Chris, Erin Byrd, Natalia Goh, Michelle Thomas, Erik Hill and Sharon Mason. Department of Biological Sciences, Campbell University. *Isolating fluoroquinolone resistant gram-negative organisms from porcine fecal matter.*

Antibiotic resistant microorganisms, especially those that are pathogenic, are of major concern to healthcare professionals as well as society as a whole. These resistant microorganisms are becoming more prevalent in both hospital and community settings. Gram-negative organisms are of particular interest because they possess a greater capacity for cross-species transformation of some antibiotic resistance genes and they are ubiquitous in the environment. A major concern is decreased sensitivity of some gram-negative organisms to current treatment options such as fluoroquinolone antibiotics. It is therefore important to properly understand the mechanisms that allow these organisms to obtain resistance genes. The treatment of livestock with antibiotics has come under increased scrutiny as a potential cause of resistant organisms that cause disease in humans. Therefore, we are attempting to isolate fluoroquinolone resistant gram-negative bacteria from porcine fecal samples, in order to identify genes that may be responsible for this resistance. Fecal samples from 10 pigs (both before and after

fluoroquinolone exposure) were studied and found to have a low incidence of fluoroquinolone resistant organisms. PCR, with primers from 4 known plasmid and chromosomal resistance genes, is being used to screen colonies that show fluoroquinolone resistance. Future studies will expand on the genes that are important or responsible for this resistance in swine. This inquiry will provide information on the relationship of treating livestock with antibiotics and antibiotic resistant organisms found in humans.

*Smith,[1] Marsalis, Ben A. Bahr,[1-3] Heather Walters-Romine,[1] Sarah Hafner,[1] Armando L. Corona,[1] Jordan A. Smink,[1] Elizabeth Metzger,[1] Katharine Willoughby,[1] Olivia Bullard,[1] Uzoma S. Ikonne,[1] [1]Biotechnology Research and Training Center, University of North Carolina at Pembroke, [2]Synaptic Dynamics Inc., Farmington, Connecticut, [3]Department of Pharmaceutical Science and the Neurosciences Program, University of Connecticut. *Lysosome modulators reduce behavioral deficits in hAPP mouse models as well as in the Fischer rat model of age-related cognitive decline.*

One of the key pathogenic factors of Alzheimer's disease (AD), the most prominent form of dementia, is the aggregation of an amyloid beta protein 42 amino acids in length, referred to as Aβ42. The cause of accumulation stems from over production of Aβ42 and/or the inefficiency of the body's method of removing these protein plaques. Cathepsin B (CatB) is an enzyme synthesized in the body that degrades proteins such as Aβ42. Degradation of Aβ42 by CatB is accomplished by truncating the end of the Aβ42 peptide chain bearing the free alpha carboxyl group of the last amino acid, or the C-terminal. Degradation of Aβ42 lowers levels in mice expressing hAPP (human amyloid precursor protein) (Mueller-Steiner et al. 2006, Neuron 51:703; Butler et al. 2011, PLoS One 6:e20501) and reduces plaque load and both behavioral and synaptic deficits. Accordingly, enhancing CatB-mediated protein clearance is a promising strategy for treating AD. Small-molecule CatB modulators, e.g. Z-Phe-Ala-diazomethylketone (PADK), enhance lysosomal CatB levels, thereby eliciting protective clearance of Aβ42 and other proteins in the hippocampus (Bahr et al. 2012, Rejuvenation Res 15:189). The effects of PADK were also examined in rodent organs. Stereospecific, non-peptidic compounds were also developed with a hydroxyethyl isostere and were decoupled from CatB inhibitory properties (Viswanathan et al. 2012, ACS Med Chem Lett 3:920). PADK was injected ip daily for 9-14 days to enhance CatB in 10-month APPSwInd and 20-month APPswe/PS1ΔE9 mice, as well as in middle-aged Fischer and aged Long-Evans rats. Aged Fischer rats provide a natural model of age-related cognitive decline and may be more translatable to humans as compared to transgenic mice. Behavior testing included shock-induced passive avoidance learning, exploratory habituation, and hippocampal-dependent spontaneous alternation behavior (SAB). Selectivity for CatB enhancement was then examined. PADK reduced the SAB deficit in APP-PS1 mice ($P<0.001$). Aged rats exhibited a deficit in passive avoidance learning. No difference was evident regarding the short pre-shock latency time, whereas after a mild foot shock the deficit in latency was significantly increased in the PADK-treated Fischer rats ($P=0.016$). Improved behavioral performance corresponded with 4-8-fold CatB increases in hippocampal and neocortical homogenates. The results support a plausible strategy to promote CatB-mediated protein clearance for a disease-modifying treatment of early and progressive dementia. Contributing to the protective clearance, the CatB modulator PADK also has the ability to disaggregate Aβ42 oligomers (Zheng et al. 2012, JBC 287:6084), thus may lead to efficient uptake of monomers and small oligomers into neurons and microglia, thereby allowing trafficking to lysosomes for proteolytic detoxification. These studies will be furthered to develop first-in-class agents for slowing and/or reversing AD-type synaptic compromise and associated cognitive decline.

Smith, McKenzie K., Parke A. Rublee, and Anne Hershey. Department of Biology, University of North Carolina at Greensboro. *Methanogens and methane oxidizing bacteria in forested, urban impaired and urban restored streams.*

Methanogenesis and methane oxidation are integral parts of the carbon cycle and may affect global climate change. Anaerobic decomposition of organic matter in streams may include methanogenesis. Some of the methane produced may then be oxidized by methanotrophs, while the remainder is released into the atmosphere or exported downstream. These two processes have been studied in major rivers, lakes, wetlands, and oceans. However, little attention has been paid to low order streams even though they constitute corridors throughout terrestrial landscapes. This study compares the distribution of methanogen and methane oxidizing bacteria and methane concentration in four forested, four urban impaired, and four urban restored streams, all located in the Piedmont of North Carolina. Water, sediment, and epilithon have been sampled from 3 riffles and 3 pools in each stream. DNA was extracted from the samples and real-time quantitative PCR is being used to assess methanogen and methane oxidizing bacteria populations. Water samples were taken to measure methane concentration in each stream. Results show seasonal differences in methane concentration within stream types; the highest methane concentration across all stream types was found in the spring. Preliminary methanogen quantitative PCR data show no pattern across stream type or across sample type within a season of sampling; however, data do show that on average fall methanogen abundance is higher than summer methanogen abundance. Preliminary methanotroph abundance data do show a pattern across stream type within sample type, with forested streams having the lowest methanotroph abundance and restored streams having the highest abundance.

*Snyder, A. and J. Brock. Department of Chemistry, Warren Wilson College. *Migration of metals from a coal ash pond into the sediment of the French Broad River.*

The coal-fired power plant located in Skyland, NC, stores coal combustion residues (CCRs) in unlined, uncapped settling ponds next to the French Broad River. Previous research has shown that CCRs contain high levels of heavy metals, and elevated metal concentrations have been found in the French Broad River near the pond discharge sites. This study examined the possible further migration of these metals along a 3 km stretch of the river. Metals in river sediments were extracted with aqua regia and analyzed by ICP-OES. Trends in concentration of As, Pb, Cr, Cu, and Zn were studied as a function of distance downstream of the power plant and reported both as overall concentrations in the sediment, as well as corrected for the amount of organic matter present. Additionally, concentrations of these metals on the power plant side of the river were compared to those on the opposite side of the river. The results of this study indicate that heavy metal concentration in sediment did not significantly increase downstream of the power plant ($p<0.05$). Additionally, sediment samples from the power plant side of the river did not have significantly higher concentrations of metals than samples taken from the opposite side ($p<0.05$). No concentrations exceeded EPA Ecological Risk Assessment Freshwater Sediment Screening Benchmarks.

*Somero, Jillian A. Department of Biology, Elon University. *The effects of an all-liquid diet on the gut microbiota.*

Inflammatory Bowel Disease (IBD) causes chronic inflammation of the gastrointestinal tract associated with abdominal pain, weight loss, and ulcers. It has been found an all-liquid diet can both reduce inflammation and induce mucosal healing; however, it remains unclear how this dietary change leads to intestinal healing. Recent work also indicates the importance of bacterial communities in the onset and propagation of intestinal inflammation. The aim of this study was to examine the mechanisms by which a liquid diet promotes intestinal healing. We hypothesize that an all-liquid diet will alter the composition of bacterial communities residing in the gut such that they favor anti-inflammatory communities. In order to test this hypothesis, bacterial DNA was isolated from mouse models of IBD. Wild-type mice were placed on an all-liquid diet for four weeks. Tissue and stool were collected and DNA extracted. PCR was used to quantify the relative amounts of bacteria within the gut. It was found that mice given an all-liquid diet showed modest decreases in total bacteria and *Bifidobacterium* (n= 8). Conversely, increases were observed in *Lactobacillus*, *F. prausnitzii*, and *E. coli*. Interestingly the most significant changes were observed with the proinflammatory *E. coli* (n=8, p = .05). These findings confirm that bacterial communities in the gut change in response to a liquid diet, but how these changes influence inflammation remains unclear. Future studies will be aimed at demonstrating whether changes in bacteria have occurred in an IBD susceptible mouse placed on an all-liquid diet and if these changes decrease inflammation.

*Spiers, Lindsay. Department of Biology, Elon University. *Elevated temperature effects on the growth and toxicity of* Lyngbya confervoides *and* Lyngbya *sp.*

Environmental conditions associated with climate change, including rising CO_2 levels and increasing seawater temperatures, are negatively impacting many coral reef organisms. These environmental changes are predicted to be either advantageous or have no effect on cyanobacteria relative to other coral reef organisms. However, few studies have directly tested the effects of these changes on benthic marine cyanobacteria. Cyanobacteria play many roles in their ecosystem. They act as a food source for some herbivores, although many contain secondary metabolites that limit their palatability, as well as a source of nitrogen in an environment that is often nitrogen limited. They can also form harmful cyanobacterial blooms under environmental conditions that favor their proliferation. This study examined the effects of increasing seawater temperature on two species of benthic cyanobacteria collected off the coast of Ft. Lauderdale, FL: *Lyngbya confervoides* and *Lyngbya* sp. They were grown at 28°C and 32°C to measure how temperature affected growth over a three-week period. *L. confervoides* demonstrated a positive correlation between elevated temperature and growth. Conversely, there was a negative correlation between elevated temperature and growth of *Lyngbya* sp. Changes in cytotoxicity of extracts of *L. confervoides* and *Lyngbya* sp. exposed to increased seawater temperature were also examined. We concluded that elevated temperatures lessened the toxicity of extracts of *Lyngbya* sp. Alternatively, there was a positive correlation between increased temperature and toxicity in *L. confervoides*. These studies indicate that not all cyanobacteria species respond similarly to changes in seawater temperature that may occur due to climate change.

*St.Clair, Katelyn P., Ryan D. Weeks, and Karen Guzman. Department of Biological Sciences, Campbell University. *Comparison of chondrocyte differentiation methods in the ATDC5 cell line as assessed by expression of a variety of chondrocyte markers including SOX9.*

Cell culture studies are used extensively to understand the differentiated phenotype of many different cell types, as well as to investigate how they respond to normal and pathogenic conditions. A first step in these studies is to characterize the best conditions to maintain the differentiated phenotype, as well as to determine if the chosen cell model is appropriate for the study of interest. With the goal of studying chondrocytes, we obtained the chondrogenic cell line, ATDC5, that differentiates into mature chondrocytes in culture. A number of methods for differentiation have been described in the literature. In this

study, three methods for differentiation were compared: ITS alone (Insulin-Transferrin-Selenite), or in combination with ascorbic acid, or with bone morphogenic protein 4. Differentiation was assessed by expression of the chondrocyte markers SOX9, GATA4, Collagen 2, Collagen X, Oxteocalcin, and Syndecans (1, 2 & 4). Cells from each method were collected on 2, 4, and 10 days post-confluence. Evaluation of gene expression was completed by analyzing the RNA levels of these markers using Reverse Transcriptase PCR (RT-PCR). Expression of these markers during differentiation and the relationship to future studies will be discussed.

*Stewart, Chantia M., LaShonda M. Caine, and David A. Beamer. Mathematics and Science Department, Nash Community College, Rocky Mount, NC. *A phylogeographic profile of the salamander genus,* Pseudotriton.

The phylogeographic evolution of the salamander genus *Pseudotriton* remains largely unexplored and undocumented. Several races of these eastern plethodontid salamanders have been recognized, yet red salamanders (*P. ruber*) and mud salamanders (*P. montanus*) remain the only identified species of the genus. In order to reconstruct the evolutionary history and evaluate whether any of the formerly recognized races warrant species status, we have sampled eighty populations spanning the extent of this genus' distribution. For each population sampled, we extracted DNA, amplified and sequenced a 1686 base pair fragment of the mtDNA genome. Here we present the results of a Bayesian phylogenetic reconstruction for this genus.

*Swan, Greg A. and Sophia D. Sarafova. Department of Biology, Davidson College. *Identification of a novel, developmental-stage-specific enhancer in the Cd4 gene.*

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 together 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. We have recently identified a novel positive cis-acting transcriptional regulatory element (NCE) in the Cd4 locus. Here we demonstrate that NCE enhances Cd4 promoter function in position and orientation independent manner using a transient transfection assay with an eGFP reporter construct in RLM11 murine thymoma cell line. Using cell lines at different developmental stages, we determined that NCE functions well at the intermediate, but not the DP stage of development. This formally demonstrates that NCE functions as an enhancer and may have developmental specificity. We are in the process of confirming these findings in vivo by generating BAC transgenic mice that lack the NCE in the Cd4 locus.

*Taylor, Jordan D. and Mary Beth Hawkins. Department of Biology, North Carolina State University. *Mutagenesis of estrogen receptor βa reveals novel role in binding of RU486.*

There are three estrogen receptors (ERs) subtypes found in teleost fish; ERα, βa, and βb. These subtypes possess changes in the amino acid sequence that may influence their binding affinity to various compounds. RU486 is a controversial drug known for its inhibitory effect on progesterone receptors. Research has shown RU486 also has some estrogenic properties. Preliminary results showed that RU486 could bind to Atlantic croaker (ac)ERs and that acERβa bound to RU486 with highest affinity. To investigate the role of acERβa amino acid changes in the differential binding of RU486, we mutated the acERβa amino acid phenylalanine (F) in the ligand binding domain to the corresponding ERβb isoleucine (I) and then produced ER proteins for competitive binding assays using a bacterial expression system. We found the acERβa F-I mutation reduces binding of RU486 by 32%, which is a shift toward the binding affinity of acERβb. This suggests that this position plays an important role in the differential binding of RU486 to ERs, but that other regions of the ERs is also involved. Investigating the contribution of additional regions of the receptor is required to better understand estrogen receptor binding to RU486. These types of studies will help develop new ER drugs and understand the physiology of all estrogen receptors.

*Thompson,[1] Marc and Chichia Chiu.[2] [1]North Carolina A & T State University, Bioengineering Department and [2]Michigan State University, Mathematics Department, *Comparison of gene expression data with mathematical data simulations using statistical analysis.*

An organism's genome acts as its fundamental source of cellular regulatory functions. The travel of information from the genome to proteins generated through transcription controls nearly all cellular functions. With the ability to predict how genes are most efficiently activated and deactivated we will have a better understanding of life processes. This knowledge will impact areas of biology ranging from a person's hair color to their susceptibility to disease. Mathematical models and computer simulations are one of the new methods researchers are using to study gene expression. The ability to compare biological lab data to computer generated data increases the number of trials and tests that can be performed in a certain period of time. This improved method of testing increases the efficiency of comparison and analysis, which are critical in studying gene expression. In this research we developed a comparison procedure which is composed of a sequence of statistical and mathematical tests that would effectively assess the efficiency of weighing what was considered both good and bad fit

simulation data against real biological data. The tests would prove effective if they were capable of differentiating between the closeness of two data sets and the actual biological data.

Upadhyay, Devang, Rinu K., Sivanadane Mandjiny, Floyd L. Inman III, and Len Holmes. Sartorius stedim Biotechnology Laboratory, Biotechnology Research and Training Center, University of North Carolina at Pembroke. *In-vitro mass production of entomoparasitic nematode* Steinernema carpocapsae *utilizing a fed-batch culture process.*

The present study deals with the implementation of a fed-batch culture process for the mass production of the entomoparasitic nematode *Steinernema carpocapsae*. These nematodes, along with other entomoparasitic nematodes, are used as excellent biocontrol agents for controlling agricultural crop insect pests. The crucial factor of large-scale production for commercialization is nematode yield, which is directly proportional to the number of "recovered" juveniles. Juvenile recovery is defined as the transition or initiation of infective juveniles (IJs) to continue development. The ability and efficiency of fed-batch culture processes to increase nematode yield were analyzed through a comparison with a typical batch culture process. In each process, the nematode mass production medium was pre-conditioned with the nematode bacterial symbiont *Xenorhabdus nematophila*. In fed-batch, the nematode yield obtained (2.02×10^5 nematodes ml^{-1}) was 88.6% higher than the nematode yield produced during the batch process ($2.3 \times l0^4$ nematodes ml^{-1}). Furthermore, the fed-batch culture process enhanced the recovery rate of the IJs and as a consequence resulted in an 8-fold higher nematode yield as compared to batch processes within a production period of six days. The utilization of fed-batch process for mass producing entomoparasitic nematodes does support commercialization of this useful "product."

Vaidya, Himani and Karen S. Katula. Department of Biology, University of North Carolina at Greensboro. *The WNT5A alternative promoter B is silenced by DNA methylation in osteosarcoma cells.*

WNT5A is a secreted glycoprotein that primarily activates non canonical Wnt signaling pathways. It has critical functions in development and mesenchymal cell differentiation. Altered WNT5A expression has been associated with many different cancers. The human WNT5a gene gives rise to multiple transcripts from distinct promoters. Custom qRT-PCR Taqman primers have been designed that can distinguish between the transcripts derived from the WNT5A alternative promoters referred to as A and B. As an initial study, we analyzed WNT5A promoter A and B transcript levels in normal human osteoblasts and the human osteosarcoma cell line SaOS-2. Results show that both promoter A and B are expressed in osteoblasts but there are more promoter B transcripts than A. In contrast, little or no promoter B transcripts were detected in osteosarcoma cells, whereas promoter A transcripts were present. Six CpG islands were identified in the region upstream of promoter B. Bisulfite sequencing was conducted to map sites of DNA methylation. Most significantly, the CpG island including the promoter B transcription start site was partially methylated (12 out of 26 sites) and two adjacent CpG islands were completely methylated. Two CpG islands closest to the promoter A exon 1 were completely unmethylated. Treatment of osteosarcoma cells with 1 microM 5-aza-2'-deoxycytidine lead to reactivation of promoter B. No effect was seen on promoter A transcript levels. These results show that the WNT5A alternative promoters A and B can be differentially affected by DNA methylation, leading to altered and distinct levels of promoter A and B transcripts during cancer progression.

*Vang, Pa Chia and Cayla Orders. Department of Chemistry, Lenoir-Rhyne University. *Generic drugs versus innovator: A study of the dissolution rates of generic and innovator formulations of aspirin and acetaminophen.*

Generic drugs are a large and important component of the health care system. The expectation is that generic drugs will be completely equivalent to the corresponding innovator drug in terms of efficacy and performance. However, because of formulation differences between innovator and generic versions of a drug product, there is a strong possibility that differences in physical characteristics can exist, which might result in differences in efficacy for the patient. This study will compare an important physical characteristic of tablet formulations, the dissolution rate, of generic and innovator versions of the two most common analgesic over-the-counter (OTC) drugs, aspirin and acetaminophen. An industry standard six-vessel VanKel dissolution bath was used to perform the dissolution study, using 0.1M HCl as the dissolution medium. Samples of 325mg Bayer® Aspirin were compared with 325mg Rite-Aid® brand generic aspirin, and samples of 500mg Tylenol® were compared with 500mg Rite-Aid® brand generic acetaminophen. The dissolution rate of the samples was monitored using UV-vis spectrophotometry by taking samples of the dissolving tablets at regular time intervals until the tablets were completely dissolved. Data on differences in dissolution rates, dissolution times and qualitative observations of the tablet integrity during dissolution will be presented.

*Vannasane, Bobbee and Olav Rueppell. Department of Biology, University of North Carolina at Greensboro. *Follow-up studies on QTL for ovary size: Evaluating sequence variation in two long non-coding RNA genes.*

The division of labor in honeybee societies has been extensively studied, particularly in honeybee workers. Ovary size has been shown to be a major factor in worker task determination. Differences in ovary sizes have been shown to heavily influence social behavior and several other important traits of worker honeybees. By performing quantitative trait loci (QTL) mapping, a

genomic scan identified two long non-coding RNA genes (on groups 11.35a and 11.35b) as potential candidates to influence ovary size. This study focuses on evaluating these two candidate genes on a molecular level in order to detect genotypic differences between Africanized and European hybrid honeybee workers with different ovary sizes. Contrary to the expectation, the analyzed fraction on the first long non-coding RNA gene displayed no structural variation among six tested worker honeybees. This result indicates that this gene is not responsible for the observed QTL effect. However, it cannot be ruled out that another segment in this gene or the second long non-coding RNA gene harbors relevant genotypic variation that may cause strong differences in worker ovary size and concomitantly, social behavior.

*White, Jackie X., Denise S. Reaves, and Catherine Silver-Key. Department of Biology, North Carolina Central University. *The Effects of ascorbic acid on locomotion in silver nanoparticle inoculated* Drosophila melanogaster.

Nanomaterials are extremely small manufactured structures that have unique chemistry and physics allowing for atypical interactions within their environments. Some of these interactions can include bioaccumulation, tissue penetration, and harmful biochemical activities. It is due to the potentially toxic nature of nanomaterials that ongoing research projects are developing toxicology profiles. In previous research *Drosophila melanogaster*, or fruit flies, were exposed to silver nanopowder (AgNP). One of the byproducts of this exposure was loss of pigmentation of the exoskeleton resulting in depigmenetation (white-colored flies) and a decrease in their ability to climb upwards in the negative geotaxis or locomotion assay. This study focuses primarily on the effects of oxidative stress caused by nanoparticle exposure and alterations in dopamine levels on fruit fly locomotion using the antioxidant ascorbic acid, commonly known as vitamin C. As a measure to determine the accuracy of our assays, we will also be observing whether ascorbic acid is indeed restoring the pigmentation of *D. melanogaster* flies that have been exposed to the nanomaterial. It is hypothesized that adding vitamin C to silver nanoparticle inoculated flies will increase locomotion. Comparisons of developmental progress have also been made amongst groups of flies ingesting AgNP with and without ascorbic acid, a group with just ascorbic acid, and finally a control group with neither AgNP nor vitamin C. Flies have been fed 1 molar 99% concentration ascorbic acid at concentrations of 40, 50, 60, and 70mM with doses during second and third instar to account for the oxidation of vitamin C. Preliminary results suggest that vitamin C partially reversed the reduced locomotion phenotype exhibited in AgNP-exposed flies. Because pigmentation and locomotion can both be controlled by dopamine levels, brain dissections and HPLC will be performed to determine if dopamine is elevated, decreased or remains the same in these AgNP and AgNP + vitamin C exposed flies.

*Wiessner, Grace. Warren Wilson College. *Measurement of soil respiration on Warren Wilson College campus.*

According to estimates by the GLOBE Carbon Cycle Project (2010), soils contain 1,500 Pg, or about three times the amount stored in the biosphere (560 Pg), and twice as much as is stored in the atmosphere (750 Pg). Historically, the balance of carbon between the atmosphere, biosphere and soils is maintained as carbon from plant matter returns carbon gleaned from the atmosphere into the soil. Loss of carbon from soils into the atmosphere occurs naturally through soil respiration, as plants and microorganisms release carbon dioxide from their metabolic processes. The complex interaction of variables that results in increased respiration, or conversely, increased carbon storage, is important to understand and to monitor over time in order to reach quantitative estimates of fluxes within various systems. Such knowledge is invaluable for application in future management decisions. Soil respiration was measured in two tilled fields and two fields in pasture on the Warren Wilson College farm in spring of 2013. Respiration was measured using the LI-COR 6400 and an attached soil respiration chamber. Temperature and soil moisture were also monitored at the time of measurement. Data were gathered on three days at each field. Soil respiration rates were compared in relative terms to each other, as the data cannot be compared in an absolute manner due to the inherent differences in independent variables that occurred at each site at the time of measurement. Respiration rates measured will be useful in informing future monitoring and management decisions.

*Wild, Kristoffer and John H. Roe. Department of Biology, University of North Carolina at Pembroke. *Risk and response of box turtles to prescribed fire.*

Prescribed fire is a common management technique used to maintain the characteristics indicative to longleaf pine communities, but the effects on non-target species are not well understood. The Eastern Box Turtle, *Terrapene carolina,* can inhabit longleaf systems, but its limited mobility and terrestrial tendencies put it at heightened risk of exposure to fire. Understanding the response of this non-target species to prescribed fire can assist park mangers in planning more effective management activities. Using radiotelemetry, we are examining the behavioral response of *T. carolina* fire management at Weymouth Woods Sandhills Nature Preserve. Turtles have selected areas that are in closer proximity to watercourses relative to random, with several individuals spending extended periods in or near water throughout the year. Turtles are typically associating with non-burned areas of the park, including bottomland and upland mixed hardwood forests, though several areas of intensive activity occur in the longleaf burn units. Box turtles have repeatedly used wet areas for extended periods and travel long distances along these wet corridors throughout the park. We suggest that turtles are associating with habitats that confer some protection against fire, though they do regularly make forays into burn management units and are then at risk of injury or death from fire. One turtle has been burned and sustained injuries that we suspect contributed to its later death. Though

still preliminary, our study highlights areas and habitats of intense turtle use that can help park managers assess the risks of prescribed fire to *T. carolina*, and ultimately lead to more effective management of this species of management concern.

Williams, Charlie. AMIS, The Michaux Society. *André Michaux's North Carolina travel routes.*

French botanist-explorer André Michaux (1746-1802) traveled and worked in North America while George Washington was President of the United States. Between 1787 and 1796 Michaux made six trips into North Carolina exploring areas not previously visited by a trained botanist and documenting many new species. He traveled in all physiographic regions of the state: coastal plain, sandhills, piedmont, and mountains. Comparing the notes in his journal with a variety of historical sources, Michaux's routes of travel throughout North Carolina have been plotted as colored lines on a copy of the first detailed map of the state published in 1808.

Wilson, Mark R., Brittania Bintz, Erin Burnside, and Hilde Stawski. Forensic Science Program, Western Carolina University. *Forensic human mitochondrial DNA analysis using emerging next generation DNA sequencing technologies.*

We have developed an improved DNA extraction protocol wherein hair shaft DNA extracts are subjected to PCR amplification using both the traditional control region amplification primer sets, as well as an expanded set designed to amplify the entire human mt-genome. We are also investigating whether or not a non-specific pre-PCR amplification step, such as that employed using whole genome amplification, could increase the amplification success rate and lead to our ultimate goal of achieving whole mt-genome data from hair shafts and other challenging forensic sample types. In a separate series of experiments, we have developed a robust protocol designed to generate whole mt-genome sequencing data from robust DNA samples, such as buccal swabs, using a long PCR amplification process with two overlapping primer sets that cover the entire mt-genome. When tagmented with Illumina Nextera XT®, a library preparation technique designed for Illumina® sequencing platforms, it is now possible to generate high-throughput sequencing data from such samples. The process is simple and fast. When combined with Illumina Nextera XT®, samples are rapidly tagmented, normalized and ready for sequencing on the Illumina MiSeq® instrument. Sequencing data can be quickly analyzed using the instrument software and is sufficient to determine the presence of expected variants, however, these data can be further analyzed with second-party online freeware using a custom analysis pipeline, and subsequently viewed in a genome browser.

Wingate, M. Jason, Betty L. Black, and Chris M. Ashwell. Department of Biology, North Carolina State University. *Gene expression during development of the embryonic chick intestine.*

The goal of the present study is to examine the ontogeny of several genes known to regulate intestinal differentiation and to examine the effect of calcium on expression of these genes during the third week of development in embryonic chick intestine. The mRNA expression levels of the intestinal homeobox genes (CDX1 and CDX4), glucose transporters (SGLT1 and GLUT2), goblet cell associated genes (CATH1 and MUC2) and the enterocyte precursor gene HES1 were examined. Embryonic jejunum from days 16 and 19 were dissected, and RNA was isolated for Quantitative real-time PCR. Each candidate gene was normalized to the housekeeping gene 18s rRNA. Tukey's tests were then used in jmp genomics to analyze all data. At 19 days of development, four genes were significantly upregulated when compared to embryonic day 16: MUC2, CDX1, SGLT1, and GLUT2 ($P < 0.05$). The mRNA expression levels of 16-day old jejunum cultured in low, physiologically normal, and high calcium concentrations for 48 hours was also examined. High calcium (2.8mM) significantly upregulated the glucose transport genes SGLT1 and GLUT2, the goblet cell precursor gene CATH1, the enterocyte precursor gene HES1, and homobox gene CDX4 ($P < 0.02$). Previous work from our lab has shown that culture with high calcium increases glucose transport, dissacharidase activity, alkaline phosphatase activity, and goblet cell differentiation. The present data is further evidence for a regulatory role of calcium during intestinal development, and indicates a role for CATH1 and HES1 in regulation of goblet cell and enterocyte differentiation in the chick.

*Zaritsky, D. and A. Boyd. Department of Environmental Studies, Warren Wilson College. *The effect of water stress on sugar concentration in strawberry (*Fragaria × ananassa*) fruits.*

Fresh water supplies have become more vulnerable in recent times; additionally agriculture is a sector that uses 40 percent of water in the U.S. Previous studies have found correlations between overwatering and its negative effects on crop yields. The relationship between overwatering and strawberry fruit weight has been the focus of past studies, but not qualitative relationships. The objective of this study is to examine the effect of water stress on sugar concentration in strawberry fruits. There are six groups of 24 plants in the experiment, each with a different water regimen. The strawberries were harvested and tested as they became ripe. The study found that there was no significant difference in sugar concentration ($F=0.38$, $p=0.858$) or individual fruit weight ($F=1.90$, $p= 0.105$) among the groups. The results show that the three groups being watered the least produced more than the three groups being watered the most. The results indicate that more water does not benefit the sugar concentration of the fruit or increase yield. From a management perspective, overwatering would not be recommended.

Zhang, Lei and Sopori Bhushan. Chemistry Department, Winston Salem State University, and National Renewable Energy Laboratory, Golden, CO. *Experimental verification of the influence of distributed microcracks on the strength of photovoltaic silicon wafers.*

Silicon photovoltaic (Si-PV) industry uses wafers that typically have low fracture strength, which leads to an excessive wafer breakage (5%-10%) during cell/module production. The main reason for this low mechanical yield is that wafers are left with micro-cracks that decrease the strength of the wafer. In this project we will establish a standard relationship between distribution/density of microcracks and the wafer strength to minimize wafer breakage without over etching the wafers. A micro-indentation system has been designed and built. Hundreds of micro-cracks on silicon wafers have been formed by knoop micro-indenter, and the "size" and structure of these microcracks have been measured and compared/analyzed under an optical microscope. The micro-indentation system is optimized to make uniform size and structure microcracks with desired distributions on the wafers. 100 microcracks with uniform size and sharp in predetermined distributions will be made on the surfaces of 25 6" x 6" single-crystal silicon wafers. This project has accomplished the first phase of establishing a procedure to produce a desired distribution of microcracks on the surface of a silicon wafer.

*Zheng, Chenkang and Patricia C. Dos Santos. Biology Department, Guilford College, and Department of Chemistry, Wake Forest University. *Insights into the mechanism of 4-thiouridine in tRNA biosynthesis in* Bacillus subtilis.

C-4 thiolation of the uridine base at position 8 of tRNA is one of the best characterized posttranscriptional modifications in tRNA. This thionuclosideis a near-UV radiation photosensor and undergoes a photoinduced cross-linking reaction with cystidine-13. In *Escherichia coli*, the ThiI rhodanase domain has an essential sulfurtransferase activity responsible for receiving the sulfur from the cysteine desulfurase IscS and transferring it to tRNA. Previous research has showed that in *B. subtilis* ThiI and cysteine desulfurase NifZ are involved in the biosynthesis of 4-thiouridine. However, unlike *E. coli* ThiI, the *B. subtilis* ortholog enzyme lacks the rhodanase domain indicating an alternate mechanism for sulfur transfer. Amino acid sequence analysis indicated the presence of four cysteine residues (81, 229, 344, and 345), serving as candidate sites for the sulfurtransferase activity of ThiI. In this study, site-directed, point mutations (Cys to Ala) were introduced to these candidate sites. The impact of these substitutions on the sulfurtransferase activity of ThiI was evaluated through *in vivo* complementation studies. This study will provide further insights into the mechanism of sulfur transfer in the biosynthesis of 4-thiouridine tRNA.

*Zito-Wolf, Alexander R. Department of Biology, Elon University. *The microflora and neuroendocrine regulation in zebrafish.*

The vertebrate gastrointestinal system houses a vast array of bacterial communities, or microbiota, that live symbiotically within the host. Current research indicates the presence of a bidirectional communication system between the gut and the brain by which the microbiota may influence both brain development and host behavior. While this axis is well studied in mice, it has yet to be established in the zebrafish. Zebrafish have emerged as a valuable tool for studying gastrointestinal biology including the microbiota. The aim of this study was to establish the presence of the gut-brain axis in zebrafish. We hypothesize that zebrafish colonized with lactobacillus, a bacteria know to influence behavior, will elicit a change in the zebrafish stress response and neurochemistry. In order to test this hypothesis, we began by diminishing the presence of intestinal bacterial using antibiotics (5 days of antibiotics at a concentration of 22.5mg/L) and recolonizing the fish intestines using lactobacillus (*Lactobacillus plantarum* for 7 days). Bacterial DNA was isolated from zebrafish intestines and quantitative PCR was used to quantitate both total bacteria as well as genus specific bacterial communities. PCR analysis indicated a dramatic decrease in total bacterial DNA in the gut (n = 4, p=0.052.), furthermore, there was an increased presence of *Lactobacillus* following recolonization with bacteria. These results indicate the microbiotia in zebrafish can be modulated; future studies will focus on determining if these changes coincide with changes in behavior and or development.

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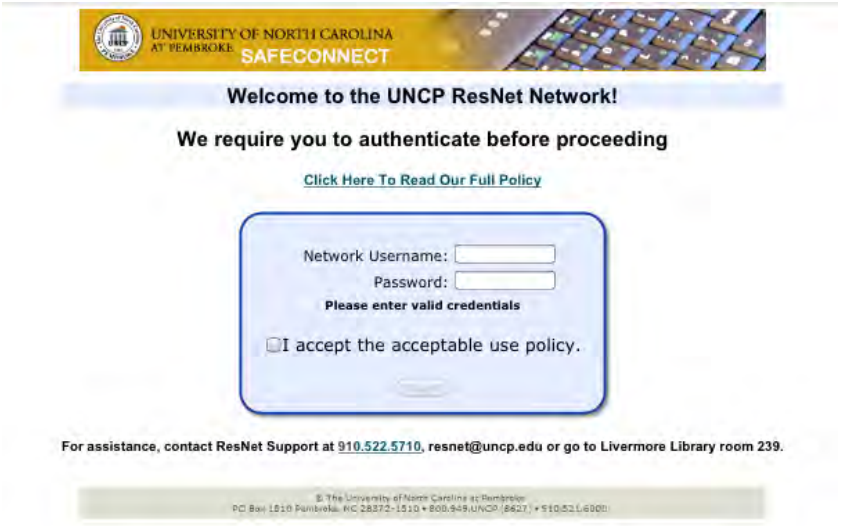

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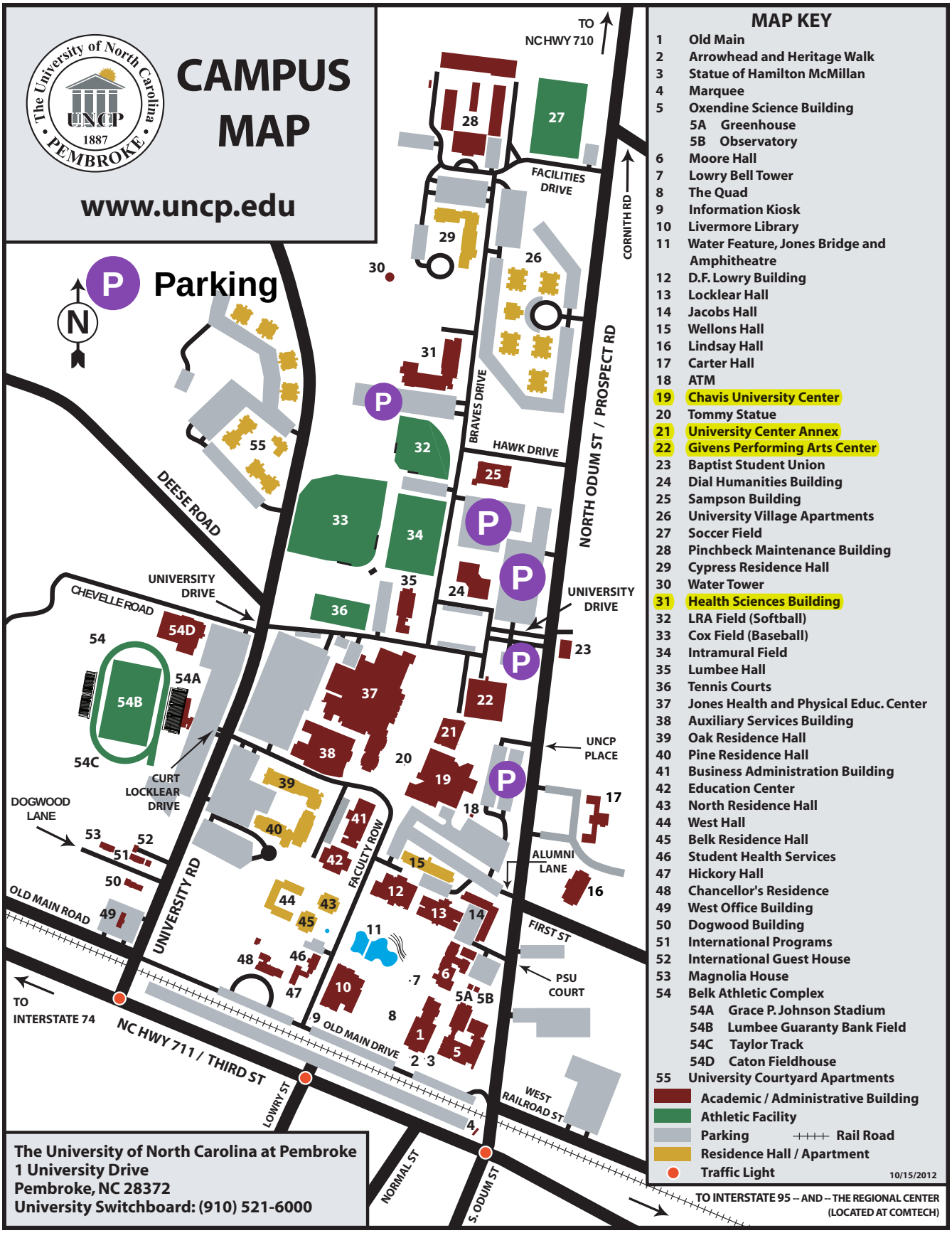
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Grants & Awards

Yarbrough Undergraduate Research Grant Recipients 2012-2013

Student Recipient	Faculty Sponsor	Institution	Proposal Title
Grace Fox	Lenoir-Rhyne University	Marsha Fanning	The Effects of Dobutamine on the Hearth Rate of the Xenopus Embryo
Chelsea Kay	Warren Wilson College	Paul Bartels	Sexual Determination in Freshwater Jellyfish Medusae, Craspedacusta sowerbii, Captured in Lake Fontana, North Carolina
Mary Podgorak-Lagro	Catawba College	Jay Bolin	Evaluating Hybrid Intermediacy in the Germination Ecology of the Ashe's Sumac, Rhus asheii (Rhus michauxii x Rhus glabra)
Nebiyou Manfredo	Warren Wilson College	Dean Kahl	Optimal conditions for L-Proline Catalyzed Direct Enantioselective Crossed Aldol Reactions
Tabitha Ndung'u	Warren Wilson College	Stephen Cartier	Quantification of Active Pharmaceutical Ingredients in Malaria Drugs Used in Malaria Endemic Areas of Kenya
Marie Orton	Warren Wilson College	Mark Brenner	Effectiveness of a Mycofilter on Pathogen Removal from Agricultural Runoff as Indicated by Fecal Coliform Presence
Melissa Rhoney	Lenoir-Rhyne University	Dale Burnside	The Effect of Vitamin C on Escherichia coli
Leah Sigmon	Lenoir-Rhyne University	Stephen Scott	The Effect of Vitamin E on the Antibody Responses of Older Horses
Amelia Snyder	Warren Wilson College	John Brock	Atmospheric Coal Ash Composition Near a Coal Ash Pond

Picture of the Derieux Awardees at the NCAS Annual Meeting 2012

Student Academy of Science District Winners

The Student Academy winners will present their posters on Saturday during lunch. Their names and titles of their poster presentations appear on the Saturday's Schedule Details, pages 12-13.

Annual Meeting Participants

For registrations through March 29, 2013

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Columbus Career and College Academy

Masum Akond
Fayetteville State University

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"Thanks to professor Margie Labadie and her Fall 2012 Art 2500 class for contributing to the design of the program cover. Congratulations to student Megan McMillan for having her original pinecone patchwork design chosen for the cover."

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