SOUTHEASTERN BIOLOGY

Volume 60 July, 2013 Number 3

ASB 74TH ANNUAL MEETING

APRIL 10-13, 2013

Marshall University, Huntington, WV
Meeting Site: Charleston Civic Center
Charleston, West Virginia

Abstracts of Papers and Posters
Presented at the Annual Meeting

MARSHALL UNIVERSITY

Panoramic view.

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PURPOSE

The purpose of this association shall be to promote the advancement of biology as a science by encouraging research, the imparting of knowledge, the application of knowledge to the solution of biological problems, and the preservation of biological resources. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. See inside back cover.

TIME AND PLACE OF FUTURE MEETINGS

2014 April 2-5: Hosted by Converse College, Spartanburg Methodist College, University of South Carolina Upstate, and Wofford College, all four in Spartanburg, SC. Meeting site is the Convention Center at the Spartanburg Marriott.

2015 April 1-4: Hosted by the University of Tennessee at Chattanooga. Meeting site is the Convention Center at the Marriott.

ASSOCIATION OF SOUTHEASTERN BIOLOGISTS
INTERIM EXECUTIVE COMMITTEE MEETING
SATURDAY, 22 SEPTEMBER 2012
CONCORD, NORTH CAROLINA

ATTENDANCE: 13 persons attended the meeting.

NAME	CAPACITY
Don Roush	President
Patricia Cox	Past President
Zack Murrell	President-Elect
Rebecca Cook	Vice-President
Conley McMullen	Secretary
Tim Atkinson	Treasurer
John Herr	Archivist
Judy Awong-Taylor	EC Member-at-Large
Bill Ensign	EC Member-at-Large
Ashley Morris	EC Member-at-Large
Sarah Noble	Membership Officer
James Caponetti	Journal Editor
Scott Jewell	Meetings Coordinator

I. Call to Order and Welcome - President Don Roush called the Executive Committee (EC) Meeting to order at 9:05 A.M., and welcomed all members in attendance. Don apologized for any recent failings in email communication due to problems with his office computer, and thanked members for their patience.

II. Approval of the Executive Committee Meeting Minutes

Don Roush pointed out one correction to the minutes of the 4 April 2012 EC Meeting and one correction to the minutes of the 7 April 2012 EC Meeting.

Motion 1. Jim Caponetti made a motion that the minutes of the 4 April 2012 EC Meeting and the 7 April 2012 EC Meeting, as corrected, be approved. Bill Ensign seconded the motion. The motion carried.

III. Officer's and Executive Committee Reports

A) President - Don Roush shared with the EC that ASB member Frank Romano had passed away. Most recently, Frank had been serving on the Meritorious Teaching Award Committee. Don reported that he had received a request from Brian McCarthy to place institution names on badges for our 2013 meeting. Don also received a request that all author names be placed in the index of the meeting program. Don also mentioned that he had tried to contact Peter Raven (via phone and email) regarding becoming an ASB Fellow, but so far he has not received a response. Don contacted Nic Nichols about giving the plenary session talk at the 2013 meeting, but Nic declined due to a schedule conflict. However, he indicated that he would be willing to make the presentation at a future date. Don received a request to make an ASB

statement for Wikipedia. Don referred the individual inquiring about this to our webpage. Finally, Don mentioned that he has kept up with the usual correspondence with various EC members regarding normal ASB activities.

B) President-Elect - Zach Murrell reported that he has been working with Howie Neufeld on the Program Committee. He has also been assisting with Rebecca Cook with the selection of a plenary speaker for the 2013 meeting.

C) Vice-President - Rebecca Cook reported that Meredith Blackwell at LSU will be our plenary speaker for the 2013 meeting. Discussion followed about making arrangements for her attending the meeting.

D) Secretary - Conley K. McMullen reported that his main activities since the April 2012 meetings involved putting together the minutes of the two EC meetings (4 and 7 April 2012) and the annual Business Meeting (6 April 2012), and circulating them for review. Minutes of the EC Meetings were sent via email to all members attending for review and comments. Minutes of the Business Meeting were sent to EC Members for review.

E) Treasurer, Business Manager (includes Finance Committee and Enrichment Fund) - Tim Atkinson reported that this year's meeting in Athens, GA was extremely successful. Tim stated that our total is $73,752, and we are out of debt. Tim thanked Scott Jewell for a successful meeting. Judy Awong-Taylor asked for attendance figures. Scott mentioned that our highest attended meeting was Gattlinburg, TN, followed by Asheville, NC. Scott stated that we generally have 800-1000 participants. The attendance at the Athens meeting was 838. Due to this success, we have been able to pay back all monies borrowed from the Enrichment Fund. Discussion followed. Don Roush reported on our tax exempt status as a non-profit, and stressed that we should limit our contact persons to reduce confusion. As such, Tim will be our contact, with Don backing him up. John Herr asked for copies of all correspondence for the archives. Tim agreed to provide the correspondence to John. Jim Caponetti will look into tax exempt status for Tennessee.

F) Archivist - John Herr reminded EC members that they should begin calling attention now to archival materials that will be useful for the 100th Anniversary meeting. A new category in the archives system, "7.4 Special and Unreported Events in the Life of the Association" has been established for information anticipated to be useful when the next history of the association is written. Don Roush thanked John for all of his efforts as archivist.

G) Print Editor - Jim Caponetti reported that the October issue of *Southeastern Biology* (SEB) is now online, and it is larger than usual. Megan Kellog took some very nice photos. Ashley Morris asked if she could have copies of some of the photos to place on the ASB webpage. Scott Jewell volunteered to send her approximately 800 photos, from which she can select a number to place online. Jim mentioned that Ken Shull has been invited to submit a research paper to be included in the January issue of SEB.

H) Web Editor - Ashley Morris reported to the EC on our newly updated website! Ashley asked for input on the new "facelift". The new template makes the website less "crowded". Ashley pointed out some of the new items on the page. Some of the information was taken directly from SEB. Many of the photos were taken from our photo contest. Discussion followed. Ashley went through each of the main pages with us (membership, meetings, awards, etc.). During the past year (1 October 2011 – 22 September 2012), we had approximately 7642 visits to the website. Obvious spikes were during registration and meeting periods. Unique visits totaled 4779. Approximately 58% were new visitors. Ashley mentioned that she advertizes new items on our site via Facebook. Ashley shared information on where various "hits" came from. Ashley has spoken with Chris Fleming about creating an "app" for ASB. Discussion followed. Ashley inquired of the EC as to what her options were when discussing this with Chris.

Motion 2. Tim Atkinson moved that the EC authorize Ashley to negotiate the production of an "app" with Chris Fleming, and report back with her findings. Patricia Cox seconded the motion. Discussion followed. The motion carried.

Top visitors this year were GA, NC, and TN. Top visitors were obviously coming from the state where the meeting was held. Our Facebook page received 375 "likes" during the past year. The most common age range of visitors was 25-34. Ashley proposed that we have another photo contest. Discussion followed regarding other possible contests and on how to select winners. Discussion also included what prizes might be given.

Ashley reported that her summer webpage assistant didn't work out. Ashley mentioned that she has been taking care of the website and doesn't need much help now. However, she has contacted a potential new worker. Ashley inquired of the EC if she should return the money that had been provided for the assistant, or instead hire a new assistant to help expand the web page. Discussion followed about other information that could be added to the website. Don Roush suggested that Ashley use the money at her discretion to have a student add material to the website. The members of the EC agreed to this plan.

I) Book Editors - Melissa Pilgrim - No report. Jim Caponetti stated that Melissa had sent no book reviews since the last report.

J) News Editor- Ricky Fiorillo - No report.

K) Past President's Council - Patricia Cox reported that she still needs to make contact with other past presidents.

L) Membership Officer - Sarah Noble reported that she has been in contact with the former Membership Officer about her duties. Sarah also reported on membership numbers for the last couple of years. The only deceased member brought to her attention is Frank Romano. As of April 2012, we have 936 members. This number is down from some previous years, although life-membership numbers have increased. Regular and student membership has dropped dramatically. Zack Murrell asked about the possibility of sending fliers to all biology departments in southeast colleges and universities. Discussion followed, including how to value

regional meetings more. Judy suggested the possibility of an ASB workshop or symposium to address this issue. Scott Jewell suggested the necessity of designing a multipronged approach to the challenge of increasing membership.

M) Meetings Coordinator - Scott Jewell reported that our first year using *cvent* went extremely well. One thing that will be done differently this coming year is that we will be giving participants the option of using a "qr code" to access the onsite program. A hardcopy of the program will be available as well.

IV. Committee Reports

A) Member Benefit Committee Report - Sarah Noble - No report.

B) Annual Meeting Arrangement Committee Reports - Scott Jewell

1. ASB 2012 - Athens, GA - 838 attendees. Scott reported that everything went smooth, and the facilities were very nice. The total income was $201,507.00, and the total expenses were $155,501.92.

2. ASB 2013 - Charleston, WV - Scott is going to WV to make a final check on things. We will be meeting at the Charleston Civic Center and staying at the Embassy Suites. Scott fielded several questions regarding the site. Discussion followed regarding the program (electronic versus hardcopy) and field trips. Tom Pauley of Marshall University and Zack Lowman of West Liberty University will be organizing the field trips.

3. ASB 2014 - Spartanburg, SC – Scott reported that the contract for this meeting had been signed. We will meet at the Marriott.

   Discussion followed concerning future meetings (possible meeting sites and dates).

   Motion 3. Bill Ensign made a motion that for the 2016 meeting we switch from Wednesday-Saturday to Thursday-Sunday on a trial basis. The motion was seconded by Jim Caponetti. Discussion followed. The motion was withdrawn. Jim seconded.

   Motion 4. Bill Ensign made a motion that for the 2016 meeting we switch from Wednesday-Saturday to Thursday-Sunday as a trial, with flexibility to consider either of these options for future meetings. The motion was seconded by Jim Caponetti. Discussion followed. The motion carried.

   Discussion followed regarding the selection process for host institutions.

C) Publication Committee - Roland Roberts (Ashley Morris) – An editorial board has been established for *Eastern Biologist*. All individuals contacted as potential subject editors have been receptive so far. Discussion followed.

D) Education Committee - Kirk Stowe - No report. Don Roush mentioned that Kirk had discussed with him the poor linkages between various stages in education. Discussion followed.

E) Program Committee - Howie Neufeld - No report. Don Roush mentioned that Howie agreed to chair the committee. Zack Murrell mentioned that a colleague (Mike Suggs) at Appalachian State University would be willing to assist with organizing and putting together the program. Discussion followed. Ashley Morris suggested that we set up forms on the website, one for presentations and another for posters that would send abstracts already formatted to the chair of the program committee. More discussion followed. Howie will head up the organization of abstracts for 2013. Zack will look into organizing the program for 2014.

F) Bioinformatics - Zack Murrell - No report.

G) Tri-Beta - Christi Magrath - No report. Don Roush mentioned that there is a new District 1 Director, Lee Sutton (East Carolina University). Lee will be communicating with Christi while learning the ropes.

V. Old Business

A) Designation of Fellow - Don Roush reported that he is trying to communicate with the proposed Fellow for 2013 (Peter Raven). He will continue to attempt to make contact.

B) Ad Hoc Committee on Electronic Vote - Tim Atkinson – Don Roush charged the committee with continuing to look into electronic voting.

VI. New Business

A) AIBS Membership - Don Roush stated that ASB would continue its membership in AIBS.

B) Elimination of News Editor Position - Jim Caponetti told the EC that Ricky Fiorillo had communicated to him that there had been a lack of news items. Discussion followed. The EC decided to maintain the News Editor position.

C) Changes to the Leadership Guide - John Herr shared with the members of the EC that formerly, the Secretary was in charge of updating the Leadership Guide. John proposed that any changes to the Leadership guide would be made by the Archivist.

Motion 5. John made a motion to approve the above change. Sarah Noble seconded the motion. The motion carried.

D) Proposal for Change to Archivist Job Responsibilities - John Herr proposed that the Archivist position be replaced with an "Archivist Office". Don Roush said that he would send the details of this proposal to the EC for consideration. If adopted, ASB membership would be notified within the required time for amending the constitution at the April, 2013

Annual Meeting. Discussion followed. John mentioned that the President and the EC would be responsible for selecting individuals to serve in the office. The EC will vote electronically on whether to adopt this proposal or not. This will then be voted on by ASB members at the Friday Business Meeting in Charleston.

E) Proposed Change to Constitution and Bylaws to Correct for Online SEB and Print SENA - John Herr reported that the Constitution and Bylaws have been changed to reflect that the official journal is SENA, and that SEB is now online.

F) Proposals for Workshops and Symposia at 2013 meeting

1. Update on Vision and Change in Undergraduate Biology Education - Judy Awong-Taylor - It was proposed that five Fellows be invited to lead this workshop. Discussion followed.

   Motion 6. Jim Caponetti made a motion that free registration for invited Fellows be provided if the group maintains a physical presence at the meeting, including manning a table. The free registrations are contingent on no outside funding. Pat seconded the motion. The motion carried.

2. Workshop to Organize an Advancing Digitization of Biodiversity Collections – A workshop proposal submitted by Henry Bart was circulated. Ashley Morris checked on the possibility of funding being obtained from "I Dig Biology". If funding is received, the workshop will be held. Discussion followed. Zack Murrell suggested that Henry would be willing to consider a workshop funded by "I Dig Biology". If the funding is not available, then a proposal could be submitted to "Advancing Digitization of Biodiversity Collections". Discussion followed regarding the workshop and symposium proposals in general. The EC agreed to endorse this workshop.

   Motion 7. Tim Atkinson made a motion that we accept Henry Bart's proposal and that ASB provide logistical support. Patricia Cox seconded the motion. Discussion followed. The motion carried.

3. Human Diversity Committee - Marilyn Pendley - A copy of the committee's workshop proposal was circulated among the EC members. The committee requested $800 to cover the cost of boxed lunches for workshop participants, as well as to cover the cost of registration for the invited speaker, Lafayette Fredrick. Discussion followed regarding the workshop, as well as the larger topic of making sure that committee chairs and members understand their duties.

   Motion 8. Zack Murrell made a motion that ASB provide $800 for the workshop luncheon and registration fee. Bill Ensign seconded the motion. Discussion followed. The motion carried.

G) New Student Award - Patricia Cox proposed that the Woman's Leadership Group sponsor an undergraduate student award at the annual meeting. Discussion followed.

Motion 9. Patricia Cox made a motion to approve a $200 award for best presentation by an undergraduate female ASB student member. Ashley Morris seconded. Discussion followed. The motion carried.

H) Nominee for John Herr Award - Don Roush read a nomination submitted by Dwayne Wise for the John Herr Award. The EC decided that not enough information was provided to move on the nomination at this time.

VII. Announcements

There were no additional announcements.

VIII. Adjournment

Being no further business, Bill Ensign made a motion to adjourn, and Patricia Cox seconded. Don Roush thanked everyone for attending and adjourned the meeting at 5:10 P.M.

Respectfully submitted,

Conley K. McMullen
17 October 2012

ASSOCIATION OF SOUTHEASTERN BIOLOGISTS
74th ANNUAL BUSINESS MEETING
FRIDAY, 12 APRIL 2013
CHARLESTON, WEST VIRGINIA

1. Call to Order and Welcome – President Don Roush called the meeting to order at 12:08 P.M. and welcomed all members. Approximately 70 persons attended.

2. Approval of the Minutes – On behalf of Secretary Conley K. McMullen, President Don Roush presented the minutes of the 2012 Business Meeting as published in the July 2012 issue of *Southeastern Biology*. A motion to accept the minutes as published was made, seconded, and approved.

3. Recognition of Members Who Passed in 2012-2013 – President Don Roush shared with members that C. Ritchie Bell, Wallace Dawson, Joe Fail, George Kent, Frank Romano, and Steve Timme had passed away since last year's annual meeting. President Roush asked for a minute of silence to pay our respects to them.

4. Members Requesting Emeritus Status – President Don Roush announced, as conveyed to him by the Membership Officer, Sarah Noble, that William Font and Patricia Parr seek emeritus status. A motion to grant these members emeritus status was made, seconded, and passed.

5. Election of Officers – Past President Patricia Cox, Chair of the Nominating Committee, presented the 2013 candidates. These included: Vice President – Joey Shaw and Victoria Turgeon; Secretary – Sarah Noble; and Executive Committee Members-at-Large – Leon Jernigan, Margaret (Peggy) Kovach, Edgar (Ed) Lickey, and Conley McMullen. There was a call for further nominations from the floor and, being none, it was moved that the nominations close. Tellers distributed the ballots and members voted. Tellers were asked to count the ballots and announce the results at the Friday evening Awards Banquet.

6. Treasurer's Report – President-Elect Zack Murrell gave this report, as Treasurer Tim Atkinson was occupied with ASB business elsewhere. Zack reported that the Society is in good shape currently, and that we have done well at this year's meeting. Further, Zack mentioned that the Executive Committee will be looking at a three-year budget projection, and will be discussing this further at the Saturday Executive Committee meeting. Additionally, the Executive Committee will be working toward resolving issues involving our non-profit status. Zack reported that the Executive Committee will also be considering fund raising possibilities. President Don Roush mentioned that the issue of producing a strategic plan will be addressed at Saturday's meeting. Discussion followed. A motion was made to accept the Treasurer's Report as submitted by Zack. The motion was seconded. Discussion followed. The motion to accept the Treasurer's Report as submitted passed.

7. Proposed Changes to the Bylaws and Constitution – Archivist John Herr outlined the proposed changes to the Bylaws and Constitution, which were published in *Southeastern Biology* 60(1). A motion to accept the changes as presented was made, seconded, and passed.

8. Resolutions – Past President Patricia Cox, Chair of the Resolutions Committee, read the "Resolution of Appreciation to Marshall University and the Organizers of the 74th Annual Meeting of the Association of Southeastern Biologists". A motion by the Resolutions Committee to accept this resolution was passed.

9. Old Business – John Herr made a motion that Tim Atkinson produce a complete Treasurer's Report and circulate it electronically. Bill Ensign seconded, and the motion passed.

10. Announcements – Program Chair Howie Neufeld reported that there had been minor glitches with computers at this year's meeting. Meetings Coordinator Scott Jewell stated that these issues will be addressed. Bill Ensign reminded everyone to fill in our membership survey. President Don Roush thanked President-Elect Zack Murrell for all of his assistance with preparing for this year's Annual Meeting, especially with the Friday evening Awards Ceremony. Zack mentioned that assisting Don had given him a better feel for ASB operations than most Presidents possess when they begin their tenure as President. Zack continued by addressing the idea of "featured institutions", and briefly mentioned that in the past, there have been some issues created by "ill-defined" duties. Members were reminded that ASB is no one person's society, but instead belongs to all of us. Zack suggested that when concerns arise, they should be brought to him. Don passionately reiterated the above points.

11. Adjournment – President Don Roush thanked everyone for attending and the Business Meeting was adjourned 12:36 P.M.

12. Election Results – Announced at the Friday evening Awards Banquet.
Vice-President – Joey Shaw
Secretary – Sarah Noble
Members-at-Large – Ed Lickey and Conley K. McMullen

Respectfully submitted,

Conley K. McMullen, Secretary 2010-2013
29 April 2013

CALL FOR NON-COMMERCIAL WORKSHOP AND SYMPOSIUM PROPOSALS FOR THE 2014 ANNUAL MEETING OF THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

Deadline for Receipt of Proposals: August 30, 2013

Proposals for non-commercial Workshops (hereafter referred to as Workshops) and Symposia to be offered at annual meetings of the Association of Southeastern Biologists must be prepared and submitted for review as described in this Call for Proposals; the same criteria for proposal preparation, submission, and review apply to proposals originating from internal leadership bodies within ASB (such as standing committees) and from individuals or groups outside of ASB. **Commercial workshops are arranged through the Meetings Coordinator, and they are subject to separate guidelines that can be obtained from the Meetings Coordinator.** Written proposals for Workshops and Symposia must be submitted to the Chair of the Program Committee, the ASB Meetings Coordinator, and the ASB President no later than two weeks prior to the fall interim meeting of the ASB Executive Committee. Proposals for Workshops must clearly describe their structure (including maximum number of participants) and concept, as well as prerequisites, space and other facilities requirements, and request for funding from ASB (if any). Proposals for Symposia must clearly address all five of the criteria listed below and be accompanied by letters of endorsement (if any). All proposals will be peer-reviewed and ranked by the Program Chair of the LAC and the ASB Executive Committee. Decisions to accept or reject proposals will be made at the fall interim meeting of the ASB Executive Committee, and proposers will be contacted shortly thereafter.

Workshops

Structure & Concept: Workshops are flexible in their structure. They can be a half-day, full day, or two days in length. Lunchtime Workshops are also offered. Workshop structure is determined by the organizers. Workshops typically have maximum enrollments, and they may specify prerequisites for participation (Workshops should be open to all meeting attendees, first-come first-served, who meet these prerequisites). Workshops often have a registration fee to cover A/V equipment and preparation. Workshops are intended to convey specific knowledge or skills; they are not intended for the presentation of research papers. Workshops are frequently more interactive and informal than sessions within the formal scientific program, and they are not scheduled concurrently with Symposia, contributed oral sessions, or poster sessions. Workshops may involve one or several teachers/presenters, and they may include computer-based or other 'hands-on' training. Weekend Workshops may be linked with a scientific field trip. A Workshop proposal should make clear what participants might expect to gain, and how the Workshop furthers the overall goals of the Association of Southeastern Biologists (these two aspects are the major criteria for Workshop acceptance). Limits of space and time may make it impossible to accommodate all worthy submissions.

Symposia

Structure & Concept: Symposia are a half-day or a full day in length. The number of speakers and the length of each talk are determined by the session organizers; talks should be between 15 and 30 minutes long, and presentation times can vary between speakers. Each session should include at least one 30 minute break that will be synchronized with the coffee break of all concurrent sessions. Generally, Symposia should be focused, integrated presentations assessing current understanding regarding a particular research problem, concept, application, or educational theme. Symposia should have broad appeal to members of ASB or involve integration across sub-disciplines.

Symposium proposals will be assessed under the following criteria. Weighting of particular criteria may vary depending on the nature of proposals, but proposals should explicitly address these criteria, as appropriate. There is typically room for only three Symposia at the annual ASB meeting.

Criteria for Evaluation of Symposium Proposals

1. **Scientific strength:** Symposia are the scientific centerpieces of the meeting, and should:
   - offer significant contributions to biological understanding,
   - present innovative or interdisciplinary approaches, including novel collaborations or syntheses across subdisciplines, and
   - have broad enough appeal to generate large audiences (>100 people) at the meeting.
2. **Structure and organization:** Symposia should be more explicitly integrated than other sessions, and should be structured to:
   - provide overall synthesis or overview; they should not be simply a set of related case studies,
   - avoid taking a narrow perspective on the Symposium topic; organizers should carefully avoid appearance of biases toward their own perspectives, and
   - build a well-integrated whole; each talk should have clear relevance to overall synthesis.
3. **Speakers:** Invited speakers should bring new contributions to the session, not simply reviews of previous work. Inclusion of experienced or particularly engaging speakers can strengthen a proposal, but new voices are also important. Proposals with a larger proportion of confirmed speakers will be favored.
4. **Funding:** Workshop and Symposium proposers must certify that they have sufficient funding available to cover all costs of the program as proposed, including expenses (travel, meals, lodging, honoraria) for all invited speakers. If additional funds are needed beyond those available to the proposers, such funds must be identified and may be requested from the ASB Executive Committee (EC), which has some funding available for Symposium proposals, usually reserved for proposals that come from ASB standing committees. If requesting funds from the EC, the Symposium proposers must specify an amount and justify that amount. If the EC provides funds requested by the Symposium proposers, it is assumed that the Symposium is fully funded as described. If partial funding is offered by the EC, the Symposium proposers must subsequently secure the additional funds required to cover all costs.

5. **Integration:** Proposals may receive higher priority if they are clearly linked to the meeting's overall theme, or if they offer particular value or insight in the context of other sessions proposed for the meeting or of Symposia at recent ASB meetings.

Endorsements

Workshops and Symposia are often endorsed by various groups, agencies, and organizations including international societies, private non-governmental organizations, governmental agencies, or internal leadership bodies within ASB, such as standing committees. These endorsements will be considered in review of proposals, particularly if they emphasize why the group finds merit (in terms of evaluation criteria above) in the proposal. **Each of these groups, organizations, or agencies is allowed to endorse only one Symposium proposal**. If a group submits a proposal, that group is considered to be endorsing its own proposal, and it cannot endorse another. Symposium proposers, in requesting endorsements, should make this policy clear. There is NO guarantee that a proposal endorsed by any group or organization will be accepted. Individuals preparing letters of endorsement should send them directly to those preparing the proposal for inclusion as part of the proposal package.

If Your Proposal Is Accepted

After proposals are accepted and the scheduling for the meeting is underway, cancellations and schedule changes are very disruptive to meeting planning. Hence, organizers of Workshops should obtain firm commitments from their teachers/presenters and organizers of Symposia should obtain firm commitments from as many of their invited speakers as possible before submitting their proposals. **Requests for additional funding will not be considered by the ASB Executive Committee.**

If a proposal is accepted, the organizers must submit a final summary description of the Workshop or Symposium to the Program Committee Chair at the same time abstracts are due. This summary will appear on the meeting website and should be written so as to stimulate interest and promote attendance. This description must include a complete and current listing of organizers' names and their affiliations, addresses, telephone and fax numbers, and email addresses; a 400-word narrative description of the session; a 50-word sentence description of the session; and a final, confirmed speaker list.

It is the responsibility of Symposium organizer(s) to see that each speaker submits an individual abstract of his/her talk using ASB's abstract submission criteria by the abstract submission deadline. It is not permissible to submit abstracts by any other means. Contact the Program Committee Chair if your situation precludes use of the abstract submission website.

It is suggested and encouraged that a written summary of the Workshop or Symposium be submitted to *Southeastern Biology* for publication.

Non-Commercial Workshop/Symposium Proposal Submission Form

Title:

Submitters' Contact Information (address, phone, and e-mail address):

Session Description: In 400 words or less and in sentence form, describe the theme and purpose of this session.

Session Justification: In 250 words or less and in sentence form, provide the justification for this session.

One-sentence Summary: Summarize your proposal in 50 words or less.

Speakers and Titles: List all teachers/presenters (Workshops) or speakers and their titles (Symposia). Next to each participant, indicate if they are confirmed or only contacted and have not yet decided (unconfirmed). Do not list individuals who have not yet been contacted.

Funding: Explain how the Workshop or Symposium as proposed is to be funded. Symposium proposers may request needed funds from the ASB Executive Committee.

This form must be submitted to the following individuals no later than two weeks prior to the fall interim meeting of the ASB Executive Committee (deadline is August 30, 2013).

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ASB Special Award

The University of Georgia
Center for Continuing Education

Date: April 2, 2013

To: TIM ATKINSON
ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

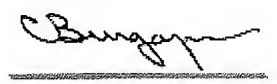
RE: ASSOCIATION OF SOUTHEASTERN BIOLOGISTS AWARD

On behalf of the entire staff, we would like to thank you for your kind sponsorship of a Special Award at the 65th Georgia Science and Engineering Fair. We are pleased that you and your organization recognize the importance of stimulating and encouraging young minds and imaginations.

Attached you will find a list of your special award winners and a receipt if you prepaid or an invoice if you have a balance due. If available, a photo of the winning student is attached. Additional photos are available at georgiasnapsphotography.com (click on "proofs").

Again, thank you for your continued support of the state science fair. Plans are already underway for the 66th Georgia Science and Engineering Fair, March 27-29, 2014. We look forward to continuing this mutually rewarding relationship.

Best regards,



Christine Burgoyne
Director, Georgia Science and Engineering Fair
University of Georgia Center for Continuing Education
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Christine Burgoyne
Director, Georgia Science and Engineering Fairs
Office of Academic Special Programs
University of Georgia Center for Continuing Education
706-542-6473

March 25, 2013

Georgia Science and Engineering Fair State Finals March 21-23, 2013

ATHENS, Ga. – More than 800 middle-school and high-school finalists from throughout the state competed last weekend in the 65th Georgia Science and Engineering Fair (GSEF) at the Classic Center in downtown Athens.

Hosted by the Office of Academic Special Programs and The University of Georgia's Center for Continuing Education, the GSEF is the state's ultimate venue for displaying the science and engineering research of Georgia's top middle- and high-school students.

An invitation to compete at the Fair culminates a string of achievements that begins for each competitor with a classroom or laboratory research project and experiment. Meritorious projects from school and local fairs are invited to exhibit at one of the 21 Regional Fairs held throughout the state in January and February. The best of the regional winners are considered for advancement to the state fair.

Students competed in 17 categories, including animal sciences, behavioral and social sciences, biochemistry, cellular and molecular biology, chemistry, computer science, earth and planetary science, electrical and mechanical engineering, engineering materials and bioengineering, energy and transportation, environmental management, mathematics, medicine, microbiology, plant sciences, physics and astronomy.

Fair Co-Director Laura Brewer said, "We were very impressed with both the caliber of research the students presented at the fair this year and the maturity and poise with which they conducted their interviews."

Head judge Joe Hughes of The Georgia Institute of Technology coordinated over 300 science professionals from throughout the state in judging the projects on Friday, March 22.

Students competed for thousands of dollars in awards, internships, and prizes, including over 100 special awards that honor students for research in particular fields.

The top prize, the Georgia Science and Engineering Fair Pinnacle Award went to Anand Srinivasan of Roswell High School for SKYNET: Modeling Spatiotemporal Systems with Recurrent Neural Net.

Four students were selected to advance to the international competition, the Intel International Science and Engineering Fair (ISEF), which will be held May 12-17 in Phoenix, Arizona. They are Julia Abelsky of North Springs High School for Cylindrically Confined Diblock Copolymers and Gold Nanocomposites, Sonam

Brahmbhatt of Rockdale Magnet School for Hypoxia Induced Effects On Chondrocyte Phenotype, Catherine Schlueter of Mountain View High School for Can Native Bees Replace Honeybees in Commercial Apple Production, and Pinnacle Award winner Anand Srinivasan of Roswell High School.

Also selected to attend ISEF are Larry Jacobs and Chelse-Amoy Steele of Rockdale Magnet School, for their project Discovering the Behavior of the Pancreas in an Obese Mouse Model. Jacobs and Steele are the recipients of the Merial Biological ISEF Trip Observer Award, which honors a 9th or 10th-grade student who displays the "desire, academic potential, and personality to attend ISEF as a participant in following years."

The Grand Awards for Top Ten State Recognition went to Julia Abelsky, Sonam Brahmbhatt, Angelina Choi, Grade Devine, Alexandra Melehan, Chuanbo Pan, Sergio Parra, Catherine Schlueter, Anand Srinivasan and Justin Williams.

Two graduating high school seniors were selected to represent Georgia at the month-long 2013 National Youth Science Camp held in June in West Virginia. They are Julia Abelsky of North Springs High School and Natalie Rakoski of Villa Rica High School.

The UGA Charter Scholarship Award went to Malcolm Barnard of Johns Creek High School for Utilizing an Algal Filter to Improve Water Quality and Aqib Momin of Rockdale Magnet School for Computational Models of Stochastic Recurrent ANN's.

The 67th Georgia Science and Engineering Fair will be held March 27-29, 2014.

For year-round information on the fair, visit http://www.georgiacenter.uga.edu/gsef or email gsef@georgiacenter.uga.edu.

Source Contact:

Fair Director Christine Burgoyne, 706-542-6473, chrisbur@uga.edu.

Science Fair Special Award Winner

Award Name: ASSOCIATION OF SOUTHEASTERN BIOLOGISTS AWARD

Sponsor Organization: ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

ASSOCIATION OF SOUTHEASTERN BIOLOGISTS AWARD

Description: 1-YEAR MEMBERSHIP ASB, FREE REG ASB 2014 ANNUAL MEETING IN SPARTANBURG, SC

Grace Devine
1471 ELENA DR.
MCDONOUGH, GA 30253

Phone: 678-272-8273; Email: grace_devine07@yahoo.com

ASB

Paper and Poster Abstracts

From the 74th Annual Meeting

Hosted by

Marshall University
Huntington, WV

Meeting Site:

Charleston Civic Center
Charleston, WV

April 10-13, 2013

74th Annual Meeting of the Association of Southeastern Biologists

Presentation Abstracts

Refer to the Program for presentation times

1 **Nitya T. Rao, Scarlett C. Murphy, A. Malcolm Campbell, Michael E. Dorcas**

A Robust Protocol for Environmental DNA Species Detection Using Burmese Pythons (*Python molurus bivittatus*) and Bog Turtles (*Glyptemys muhlenbergii)* as Models

Department of Biology, Davidson College, Davidson, NC

Environmental DNA (eDNA) refers to the collection of cellular and extracellular DNA that organisms leave behind in their environment. Investigators have recently begun using the eDNA present in water, air, and soil samples to determine the presence of cryptic species. As with any new technique, it is important to establish robust protocols to prevent false positive or false negative results. PCR is particularly prone to the erroneous amplification of DNA, and our goal was to develop appropriate controls for the use of eDNA in PCR-based species detection. We designed universal primers that amplify a single locus from all eukaryotic DNA to provide a positive control for PCR amplification. We designed species-specific primers and sequenced the amplicons to ensure the primers only amplified the target species. The species-specific primers designed for the Burmese python only amplified the target species while those designed for the bog turtle amplified the target species as well as the closely related wood turtle (*Glyptemys insculpta*). In addition to constructing three sets of primers, we also provided recommendations for other critical PCR conditions such as the temperature of the annealing cycle, the number of amplification cycles, and the prevention of template DNA contamination.

2 **Derrick Cardin, Satish Dahal, Chris R. Gissendanner**

Signaling activity and functional interactions of a nematode-specific extracellular leucine-rich repeat protein (eLRRP)

Department of Basic Pharmaceutical Sciences, College of Pharmacy, University of Louisiana at Monroe, Monroe, LA

CANCELLED

3 **Erika Balogh, John M. Herr Jr., Claire T. Hann, Soumitra Ghoshroy, Mihaly Czako, Marton Laszlo**

Silica Storage Cells in *Arundo donax* L. Leaves

Department of Biological Sciences, University of South Carolina, Columbia, SC

In *Arundo donax* leaves, clusters of silica storage cells are situated in rows between the vascular bundles. Each cluster, consisting of 3-5 colorless cells of unequal size but all larger than those of the adjacent mesophyll, occurs beneath four bulliform cells in the adaxial epidermis. Longitudinally in the leaf, the clusters are approximately 10 µm apart, a distance less than the thickness of a hydro-microtome section (approximately 22 µm). Therefore, they consistently appear between the vascular bundles in cross sections of the leaf. The cell immediately below the four bulliform cells is larger than the 2 to 4 cells below it, and this larger cell is the primary site for silica storage. Accumulation of silica in the smaller cells is infrequent. Silica has been reported to reduce salt stress in certain crop plants. To determine the role of these cells under salt stress, salt tolerant and non-salt tolerant ecotypes were grown on 1% and 0% NaCl. Previous studies show that salt tolerant ecotypes exclude sodium ions from stems and leaves. Sodium uptake and silica content in the storage cells were measured by ESEM (Environmental Scanning Electron Microscopy). EDS (Energy Dispersive X-ray Spectroscopy) analysis shows that silica accumulation is greater in the non-salt tolerant ecotype under salt stress than in the salt tolerant ecotype not under salt stress.

4 **John Russell Williams, James Rayburn**

Inhibition of Developmental Toxicity of Acrylamide Using L-Cysteine in *Xenopus laevis*

Department of Biology, Jacksonville State University, Jacksonville, AL

Acrylamide is a known neurotoxin produced industrially for use in products such as plastics, grouts, water treatment products, and cosmetics and also used to make polyacrylamide gels. In 1997, trace amounts of acrylamide were found in starchy foods as a byproduct of the Maillard Reaction. L-cysteine has previously demonstrated to inhibit the toxicity of acrylamide. This study was to show the degree of inhibition of acrylamide utilizing toxic unit analysis. One toxic unit is equal to the LC50 of that chemical. We chose to test mixtures of 1:1, 3:1, 1:3 and 19:1 toxic unit ratios of acrylamide to L-cysteine. The Frog Embryo Teratogenesis Assay – Xenopus (FETAX), a 96hr teratogenesis protocol was employed for this analysis. Newly laid Xenopus eggs were exposed to a series of concentrations of each test solution, in a standardized water solution, of mixtures of L-cysteine and acrylamide for 96hrs. At the end of each 24hr period, the solutions were renewed with freshly made test solutions. Mortality, Malformation and growth were recorded at 96 hours. The LC50 (lethality in 50% of a population) and EC50 (malformation in 50% of a population) were calculated using Systat 13, probit analysis, and Teratogenic Index (TI = LC50/EC50) was then determined. Lowest observable effects were determined using ANOVA and Bonferroni's multiple comparison test. This research showed that L-cysteine inhibits the toxicity of acrylamide by approximately doubling the LC50 of acrylamide for some of the mixtures.

5 **Gabriel Spencer, Bakari Thomas, Andre Artis, Erica Tross, Kimiko Moore, Tedean Hunter, Yoedono Sovyanhadi**

Vitamin C intake by prostate cancer cell line PC-3 as affected by glucose starvation and vitamin availability in the media

Biological Sciences Department, Oakwood University, Huntsville, AL

The apoptotic-inducing potency of vitamin C against cancer cells has long been accepted. This project aims to find the highest level of vitamin C intake by PC-3 cells as influenced by glucose deprivation and vitamin availability. In the first study, glucose starvation of 0, 1, 2 and 3 hours were tested by incubating the cells in PBS. The PBS was changed with fresh medium before addition of 125, 250 and 375 µM vitamin C. After 15 minutes incubation, the amount of vitamin left in the media was determined. The second study consisted of two steps. The first step was examining cell tolerance to concentrations of vitamin C. In the second step, vitamin C at 250, 500, 750, 1000 and 1250 µM and glucose starvations of 0, 1, 2, and 3 hours were tested. In this case, the PBS was not changed with fresh medium. Results of these studies indicated that PC-3 cells more readily took glucose than vitamin C after starvation. When glucose was absent, the percent absorption of vitamin C ranged from 69 to 88%. The highest absorption of 990.8 µM occurred after 1 hour glucose deprivation and treatment of 1250 µM vitamin C. Apparently, the active transport of the vitamin has reached saturation at this level. This treatment level will be further used for investigating intracellular Fenton's reaction by supplying ferrous-sulfate and catalase inhibitor. The overall study will significantly contribute to the development of effective therapeutic strategies for cancer as well as tissue-specific delivery of vitamin C-drug conjugates. Key words: PC-3 cells; vitamin C; absorption; glucose starvation

6 **A.K. Helton[1], J.M. Ross[2], J. Schulz[2], S.A. Lloyd[2], R.A. Shanks[1]**

Methamphetamine differentially alters the expression of peroxiredoxins in dopaminergic regions of the brain

[1] Department of Biology, University of North Georgia, Dahlonega, GA; [2] Department of Psychological Science, University of North Georgia, Dahlonega, GA

Abuse of the psychostimulant and dopamine (DA) agonist, methamphetamine (METH), leads to neurodegeneration of DAergic neurons in the striatum (STR) and prefrontal cortex (PFC). This study focuses on the mRNA expression of the antioxidant family of proteins, peroxiredoxins (PRXs), which have the potential to eliminate toxic free radicals created by METH-induced oxidative stress. PRXs represents a family of six antioxidant isoforms (PRX1-6) that have both intra- and

extra-cellular peroxidase activity. To understand how METH alters expression of these proteins, C57B1/J6 mice were exposed to saline or an abuse dosing paradigm of METH (5 mg/kg) for 10 days. Real-time PCR analysis of PRX1-6 mRNA expression was performed on micro-dissected STR and PFC. In the PFC, METH induced a significant increase in expression of PRX4. PRX4 is secreted into the extracellular space and is a putative biomarker. An increase in PRX4 expression provides insight into a possible protective mechanism underlying METH-induced neurodegeneration. In the STR, METH induced a significant increase in PRX5 and decrease in PRX2. PRX5 is localized to the mitochondria and is upregulated in response to oxidative stress in activated monocytic cells. Therefore, increases in PRX5 expression may result from microglia activation in response to METH-induced neurotoxicity. PRX2 is an anti-apoptotic factor concentrated in the cytosol of neurons. Together this study suggests a role of PRXs in preventing METH-induced neurotoxicity in DAergic pathways of the brain. Analysis of PRX protein levels and enzymatic activity is on-going, but will provide additional understanding of these interactions.

7 **Haley Kinney, Jennifer T. Thomas**

Analysis of E-cadherin Levels in Human Papillomavirus Positive and Negative Cervical Cancer Cells Infected with Microorganisms

Biology Department, Belmont University, Nashville, TN

It is estimated that as high as 80% of women will get a Human Papillomavirus (HPV) infection in their lifetime, but of that, less than 1% will progress into cervical cancer. The absence of E-cadherin, a tumor suppression adhesion protein, has been linked to cancers. Furthermore, recent studies have shown that secondary infections beyond HPV infection, may lead to cancer progression. Through gel electrophoresis and Western blotting, E-cadherin levels were examined in HeLa cell lines (HPV positive) and C33A cell lines (HPV negative) that were infected with other microorganisms. While there was no detection of E-cadherin protein in our analysis, we cannot make conclusions about the impact of HPV or an additional infection on this adhesion protein. In the future, further analysis of other adhesion proteins and secondary infections in the presence of HPV may shed light on this important cancer.

8 **Kailee Hawkins, Jennifer T. Thomas**

Analysis of Calpain-6 and Endostatin Expression in Human Papillomavirus Positive and Negative Cervical Cancer Cell Lines and the Impact of Microbial Infection

Biology Department, Belmont University, Nashville, TN

Human Papillomavirus (HPV) positive cervical cancers make up over 95% of all cervical cancers; however, only a small percentage of these high-risk HPV infections become cancerous. Recent evidence suggests that a bacterial infection causing inflammation, alongside a high-risk HPV infection may be enough to induce such transformation. Calpain-6 is a cell signaling protease used to modify many cellular proteins, and it is known to be amplified in certain cancerous cells. Elevated expression of calpain-6 has been linked with the promotion of angiogenesis and prevention of apoptosis in HPV-positive and HPV-negative cervical cancer cell lines. In addition, the role of Endostatin, an angiogenic inhibitor, in cervical cancer progression remains unclear. In this study, we repeated the analysis of calpain-6 expression in cervical cancer cell lines, but also examined the impact of microbial infection on expression of calpain-6. Further, we examined the levels of Endostatin in cervical cancer cell lines with and without microbial infections. Following Western Blot analysis, calpain-6 expression was too low to draw conclusions. Endostatin levels, however, were detectable and consistent, regardless of the expression of HPV or microbial infections, in the cell lines examined. Analysis of additional cellular proteins in this system may shed light on the impact of HPV, co-infections, and alterations of angiogenesis in cervical cancer progression.

9 **Tanja M. Schuster, Nikolaus G. Anderson, Maile C. Neel**

Creating a 21st Century Virtual Herbarium at the University of Maryland

Department of Plant Sciences and Landscape Architecture, University of Maryland, College Park, MD

Staff at the Norton-Brown Herbarium (MARY), Department of Plant Sciences and Landscape Architecture, recently launched a Virtual Herbarium via our new webpage (www.nbh.psla.umd.edu). We serve online high-resolution images of herbarium specimens, georeferenced locality data, label information, and vetted species identifications including currently accepted names (APG III classification). The digital collection can be queried and images and label data are downloadable. Locality information can be plotted on an interactive map. The website also features an interactive key for approximately 400 woody plants of the Mid-Atlantic region.To date, Federal Work Study Students have produced 21,000 high-resolution images of the 87,000 specimens held at MARY and students continue to gain databasing and plant identification skills by digitizing herbarium label information. Species that occur in Maryland were imaged first and databasing efforts prioritized taxa invasive to the state. Approximately 5,100 specimens are currently available digitally through the website.Data fields are structured according to 'Darwin Core' standards (e.g. species name, locality information, coordinates, collector name and number, accession number). All of the applications we use, such as Specify 6 for specimen data management, Image Cutter for image processing, and NaviKey for the interactive key are free and open source. The website uses custom PHP scripts to query a MySQL database.Future goals are the imaging of the remaining 66,000 specimens not yet captured, which includes Asteraceae and Poaceae of Maryland, and to that end, the purchase of an imaging system, which could be loaned to other small regional herbaria.

10 **Elizabeth Mercer[1], Brandi Griffin[1], Joshua Steele[1], Kate Goodrich[2], Catherine Bush[3]**

The phylogeny of *Asimina* and *Deeringothamnus* Eliz

[1] Department of Biology, Valdosta State University, Valdosta, GA; [2] Department of Biology, Widener University, Chester, PA; [3] Department of Biology, Elon University, Elon, NC

The molecular phylogenetic classification of the North American genera *Asimina* and *Deeringothamnus* (Annonaceae) has never been determined with strong support and/or resolution. In this analysis, ISSR DNA fingerprinting techniques were used in order to elucidate the phylogeny of the group. DNA was extracted from accessions from both the field and herbarium. Six ISSR primers were used with 15 species, including 11 of *Asimina,* two of *Deeringothamnus,* one *Annona* and one *Disepalum*. AAgarose gels stained with ethidium bromide were used to determinethe presence and absence of bands. These data were analyzed in PAUP using Neighbor Joining algorithms. Morphological traits (including floral scent characteristics) and chemical presence data were included in addition to the molecular data. *Deeringothamnus* is strongly supported as being both a monophyletic group as well as being placed within the genus *Asimina*. The white-flowered and red-flowered species of *Asimina* split into two separate clades, albeit with less than 50% bootstrap support.

11 **Kari M. Harris, Christopher R. Burkhart, Rebecca D. Kennedy, Starlene M. Loerch, Alexander J. Worm, Travis D. Marsico**

Digitizing Specimens in a Small Herbarium: A Template for Other Collections Working with Limited Resources

Department of Biological Sciences, Arkansas State University, State University, AR

The Arkansas State University Herbarium (STAR) contains collections that are important to the botanical history of Northeast Arkansas. These data need to be more widely accessible to researchers, educators, and others with an interest in the natural heritage of the region. Within this project we explore the field of biodiversity informatics to broaden the reach of the STAR Herbarium. It is vital to the continuation of botanical research that herbaria link the information held within them. Digitization efforts are the most efficient way to accomplish this goal. Small herbaria represent a significant portion of herbaria in the United States, yet many are not digitizing. Of

those that are digitizing, many are not making their data widely available. In the STAR herbarium we have annotated all Arkansas specimens to update their nomenclature and imaged the 17,500 Arkansas collections accessioned. A graduate student and four undergraduates averaged around 175 specimens per hour during the annotation and imaging stages, allowing the entire collection to be imaged in a little over a semester with 5 students. We have begun databasing and georeferencing the collection, and in the coming months these data will be made available through larger database portals as well as a local website component specific to the STAR Herbarium. As a small herbarium with limited resources, the implementation methodology described by our effort should assist curators of similar sized collections as they undertake the digitization process.

12 **Derick B. Poindexter**

Vascular flora of Alleghany County, North Carolina: a contemporary approach.

Department of Biology, Appalachian State University, Boone, NC

An inventory of the vascular plant species of Alleghany County, North Carolina was conducted from spring 2008 – summer 2012. Extensive fieldwork was augmented by a search of numerous herbaria, resulting in the documentation of 1507 taxa (1456 species) in 641 genera and 161 families. Four hundred and thirty-four taxa, 28.8% of the total flora, are considered exotic. Sixty-five native taxa have state or global ranking due to rarity. Many state and county records were discovered during the course of this project. A comparative assessment was made of all plant origin (native vs. exotic) categories within the flora. In an attempt to modernize floristic research, a companion website (www.vascularflora.appstate.edu) comprised of georeferenced vouchers and field images was created to provide a dynamic source of digital documentation for this study.

13 **Christine Gang, Sam Tessel, Alan Weakley**

Additional species in southeastern *Trichostema* (Lamiaceae) Department of Biology

Department of Biology (UNC Herbarium) University of North Carolina at Chapel Hill, Chapel Hill, NC

The genus Trichostema has endemic species on the Western and Eastern seaboards of the North American Continent. The Western endemic species, which include *T. lanatum* and *T. lanceolatum*, are greater in number than the Eastern endemic species which include *T. suffrutescens* and *T. setaceum*. In this study, the Eastern endemic species are further examined, and two new taxa are proposed. In addition to *T. dichotomum*, *T. suffrutescens*, and *T. setaceum*; *T. nesophilum*, and *T. floridanum* are to be recognized. *T. nesophilum* and *T. floridanum* are both geographically isolated from the other three currently recognized species. Based on morphology, *T. nesophilum* is found on the barrier islands of North and South Carolina and has secondary branching and a low branching node different from either *T. dichotomum* or *T. suffrutescens*; *T. floridanum* is found on the coast of Florida panhandle and has pink flowers rather than the dark blue/black flowers like *T. suffrutescens*. Molecular data supporting that *T. nesophilum* and *T. floridanum* are in fact distinct species in the genus *Trichostema* is still in progress.

14 **Derick B. Poindexter, Alan S. Weakley**

Mountain men chasing a mountain mint: variation in *Pycnanthemum muticum* (Michx.) Pers.

UNC Herbarium (NCU), N.C. Botanical Garden, Univ. of North Carolina, Chapel Hill, NC

The genus *Pycnanthemum* is notoriously difficult, plagued by allopolyploidy, autoploidy, and aneuploidy. *Pycnanthemum muticum* is a widespread member of this primarily southeastern genus that has been implicated as a parent to multiple putatively stable current species, as well as many sporadic hybrids. While encountering this taxon in the field within the southern Appalachians over a ca. 10 year period, it became apparent that more than one distinguishable entity was involved in the current concept of this species. Upon further investigation into geographic patterns of variation, we propose a novel taxonomic treatment within this taxon.

15 **Helen Fowowe, Dane Kuppinger**

Rediscovering the nation's oldest herbarium; Salem College's herbarium rejoins the botanical community

Department of Biology, Salem College, Winston-Salem, NC

Salem College, the nation's oldest women's college is also home to the oldest herbarium in the country. Unfortunately, in the fall of 2010, the herbarium was in a sad state of disrepair; beetles had found the collection and all records of its contents had been lost. Since then, a great deal of cleaning, sorting, and cataloging has gone into making the collection presentable. Started in 1772, the herbarium contains plants collected by the first Botanists in Salem including Christian Denke (1775-1838), Jacob van Vleck (1751-1831), and Emma Lehman (1841-1922). Although given its founding date, specimens collected by Samuel Kramsch (1758 – 1824) should be present, none have yet been located. The oldest specimen located so far is from 1819. These historical collections were largely used as teaching tools and as such they contain family and species information by only limited information on where or when they were collected. The majority of these "historical" specimens appear to have been collected locally, though there are also contributions from Moravian missionaries who traveled in South America and Africa. The collection also contains ~4,500 modern specimens collected since 1920, primarily from the southeastern US. These "modern" specimens largely have location, date, and collector information and over 200 of these have been added to the herbarium database maintained by the University of North Carolina Herbarium. The historical collection remains largely unexplored and represents an exciting opportunity for future research.

16 **Derick B. Poindexter[1], Robert F.C. Naczi[2]**

Taxonomy of *Carex lucorum* Willd. ex Link var. *austrolucorum* Rettig (section Acrocystis, Cyperaceae)

[1] UNC Herbarium (NCU), N.C. Botanical Garden, Univ. of North Carolina, Chapel Hill; [2] The New York Botanical Garden, Bronx, New York

Carex lucorum is currently comprised of two morphologically similar varieties that have been in need of some geographic and taxonomic reassessment. We revise the taxonomy of *C. lucorum*, and map the distribution of the two taxa. Morphological data used for multivariate analyses and analyses of variance, combined with allopatry and previously described variation in chemistry, achene micromorphology, and chromosome differences suggest that *C. lucorum* var. *austrolucorum* is best treated at the specific rank.

17 **Alan S. Weakley[1], J. Christopher Ludwig[2], John F. Townsend[2]**

The Flora of Virginia: A new flora for the Old Dominion, and not a century too soon

[1] UNC Herbarium (NCU), N.C. Botanical Garden, Biology Department, University of North Carolina, Chapel Hill, NC; [2] Division of Natural Heritage, Virginia Dept. of Conservation and Recreation

The Flora of Virginia was published in late 2012. It represents an example of a new flora for the 21st century, yet rooted in the many-centuries tradition of floras. Features include: full descriptions of all taxa (with necessary technical terminology but avoiding as much jargon as possible), keys to families and genera emphasizing readily visible vegetative characters as much as practicable, extensive citation of scientific literature (providing access to the user into the detailed basis for taxonomic decisions), state-specific habitat and distribution information (useful for conservation practitioners), introductory chapters on the botanical history, habitats, and 50 sites for productive field botany of Virginia, and new diagnostic and beautiful line drawings of almost half the species in Virginia.

18 **Karl C. Fetter**

Biogeography of North American *Liriodendron*

University of North Carolina at Chapel Hill

The two extant species of *Liriodendron* found in Eastern China and Eastern North America represent only a fraction of the diversity that has existed in the genus globally and through time. Populations of *Liriodendron tulipifera* L. occur in North America that have unique genetic, morphological, and ecological traits. One such set of populations in Peninsular Florida may represent a lineage of trees that diverged in the recent past. Sequences from *trnL-trnF*, *tmK5'-matK*, *trnH-psbA*, and ITS resolve distinct genotypes from the Peninsular Florida populations. Geometric morphometric analysis of leaf shape and traditional morphometric analysis of flower shape differentiate the Peninsular Florida populations from the widespread coastal plain & piedmont/mountain populations. These data describe novel genotypes and phenotypes and may provide support for the description of a new species of North American *Liriodendron*.

19 **Alexandra Permar, Alan S. Weakley**

Biogeographical Assessment of Vascular Plant Endemic Centers in the Eastern US

Ecology, University of North Carolina at Chapel Hill, Chapel Hill, NC

Centers of endemism are geographic areas characterized by local taxa uniquely adapted to a given set of ecological conditions, which may be both historical and contemporary in nature. A substantial amount of work has been conducted analyzing how best to delineate centers of endemism, and in understanding how best to correlate evolutionary-, historical-, and ecological factors with endemic taxa in attempts to decipher why certain taxa are endemic. For any given plant taxon a suite of variables including light, moisture, soils, geology, physiology, climate, and community interactions may explain its geographic distribution, whether broad or narrow in extent. Identifying what roles such aforementioned variables have in the evolution of endemic species can help us understand ecological conditions conducive to the adaptation and preservation of global flora and fauna. Currently we are compiling and analyzing a vascular plant distribution database (to the level of infraspecific taxa) for the Eastern US (EUS). We are using multi-county level thresholds (e.g. 30, 25, 20) to characterize the distributions of EUS endemic plant taxa. The information derived from the database analysis will be merged with geographic information to ascertain which plant taxa are distributed where, and identify which of those taxa are characterized by endemic-, disjunct-, and/or peripheral distributions. This analysis will aid in a biogeographical assessment of endemic plant distributions to understand the historical and ecological factors that may explain present-day species distributions. Regional patterns of paleo- and neo-endemics have implications for the conservation of regional biota in an era of rapid climate change.

20 **Emma Levin-Nielsen, Ann Jackson, Gabrielle LaFata**

Comparison of plant height, leaf surface area, and leaf length to width ratio between two populations of *Aster prenanthoides* in Upshur County, WV

Department of Biology, West Virginia Wesleyan College, Buckhannon, WV

Variation in vegetative characteristics can be seen within the same species of plants when they grow under different environmental conditions. We compared two populations of *Aster prenanthoides* approximately 23 miles apart in Upshur County, WV. The more northern population was at Stonecoal Lake Wildlife Management Area imbedded in mixed grasses and herbs in an open swale by the roadside. The second population was located southwest of Rock Cave, 1.1 miles northeast from WV Route 4 on Straight Fork Road. Also with no direct canopy layer, plants were on an abrupt northern edge of Straight Fork Creek beside a community of mixed grasses and herbs. On the south side of the creek was a steep, north-facing, wooded slope that blocked direct sunlight for large portions of the day. Thirty individuals from each population were randomly selected by dividing the population area into thirty equal sections, and taking measurements from one plant in each section. Mean leaf surface

area, estimated by length X width, was significantly greater at Straight Fork. Mean leaf length/width ratio was significantly greater at Stonecoal, indicating longer, skinnier leaves there compared to those from Straight Fork. Mean plant height at the Stonecoal population was less than or equal to height at the Straight Fork population. The greater leaf surface area at Straight Fork could be beneficial to absorb more light from an environment with less direct sunlight exposure. Other possible adaptive benefits will be discussed.

21 **Peter Wilfahrt**

Regeneration of a North Carolina piedmont woodland 15 years after Hurricane Fran

Curriculum the Environment and Ecology, University of North Carolina, Chapel Hill, NC

Wind disturbance can cause major and rapid changes in the structure and diversity of forest vegetation due to significant loss of basal area and canopy cover and a resulting influx of resources. The North Carolina Botanical Garden established 82 permanent 0.1 hectare vegetation plots inventorying all species and the DBH of woody stems in forested uplands that have been free of human disturbance since at least the 1930s. In September of 1996 the eye of Hurricane Fran passed seven kilometers east of the study area, causing severe wind damage. Nineteen of these plots were resampled in the summers of 1997, 1998, and 2011. Plots experienced an average basal area loss of 14.2% and were categorized as damaged if they experienced more than a 5% loss of their basal area. Damaged plots experienced a significant increase in overall species richness in 1997, while undamaged plots showed no change. This signal was still present in the 1998 species survey but species richness had returned to the pre-hurricane values of the 1990 survey by 2011, fifteen years after the hurricane. Basal area in the damaged plots decreased by an average of 24.8% in 1997, and was back to pre-hurricane levels in the 2011 survey. Meanwhile, undamaged plots showed an average increase of 15.5% in basal area from 1990 to 2011. Additionally, damaged plots from 1997 to 2011 showed an increase in basal area of 36.1%, while undamaged plots showed an increase of 11.5%.

22 **Alexander K. Anning, Brian C. McCarthy**

Competition, size and age affect tree growth response to fuel reduction treatments in mixed-oak forests of southeastern Ohio

Department of Environmental and Plant Biology, Ohio University

Restoration methods, such as prescribed fire and thinning, can be efficiently calibrated by a detailed knowledge of residual tree growth in relation to size, age and competition. However, despite growing interest in tree growth responses to these methods, the underlying effects of size, age and competition are poorly documented. Here, we examine the influence of these factors on the growth of 348 trees (DBH ≥ 25 cm), comprising five species (*Quercus alba, Q. prinus, Q. velutina, Carya spp., Liriodendron tulipifera*), using a dendrochronological approach. Samples were collected from 80 0.1-ha plots distributed across four treatment units (control, thin, burn, thin+burn) in the hardwood forests of southeastern Ohio. Analysis of covariance indicated a positive relationship between basal area increment (BAI) and size across all treatments, with the strongest correlation found for the burn-only treatment. Age and competition varied negatively with BAI, but the degree of correlation between competition and BAI was highest for the thin-only unit. Larger trees were more sensitive than moderately sized trees in their growth responses to crowding. Multiple regression analysis showed that the three variables together explained 36.83% of the variance in BAI. This value increased to 38.80-57.39% when data were analyzed separately for species, suggesting significant variations in species responses to the treatments. Competition appeared to be more important than size and age for BAI response to the treatments. Our results indicate that fuel reduction treatments influence forest growth and development partly by creating heterogeneity among stands with respect to tree size and competitive status.

23 **Kelly A. Anderson[1], Laura A. Zahn[2], Sarah Lundin-Schiller[2], L. Dwayne Estes[1]**

A Morphological Investigation of the [*Andropogon gerardii*] (Poaceae) Complex using Confocal and Scanning Electron Microscopy

[1] Center of Excellence for Field Biology, Austin Peay State University, Clarksville, TN; [2] Department of Biology, Austin Peay State University, Clarksville, TN

CANCELLED

24 **Casey Carpenter, Tim Gaudin, Thomas Wilson, Joey Shaw**

Phylogeography of short-tailed shrews (genus *Blarina*) of southeast Tennessee

Department of Biological & Environmental Sciences, University of Tennessee at Chattanooga, Chattanooga, TN

Shrews of the genus *Blarina* are among the most common small mammals of the southeastern United States. Two species are found in the area surrounding Chattanooga, TN: *Blarina brevicauda*, the northern short-tailed shrew and *Blarina carolinensis*, the southern short-tailed shrew. In an effort to clarify geographic ranges of the two species in southeast Tennessee, *Blarina* vouchers were collected throughout the study area and mitochondrial DNA cytochrome *b* genes were isolated and sequenced. Specifically DNA data from 3-9 samples from 13 separate populations were collected throughout southeast Tennessee and southwest North Carolina. These sequences were then compared to Genbank data and phylogenetic relationships were determined among the samples. A molecular clock was also estimated using fossil data in conjunction with BEAST. We compared our 53 samples to 101 more widely geographically spaced samples obtained from Genbank. Results indicate *Blarina brevicauda* is found in areas north and west of the Tennessee River and *Blarina carolinensis* is found in most areas south and east of the Tennessee River. *B. brevicauda* specimens from the study were monophyletic and resolved with Genbank sequence data into haplotypes classified as either 'Appalachian' or 'East-Central' by previous publications. *B. carolinensis* specimens were monophyletic, and more similar to *B. carolinensis* from Arkansas, Illinois and Louisiana rather than those from Georgia, Florida and Virginia.Haplotype distributions seem to be influenced by the great physiographic variation in the region.

25 **Lauren E. Bizzari, Brian C. McCarthy**

A large-scale experimental assessment of growth and survival of American chestnut and reforestation efforts across the central Appalachian range

Department of Environmental and Plant Biology, Ohio University, Athens, OH

In the last century, coal surface mining and decimation of the American chestnut (*Castanea dentata*) by chestnut blight (*Cryphonectria parasitica*) have heavily impacted many forests in the Appalachian Region. Reforestation of former mined lands is a new priority in this region. Concurrently, mined lands are under consideration as potential reintroduction sites for blight-resistant chestnut hybrids when they become available. The American Chestnut Foundation (TACF) and the Appalachian Regional Reforestation Initiative (ARRI) initiated a project in 2008 to field-test the growth and survival ability of chestnuts on reclaimed mine lands. Five chestnut taxa (*C. dentata*, *C. mollissima* (Chinese chestnut), and three putatively blight-resistant backcrossed hybrids) were planted as seeds on reclaimed mine lands in six Appalachian states. Results from the first two years of growth indicated little to no difference among the five taxa, though we expected growth might diverge over longer time periods. We revisited four states in 2012 to assess chestnut growth and survival after five growing seasons, as well as site characteristics (e.g., soil properties, vegetation cover). Though Chinese chestnuts had significantly higher five-year survival (64%) than target hybrids and American chestnuts (40%), total height did not differ among chestnut taxa. However, site was very important with the best mean growth occurring in KY (173.4 cm) and TN (142.4 cm). Plantings in OH (49.3 cm) and PA (76.9, 69.7 cm) had the lowest mean growth, but highest total vegetation cover. Identification of site characteristics favorable to chestnut growth will facilitate reforestation and the successful reintroduction of this species.

26 **Laura M. Boggess, Eric R. Purdy, Mike, D. Madritch, Gary L. Walker**

Cliff community composition and modeling: an approach for climbing management

Department of Biology, Appalachian State University, Boone, NC

Many rare or endemic species exist on cliff faces around the world, but most cliff ecosystems remain unexplored by biologists and little is known about plant community dynamics on cliffs. There is a growing concern that biodiversity on cliffs may be threatened by impacts from recreational rock climbing. The Big South Fork National River and Recreation Area (BISO) on the Cumberland Plateau spanning Tennessee and Kentucky, boasts one of the richest floras in the southeastern United States. The area is also a rock-climbing destination which is likely to grow in popularity in the coming years. This study characterizes the vegetative communities of fourteen cliff systems within the recreation area to determine what factors, including rock climbing, may influence the structure of vegetational communities. Preliminary results indicate that cliff aspect influences vascular plant and lichen community composition, while slope is the most important factor in determining richness and diversity of bryophytes. Based on these results we have created an ecological model to predict cliff vegetation patterns. Additionally, the model includes parameters to predict cliffs that may be attractive to rock climbers. This model will provide a tool to aid park managers in determining where climbing may pose a threat to rare or significant vegetation and where it could be permitted with limited potential impact on rare species. With the increasing popularity of rock climbing, understanding plant community dynamics on cliff faces, such as the Big South Fork, is increasingly important for developing sound management practices.

27 **Lea Abel, David Vandermast**

Assessment of Invasive Plant Species Threat on Elon University Forest

Department of Biology, Elon University, Elon, NC

In the United States, invasive species are known to reduce biodiversity and affect human health; they also cost the United States billions of dollars per year. Since invasive species are constantly moving into and influencing new environments, more information and research is needed about their spread. Elon University Forest (EUF) was a productive farm until the mid-1960s when the remaining agricultural land was abandoned to return to forest. Like many farms in the Piedmont of North Carolina, EUF contains an old wood lot that was never clearcut and has features consistent with those of old-growth forests. We call these "forests of continuity". We used transects and 8 pre-established Carolina Vegetation Survey (CVS)-style permanent plots, to survey EUF for invasive plant species. Each invasive species was assigned a cover value that corresponds to a cover percentage range. Our surveys identified 24 different invasive plant species in EUF, including many of the common species typically found in Piedmont forests: Japanese honeysuckle (*Lonicera japonica*), Chinese privet (*Ligustrum sinense*), and Japanese stiltgrass (*Microstegium vimineum*). Interestingly, the plots within the forest of continuity contained significantly fewer invasive species with a significantly reduced cover compared to invasive species richness and cover in younger forests. Japanese honeysuckle was the most common and widespread invasive species in EUF while Chinese privet and Japanese stiltgrass grew densely in mesic habitats. Our results indicate that forests of continuity throughout the Piedmont region may be less invasible than younger forests, possibly because of the dominance of existing vegetation.

28 **Matthew J. Heard[1], Dov F. Sax[2]**

Long-Term Coexistence Between Native and Exotic Plant Species is Facilitated by Trade-Offs in Biotic Interactions

[1] Department of Biology, Winthrop University, Rock Hill, SC; [2] Department of Ecology & Evolutionary Biology, Brown University, Providence, RI

Plant invasions are increasing worldwide and most communities now contain at least one and often numerous exotic species. As a result, it has become increasingly common to find coexistence occurring between native and exotic plants over decades or even centuries. In spite of the commonness of long-term coexistence between

natives and exotics, the mechanisms facilitating this remain largely unresolved. Trade-offs or asymmetric differences in functioning among species can facilitate coexistence and may provide a potential explanation for the long-term coexistence between native and exotic plants in historically invaded communities. One common difference exhibited by native and exotic species is a trade-off in competitive ability and herbivore susceptibility, as exotic species are often competitively dominant, but more severely impacted by herbivores. Here we experimentally examined whether these differences exist between native and exotic plants in a community invaded for over 200 years and whether removing competitors or herbivores influences coexistence. Our findings show that native and exotic plants exhibit pronounced differences as exotics were competitively superior to natives, but exhibited greater susceptibility to damage from herbivores. In addition, we also found that herbivore removal mediated the outcome of competitive interactions, increased exotic dominance, and effectively removed coexistence across our field sites. Collectively, these findings suggest that trade-offs in biotic interactions may facilitate coexistence in these historically invaded communities. However, they also suggest that trade-offs between coexisting species may not be entirely reciprocal and that herbivory on exotic species may be the key factor regulating coexistence.

29 **Kate Lyn Sheehan, Ron J. Johnson, Greg K. Yarrow**

Intestinal Parasites of Double-crested Cormorants Culled in the Eastern United States

School of Agricultural, Forest, and Environmental Sciences, Clemson University, Clemson, SC

Parasite assemblages of waterbirds represent the diversity of intermediate hosts utilized by definitive hosts at local, landscape, and migratory scale when infections persist through time. A larger variety of parasites can indicate a definitive host has encountered a large diversity of habitat, intermediate host assemblages, or foraging locations. A commonality of parasites might suggest similarities among intermediate host assemblages (extensive ranges of intermediate hosts), a lack of host specificity, and/or persistent infection that continues after migration and inundation with new infection. Here we document the parasites of Double-crested Cormorants (*Phalacrocorax auritus*) from over one dozen nesting and wintering colonies. We document trends in parasite distribution and discuss the trophic interactions that could lead to the patterns in distribution that we observed.

30 **Stephen C. Landers[1], Al Nichols[2], Nathan K. Barron[1], Craig A. Schimmer[1], Mark D. Schneider[1], Justin C. McDonald[1], Paul M. Stewart[1], Steve Ramroop[3]**

Meiofauna and heavy metals from Gulf of Mexico sampling in 2012

[1] Department of Biological and Environmental Sciences, Troy University; [2] Department of Physical and Earth Sciences, Jacksonville State University; [3] Department of Mathematics and Geomatics, Troy University

Meiofauna and sediment samples were collected in October and November 2012 from the edge of the continental shelf in the northern Gulf of Mexico. Samples (52) were collected on NOAA ship Gordon Gunter from depths of 49-361 m with an average of 120 m. Average temperature and salinity were 20.1 degrees C and 35.6 ppt. Two focus areas are currently being examined, near the Deepwater Horizon Oil Spill location and the area east of the DeSoto Canyon off the coast of Florida. Meiofauna abundances and heavy metal analysis (particularly nickel and vanadium) from select sites will be presented along with statistical analysis of the data. This research was made possible by a grant from BP/The Gulf of Mexico Research Initiative.

31 **Todd A. Egerton[1], Katherine C. Filippino[2], William Hunley[3], Harold G. Marshall[1]**

Storms, river flow and algal blooms in Virginia tidal tributaries.

[1] Department of Biological Sciences, Old Dominion University, Norfolk, VA; [2] Department of Ocean, Earth and Atmospheric Sciences, Old Dominion University, Norfolk, VA;[3] Hampton Roads Sanitation District, Virginia Beach, VA

Phytoplankton abundance and composition change in response to numerous environmental variables. Algal blooms can form when a phytoplankton species is able to take advantage of a particular set of conditions, and quickly grow in numbers to become dominant in the algal community. In estuaries, the main source of nitrogen and phosphorus is often from terrestrial runoff, leading to a positive correlation between precipitation, nutrient inputs, and algal growth. Seasonal algal blooms, including those of potentially harmful dinoflagellate taxa occur in Chesapeake Bay and its tidal tributaries following precipitation events, although the exact mechanisms remain unknown. During 2011 and 2012, weekly algal densities and species composition were monitored in the James River, Virginia, along with meteorological and water quality data to better understand the factors involved in bloom initiation, development, transport, and subsidence. The region experienced significant blooms of a variety of dinoflagellates, most notably spring blooms of *Heterocapsa triquetra*, and summer/autumn blooms of *Cochlodinium polykrikoides* and *Alexandrium monilatum*. Chlorophyll mapping and microscopic species identifications indicated that the *C. polykrikoides* bloom appeared to initiate within the Lafayette River and reach maximum densities in the polyhaline waters near the mouth of the James. Tropical storms during occurring in 2011 had a disruptive effect on the autumn blooms of that year, but combined with record warm winter temperatures may have contributed to the increased intensity, spatial coverage, and duration of algal blooms observed in 2012. This work was supported by Virginia Department of Environmental Quality.

32 **Timothy Wynn, Arthur Benke**

Habitat-specific production of a southeastern river shoal snail assemblage

Department of Biological Sciences, The University of Alabama, Tuscaloosa, AL

CANCELLED

33 **Mark Meade[1], David White[1], Greg Scull[2], Megan Cordle[1], Lindsay White[1]**

Fishes of the Choccolocco creek watershed in NE Alabama.

[1] Department of Biology, Jacksonville State University, Jacksonville, AL; [2] USFW Warm Springs Hatchery, Warm Springs, GA

Choccolocco Creek, a subwatershed of the Coosa River system, supports a diverse assemblage of aquatic animals including many threatened and endangered species. The watershed is routinely surveyed (every 5-10 yr) and assemblage data is used by conservation managers to assess system health. Sites surveyed in this study included USGS biological monitoring stations along Choccolocco creek as well as many tributaries within the watershed. Many sites were surveyed based on potential habitat for imperiled endemic species such as the Holiday darter, *Etheostoma brevirostrum*, the Coldwater darter, *Etheostoma ditrema*, the Blue shiner, *Cyprinella caerulea*, and the flame chub, *Hemitremia flammea*. Creeks surveyed included Blue Eye, Blue Spring Branch, Choccolocco, Cheaha, Chinch, Coldwater, Cottaquilla, Cathy's, Dry, Egoniaga, Hillabee, Jones Branch, Joseph creek, King's Gap Branch, Little Shoal, Poorhouse Branch, Rocky Branch, Salt, Scarbrough, Shoal, and Snow. USGS protocols for ichthyofaunal sampling were followed and an Index of Biological Integrity, or IBI, was calculated for each site. In general, IBI scores for the sites in forested and/or rural areas in the upper Choccolocco watershed were higher than sites in the middle and lower areas where urbanization dramatically impacts assemblages. Habitat in the upper sites was plentiful providing habitat for numerous species of darters and minnow. The predominance of pool habitat in the lower sites reduced the numbers of darters and minnows observed. Centrarchidae and other gamefishes dominated the lower sites. Although no site on the watershed scored "excellent", patchy populations of imperiled species continue to persist and presently appear stable.

34 **Lindsay White, Mark Meade, David White**

Occurrence of the Asiatic weatherfish, *Misgurnus anguillicaudatus*, in Northeast Alabama.

Department of Biology, Jacksonville State University, Jacksonville, AL

The Asiatic weatherfish, *Misgurnus anguillicaudatus* (Cantor, 1842), is an exotic species that has been reported in native US watersheds since the 1960s. Aquarium trade, use for food by Asian immigrants, and use as baitfish have all been suggested as the means by which the species was introduced to the US. Weatherfish are a hardy species and can tolerate low oxygen, drought, and starvation. In recent years the species has been observed in numerous watersheds in the Southeast. Weatherfish were reported in Alabama in 2009 when an apparent "established" population was observed in Poorhouse branch near Goray Spring. Poorhouse branch is a tributary of the Coosa River and is located near Choccolocco creek, one of the more biodiverse subwatersheds of the Coosa River. In fall of 2012, while conducting fish surveys on Choccolocco creek and its tributaries, Asiatic weatherfish were observed in Blue Eye spring near Blue Eye creek, another Coosa River tributary. A subsequent re-survey of Poorhouse branch in 2012 also revealed weatherfish. In total, six individuals were collected from the Poorhouse Branch; eight individuals were collected from Blue Eye Spring. Numerous weatherfish were observed but escaped capture. Due to the overwhelming biodiversity of aquatic life in the Southeast, many environmentalists are concerned with potential competition and impact that weatherfish may have on native species. Poorhouse branch sustains populations of the Coldwater darter, *Etheostoma ditrema*, a rare darter species. Many suggest weatherfish may directly compete with native darter species, reducing aquatic insect populations that native species rely on for food.

35 **Kristen K. Cecala[1], Steven J. Price[2], Michael E. Dorcas[1]**

Modeling the Effects of Life-History Traits on Estimation of Population Parameters for a Cryptic Stream Species

[1] Department of Biology, Davidson College, Davidson, NC; [2] Department of Forestry, University of Kentucky, Lexington, KY

Estimating demographic values and rates for populations of cryptic stream species frequently is difficult because of prohibitively low capture probabilities. When assessing cryptic populations, researchers often are forced to make simplifying assumptions that could alter their conclusions about a population. We constructed models based on different assumptions about cohort structure, behavioral responses to capture, temporary emigration, and survival in a cryptic, larval population of red salamanders (*Pseudotriton ruber*) and fitted models to capture-mark-recapture data. Overall, models based on two cohorts were favored over models based on one cohort. Models based on assumptions of constan survival, behavioral responses to capture, and random temporary emigration were ranked higher than models lacking these assumptions. Consistent behavioral responses to capture demonstrated that using uncorrected counts to assess trends for this, and perhaps other larval amphibians, yields misleading results. Counts that are not corrected for trap-shy behavior may inherently show negative trends. Temporary emigration was a critical assumption when describing larval salamander demography because only 27% of the larvae were active on the surface (the rest were in substratum habitats). Our study demonstrates the importance of making appropriate assumptions about demographic parameters and shows how population models can quantify aspects of the natural history of cryptic species.

36 **Jose Orlay Castano, Mark Andrew Schlueter**

Can North American Bioassessment Methods Using Macroinvertebrates for Water Quality Analysis Be Used in Central and South America?

Georgia Gwinnett College, Lawrenceville, GA

Rapid water quality assessment methods are constantly being redesigned to meet the demand for water management worldwide. Bioassessment surveys protect freshwater habitats by raising public awareness of water quality, and provide baseline data that may be needed for future habitat restoration. This study examined the effectiveness of typical North American bioassessment surveys using macroinvertebrates to evaluate water quality in Central and South America. In this survey, specific water

quality indicators gathered from biological, physical, and chemical results were combined to grade 26 streams and rivers in Georgia-USA, Costa Rica, and Buenaventura-Colombia. Each site was sampled for macroinvertebrates using D-nets and seines in 3 riffle and 3 pool areas per site. The chemical and physical analysis examined stream-water for: pH, dissolved oxygen, nitrate, phosphate, copper, mercury, turbidity, and water-flow. The investigation found that water quality was negatively associated with human activity (urban vs. suburban vs. rural sites). Costa Rican rainforest streams had significant decaying material, which reduced macroinvertebrate abundances and dissolved oxygen levels (2.23ppm). Caddisflies (Trichoptera) and mayflies (Ephemeroptera) were abundant in all three countries, while fishflies (Megalopera) were present at lower numbers. Sensitive macroinvertebrate species, indicators of excellent water quality, such as stoneflies (Plecoptera) and riffle beetles (Coleoptera) were present in all three countries. The study's data was used to categorize new macroinvertebrate groups not present in North America, such as shrimp, into the tolerant macroinvertebrate group. Bioassessment surveys using macroinvertebrates were found to be a low cost and reliable method for water quality assessment in Central and South America.

37 **Andrea R. Benson, Joey Shaw, Jennifer N. Boyd**

Impact of large mammal herbivory on the federally threatened plant, *Scutellaria montana* Chapm. (large-flowered skullcap) at a military site, Catoosa County, Georgia

Department of Biological & Environmental Sciences, University of Tennessee at Chattanooga, Chattanooga, TN

Scutellaria montana Chapm. (large-flowered skullcap) is a federally listed perennial herb with a large population in the Tennessee Army National Guard Volunteer Training Site (VTS), Catoosa County, GA. To investigate the impact of large mammal herbivory on *S. montana* there, we implemented a field experiment consisting of five herbivore exclosure treatments: small and large herbivores exclosed, large herbivores exclosed, open exclosure frames, flat PVC squares, and non-exclosed controls. Results from the 2012 study season indicated that number of leaves per individual decreased across all treatments, while stem height decreased for individuals in all treatments except the non-exclosed controls, which had a negligible change. Compared to control individuals, plants protected from herbivores did not experience a significant mean stem height change, but plants accessible to herbivores through a PVC frame or square showed a significant decrease in mean stem height. Results suggested that browsing pressure was greater on individuals when white PVC pipe attracted herbivores to plants. At the population level, results indicated that herbivores showed a preference for juvenile plants because they browsed a greater proportion of juvenile than adult plants. Comparative results of 2011 vs. 2012 data suggested that a factor other than herbivory contributed to change in number of leaves, and that during 2012, the PVC pipe attracted herbivores to plants causing a significant decrease in stem height for plants in the blank exclosure treatment. Overall, results of this study suggested that the current herbivory level is not threatening the continued existence of *S. montana* at the VTS.

38 **J. Murray Hyde, Bijay B. Niraula, Jonathan M. Miller, Paul M. Stewart**

Detectability and Population Size Estimation of Two Threatened Mussel Species in the Choctawhatchee River Watershed

Department of Biological and Environmental Sciences, Troy University, Troy, AL

Two freshwater mussel species found in the Choctawhatchee River watershed were recently listed as federally threatened. Information regarding the populations of these species is needed to efficiently implement conservation strategies. The purpose of this study was to estimate the detectability (probability of capture) and population size of *Fusconaia burkei* and *Pleurobema strodeanum* at three sites. Three sites (BS, 8M1, and 8M2) from the Choctawhatchee River watershed were sampled eight times between June and October 2012 using a robust mark-recapture sampling design. Each primary sampling period (four) consisted of two days of sampling that occurred as close to each other as weather permitted (usually the next day). Mussels were tagged using Hallprint® glue-on shellfish tags and returned to the streambed. To estimate population parameters, a set of twelve candidate models were chosen *a priori*. Models were analyzed using the computer program MARK® and the most

parsimonious model for each site and species was selected based on Akaike's Information Criterion (AIC). These models were used to estimate detectability and population size of both species at each site. Detectability ranged from 0.06 to 0.51 for *P. strodeanum* and 0.17 to 0.90 for *F. burkei*. The average number of *F. burkei* was 0.34 m^{-1} at 8M1 and 2.06 m^{-1} at 8M2. The average number of *P. strodeanum* was 0.58 m^{-1} at 8M1, 4.8 m^{-1} at 8M2, and 0.40 m^{-1} at BS. These data provide information on detectability and population size of threatened mussel species at sites where these species were previously known to occur.

39 **Bijay B. Niraula, J. Murray Hyde, Jonathan M. Miller, Paul M. Stewart**

Analysis of simple physical microhabitat variables for three threatened freshwater mussels in the Choctawhatchee River watershed

Department of Biological and Environmental Sciences, Troy University, Troy, AL

Substrate and hydrological variables at the microhabitat level are factors that determine habitat suitability for freshwater mussels. This study determined microhabitat preferences for three threatened mussels *Pleurobema strodeanum*, *Fusconaia burkei*, *Hamiota australis*, and a common mussel *Elliptio pullata*. Three sites (BS, 8M1, and 8M2) were selected in the Choctawhatchee River watershed, and the exact location of each individual mussel found was marked with a color-coded flag so that depth, current velocity, and compaction could later be measured. The non-parametric Kruskal-Wallis test was used to determine differences in microhabitat variables among the mussel species. At BS, velocity ($p < 0.001$) and compaction ($p = 0.008$) were significantly different among *E. pullata*, *P. strodeanum*, and *H. australis*. Depth ($p < 0.001$), current velocity ($p < 0.001$), and compaction ($p = 0.001$) were all significantly different among *E. pullata*, *P. strodeanum*, and *F. burkei* at 8M1. At 8M2, depth ($p = 0.001$) and current velocity ($p = 0.004$) were significantly different among *E. pullata*, *P. strodeanum*, *F. burkei*, and *H. australis*. At all sites with significant habitat differences, *E. pullata* had the lowest microhabitat values. Results suggested that *E. pullata*, being a 'weed' species, survived lower values of microhabitat variables, while the more sensitive threatened species were limited to higher values. There is an urgent need for habitat management practices in the Choctawhatchee River watershed, such as control of agricultural and forestry practices, to prevent a continued decline in the threatened mussels.

40 **Andrew N. Morgan, Claudia L. Jolls**

Limited seed dormancy in a rare thistle of Great Lakes shorelines

Department of Biology, East Carolina University, Greenville, NC

Successful seed germination is a critical and often complicated event in plant life history, particularly for rare taxa. *Cirsium pitcheri* T. & G., Pitcher's thistle, Asteraceae, is an iconic member of the dunes and coastal shorelines of the upper Great Lakes, federally listed as threatened, primarily due to habitat destruction. This largely self-incompatible, monocarpic perennial lives for 2-12 years, flowers and then dies, and lacks vegetative forms of reproduction. Establishment of seeds from seedlings is the key for population viability and conservation of this taxon. We performed a laboratory study to determine how age of seeds, length of a moist chilling period (0-5 °C to simulate winter and spring) and nicking (to simulate abrasion of the fruit coat) affect germination. We exposed a total of 400 seeds of four age groups (collected in 1996, 2007, 2009 or 2011) to one of five chilling durations. Seeds then were either nicked or not, and germinated under a 30/15 °C, 15/9 hr thermo- and photoperiod. After 2 wk, we recorded emergence of the radicle. In general, seeds more than 3 yr old did not germinate. Seeds from 2009 and 2011 appeared equally likely to germinate. Nicking dramatically improved germinability (~84% of the 97 germinants had been nicked). Small sample sizes limit our inference; however, Pitcher's thistle does not appear to have any long-term seed dormancy. Given new threats, including several biocontrol weevil seed predators, successful seed set and establishment in the short term is vital for these populations.

41 **Kunsiri Chaw Grubbs**

Propagation of Schweinitz's sunflower, *Helianthus schweinitzii* T. & G. (Asteraceae)

Department of Biology, Winthrop University, Rock Hill, SC

The developments of a federally endangered Schweinitz's sunflower (*Helianthus schweinitzii*) inflorescence were observed and analyzed between August and October 2012. The researcher randomly collected the past-bloomed inflorescences and recorded the numbers of mature and abortive seeds. Number of mature seeds were somewhat varied among the inflorescences. Only full-grown seeds were reserved and used for further propagation purposes. The studies of the effect of seed age and the effect of cold stratification have been conducted. The results show that percent of seed germination from each treatment was very low and the seeds have grown slowly. Some of the treatments are under progress. In mid-November, 2012 the underground rhizomes were collected and kept at 5-8°C for 0, 30, and 60 days, after they reached their ages the rhizomes were transplanted to the potting soil and were kept in the greenhouse. None of the 0 day-old rhizomes formed new shoots; whereas 100% of the 30 days-old rhizomes developed new shoots as early as 10 days and become fully developed within 30 days. The results indicate that Schweinitz's sunflower propagate better by using its rhizome than seeds.

42 **Corey K. Kapolka[1], Cheryl R. Coon[2], Brian C. McCarthy[1]**

Effects of woody encroachment and restoration efforts on plant community composition of the remnant prairie 'Buffalo Beats,' in southeastern Ohio.

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The Buffalo Beats Research Natural Area of the Wayne National Forest (Athens County, OH) has long been of interest to botanists and ecologists due to its assemblage of prairie plant species that are rare in this region. Though small in size, the prairie boasts healthy populations of *Andropogon gerardii, Eryngium yuccifolium,* and *Gentiana alba,* among other species of interest. The results of previous studies indicated an encroachment upon the prairie by neighboring forest species, attributed to a lack of fire disturbance. In the mid-1980's, the US Forest Service initiated an active management plan to preserve the site and its rare species. Restoration methods have included a prescribed burn regime, girdling of trees, and physical and herbicidal elimination of saplings. Using previously published cover and frequency data, and new data, we examined the success of the applied restoration treatments in preserving the prairie community of Buffalo Beats and its species of high conservation value. Over several decades, species richness has increased in the prairie, from 22 observed species in 1962 to 39 in 1984 and 50 in 2012. This increase can be attributed primarily to the encroachment of native forest species into the prairie. Average percent cover and frequency of species of conservation interest has remained largely unchanged following the introduction of restoration treatments. Initial results suggest that prescribed burning and other restoration efforts at Buffalo Beats have been successful in preserving rare species populations, but encroachment by forest species continues.

43 **John Taggart**

Effects of white-tailed deer on the maritime forest of Bald Head Island, North Carolina

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White-tailed deer impacts on maritime evergreen forest vegetation were sampled on Bald Head Island, North Carolina. Twenty 10 m x 10 m paired exclosure and control plots were established in 2007 and sampled in 2011 within a 77.3-ha state protected area. Data analyses indicated that changes in density, diversity, or composition were not significant among understory species, particularly *Ilex vomitoria* Aiton and *Persea borbonia* (L.) Sprengel, available for browse. Herbs were sparse throughout while primary canopy species, *Quercus virginiana* P. Miller and *Q. hemisphaerica* Bartram ex Willdenow, showed little to no reproduction by seedlings or sprouts within the forest proper. Plot data, *Q. hemisphaerica* tree cores, observations of oak seedlings elsewhere on the island, and reviews of past site research and weather data suggested that oak recruitment occurred as a function of canopy openings related to major storm events. Deer appeared to use the forest area primarily for shelter and selectively grazed adjacent herb-dominated communities. Continuation of a 200-deer carrying capacity for the island was recommended.

44 **Jacquelyn C. Guzy[1], Steven J. Price[2], Michael E. Dorcas[1]**

The spatial configuration of greenspace affects semi-aquatic turtle occupancy and species richness in a suburban landscape

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Within urban areas, the importance of greenspaces for wildlife has been widely investigated for some animal groups, but reptiles have generally been neglected. To assess the importance of the amount, spatial distribution, and configuration of greenspaces (comprised of terrestrial and aquatic areas), we examined semi-aquatic turtle species richness in urbanized areas. In this study, we sampled turtles from 2010-2011 at 20 ponds, including farm (rural) ponds, ponds in urbanized environments, and golf course ponds. We used a hierarchical Bayesian species-richness model to estimate species richness and species-specific occupancy responses to three pond types (rural, golf, or urban) and four landscape measurements of greenspace (i.e., Euclidean nearest neighbor, interspersion juxtaposition, percent of landscape, and connectance), generated in FRAGSTATS. We found that probability of occupancy of four species, *Kinosternon subrubrum*, *Trachemys scripta*, *Chelydra serpentina*, and *Pseudemys concinna* increased substantially with an increase in connectance of greenspace within 500 m of each pond. When the model examining the configuration of greenspaces was analyzed, estimated species richness was greater at golf ponds as compared to either rural or urban ponds, and richness increased with increasing connectivity of greenspaces. Our results indicate that in suburban areas, golf courses can potentially support a greater diversity of semi-aquatic turtle species than rural or urban ponds and thus may be considered superior habitat in suburban environments. In addition, we suggest that maintaining connectivity of greenspaces in suburban areas is important for semi-aquatic turtles and should be considered in urban planning.

45 **M. Worth Pugh, Michael M. Gangloff, Lynn. M. Siefferman**

Physiochemical and landscape parameters influence the distribution of an imperiled salamander.

Department of Biology, Appalachian State University, Boone, NC

Eastern hellbenders (*Cryptobranchus alleganiensis alleganiensis*) are giant salamanders endemic to Eastern and Central North America. Recent data suggest that hellbenders have exhibited significant declines in both distribution and abundance across much of their former range. Hellbenders are frequently associated with high-quality streams as alteration of habitat parameters is presumed to impact size and viability of populations. However, quantitative data linking declines to habitat and land-use changes are uncommon. We examined hellbender abundance and physiochemical habitat parameters at 20 sites in the Watauga River Drainage of Western NC and used GIS software to quantify upstream land-use at the catchment scale for all site localities. We found that sites with hellbenders had significantly lower percentages of fine substrates (ie. sand and silt) and NO_x^- concentrations than sites where hellbenders were absent. At the landscape scale, forest cover was significantlyhigher at hellbender-present compared to hellbender-absent localities and all sites with hellbenders had >80% forested catchments. These data suggest that land-use and its resulting effects on habitat conditions may be a key factorlimiting hellbender distributions in the Watauga and other high-quality drainages.

46 **Ryan Dorkoski, Jared L. DeForest**

The consequences of acid rain deposition on fine-root biomass in temperate deciduous forest soils in southeastern Ohio

Department of Environmental and Plant Biology, Ohio University, Athens, OH

Soil acidification due to acid rain deposition has been shown to decrease bioavailable soil phosphorus (P). Plants invest a significant amount of carbon (C) gained from primary production to both fine-root and mycorrhizal association to, among other things, acquire P. When inorganic nutrients are readily available, there should be less need to maintain expensive mycorrhizal association, and the nutrient-acquiring enzymes they produce. It is still unclear how below-ground C allocation will respond to changes in bioavailable P. Exactly how does available P affect fine-root biomass and microbial enzyme activity? I hypothesized that under low P conditions plants allocate more C to fine-roots than when bioavailable P is high; once P demand is

satiated, C investment into fine-roots and mycorrhizal association should be reduced. For the same reasons, phosphatase activity should be decreased when bioavailable P is high when compared to ambient conditions. The hypothesis was tested on field manipulations of levels of bioavailable P on acidic temperate deciduous forest soils in southeastern Ohio (n=9).Fine-root biomass was 26% (P=0.03) lower in elevated P plots when compared to ambient. Further, phosphatase activity was 48% (P<0.01) lower In elevated P when compared to ambient. This implies that when inorganic P is available, essential nutrient demand can be met without mycorrhizal support. This also suggests that similar to nitrogen, P availability influences theallocation of C to fine-roots. Therefore, implications of acid rain deposition may include a tradeoff between increased allocation of below-ground C at the expense of decreased above-ground growth.

47 **JohnRyan A. Polascik, David R. Brown, Tanner M. Morris**

Using Vegetation and Landscape Analysis to Validate a Wetland Rapid Assessment Method for Kentucky's Forested Riparian Wetlands

Department of Biological Sciences, Eastern Kentucky University, Richmond, KY

Within the past few decades, Rapid Assessment Methods (RAMs) have been employed as a quick and qualitative approach to determine ecological integrity across various ecosystems. In terms of total wetland loss, Kentucky is among the nation's highest with losses exceeding 80%. Of those wetlands remaining, the vast majority are forested floodplains. Kentucky is currently in the process of developing a Kentucky Wetland Rapid Assessment Method (KYWRAM) to be used in regulatory processes and scientific research. The goal of this project was to begin a validation of the KYWRAM by quantifying vegetation communities and landscape intensity along a wetland disturbance gradient. This study was conducted within the Green River and Upper Cumberland River basins of Kentucky. Sites were selected randomly and sampled between 23 May and 26 September, 2012 (n = 20). At each site, a Vegetation Index of Biotic Integrity (VIBI) and KYWRAM were conducted. A Landscape Development Intensity Index (LDI) was also used to calculate landscape disturbance for each site using the 2005 National Land Cover Dataset in ArcGIS v 10. Both indicators show similar relationships to the KYWRAM, although total scores from the VIBI and LogLDI were not strongly correlated (R^2 = 0.153 and R^2 = 0.1, respectively). However, the VIBI and LogLDI did show a stronger, significant correlation (R^2 = 0.219, P < 0.05). Since all three methods are in relatively early stages of development and application in Kentucky, future research will focus on sampling more sites; refining our approach and testing which variables best explain wetland disturbance.

48 **Eric Duncan[1], Mario Geraldo[2], Paula Jackson[1]**

Use of the Granier Thermal Dissipation Probe (TDP) method to gain insight into species specific water use in a mature mixed tree stand in Northwestern Atlanta, GA.

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Our study looked at water use in three tree species (*Pinus taeda, Liquidambar styraciflua,* and *Quercus coccinea*) in a mixed pine oak forest stand in Northwestern Atlanta on the Kennesaw State University campus, Georgia. Sap flow of individual trees was measured utilizing the Granier (TDP) method (Dynamax Probe 12 system) over the 2012 growing season. The intent of the study was to gain insight into variation in sap flow at the tree level, among trees of the same species, and among species, and the level of association of sap flow with atmospheric conditions registered with a local weather station (DynamaxMetpak Pro weather station). Preliminary data indicated strong differences in sap flow among seasons and individuals, with vapor pressure deficit (VPD) as a main contributor to sap flow on most days. When water was not a limiting factor, all species showed a similar and high correlation between sap flow and VPD, also inter tree variation in sap flow for individuals of a species had a similar range to variation among species. When water was limiting, the relationship between VPD and sap-flow was less clear for *Pinus* and *Quercus*. The pattern of water use observed for these two species has implications for stand level evapotranspiration estimates based on assumed VPD correlations in areas where water may be a limiting factor. Data from this study will serve as a

starting point towards more accurately scaling up from trees to species and modeling mixed stand water use.

49 **M.H. Schaus[1], M.J. Catalano[2]**

Shifts in size structure alter nutrient release by a population of omnivorous fish

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Body size can have important consequences for physiological factors, such as feeding, respiration, and nutrient excretion. Thus, the size structure of a fish population can greatly impact its role in lake nutrient cycles. We examined how shifts in body size impacted phosphorus cycling by gizzard shad in a central Florida lake that had recently undergone a size selective fish harvest. We combined a size structured stock assessment model with excretion prediction coefficients derived from previous studies to determine how shifts in population size distribution can impact nutrient cycling. Comparisons of hypothetical populations dominated by age-1 (mean mass 65g) vs. age-5 (mean mass 720g) fish indicated that an equivalent biomass of smaller fish excreted more than twice as much P as the population dominated by larger fish. The experimental harvest in Lake Dora removed approximately 70% of the harvestable (>28 cm TL) biomass, reducing the total population biomass by ~33% and shifting the population toward dominance by smaller size classes. However, phosphorus excretion only decreased by ~20% during the harvest because smaller sizes excrete more P per gram. During the 3 years following the harvest, biomass averaged 8% below the pre-harvest average, but phosphorus release returned to near the baseline average in ~1 year. Sensitivity analyses indicated that the model was most sensitive to variations in mass, recruitment and von Bertalanffy growth parameters. Our results indicate that size shifts that accompany many biomanipulation efforts may offset some of the reductions in internal nutrient cycling.

50 **Elizabeth M. Hillard, Laura E. DeWald**

Elk (*Cervus elaphus*) habitat use in Great Smoky Mountains National Park

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Evaluating how the established herd of elk (*Cervus elaphus*) is using forested areas in Great Smoky Mountains National Park is important for the health/management of the elk and the protection of the diverse flora within the park. We assessed habitat selection and use along with forest type preference of the elk population. Elk trails were mapped, fecal pellet density was used to estimate elk densities, and habitat variables (soil bulk density, vegetative cover, understory and overstory traits) were measured in areas of differing elk densities to determine if there were relationships between elk densities, forest type, and habitat. Results indicate significant differences in elk densities among forest types ($p < 0.05$) when proportions were compared to forest type availability. Early successional, oak-hickory, northern hardwood, and high elevation oak forests had greater densities than expected while floodplain and hemlock forests had lower densities, and montane-cove and pine forests had elk densities in proportion to their availability. In addition, elk densities were significantly greater in forested areas that were closer to open fields and areas of human disturbance ($p < 0.01$). These strong patterns of selection suggest elk habitat use dependent upon forest structures that provide or are spatially contiguous to food, cover, and space. Results will be used for the development of long-term vegetation monitoring to improve management of elk habitat in the park.

51 **Scott Kim, Nick Ragsdale**

Role of PMK-1 Immune Pathway in *Caenorhabditis elegans* Infected with *Acinetobacer baumannii*

Department of Biology, Belmont University, Nashville, TN

Acinetobacer baumannii is an opportunistic pathogen in humans that is known for its innate antibiotic resistance.By using the model organism *Caenorhabditis elegans*, this study aims to find the importance of the PMK-1 pathway in defending against *A. baumannii*. In this study, wild-type (N-2), AU1, and AU3 mutant strains of *C. elegans* were used. The AU1 and AU3 were *nsy-1* and *sek-1* knockouts, respectively. Previous studies have shown that these strains lack vital components of the PMK-1 pathway cascade, which renders these strains immunocompromised. The N-2 strains were unaffected by the presence of *A. baumannii*. However, the AU1 and AU3 strains

showed signs of death either due to *A. baumannii* infection or due to physical problems.

52 **Anderson Webb, Nick Ragsdale**

The effects of pathogenic *Acinetobacter baumannii* on mortality of the host model *Caenorhabditis elegans*.

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Acinetobacter baumannii is a gram-negative bacteria that infects immuno-compromised organisms. The Ced-1 receptor has been shown to influence the immune systems response to bacteria, specifically gram-positive bacteria. *Caenorhabditis elegans* missing the Ced-1 receptor were infected with *A. baumannii* to see if the Ced-1 receptor played a role in the immune response for this particular gram-negative bacteria. It was found that the Ced-1 receptor is not necessary for surviving infection from *A. baumannii*.

53 **Linda A. Major, Roger Sauterer**

Histone Effect on Membrane Permeabilization of Plant Mitochondria

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The genome is continuously exposed agents that can damage the DNA which activates the DNA damage response to either repair the DNA or induce apoptosis. During the early DNA damage response the chromatin compaction around the damage site is relaxed through specific core Histone modifications and by displacement of linker Histone H1. The specific core Histone modifications target the p53 tumor suppressor protein that leads to the activation of the mitochondrial apoptosis pathway. In animal cells, displaced H1 and other Histone proteins enter the cytoplasm and bind to mitochondria, leading to the permeabilization of the inner and outer membrane of the mitochondria. This event triggers the release of a set of pro-apoptotic proteins, including cytochrome *c*, from the mitochondrial intermembrane space to the cytosol where they activate caspases and endonucleases that initiates apoptosis.I propose to determine if Histone proteins can bind specifically to mitochondria and chloroplasts and induce mitochondrial membrane permeabilization in planst as is the case in animals. The approach I intend to use will isolate, purify and test for viable mitochondria, viable chloroplasts, and extant Histone proteins from the plant nuclear extracts. Once this is accomplished, I will add a Histone-enriched fraction to the purified mitochondria, incubate, centrifuge and examine by Western Blotting against Histone proteins to evaluate if the Histone proteins bind specifically to these organelles. To determine if mitochondrial permeabilization occurred, I will use immunoblotting to detect if cytochrome *c* is in the supernatant of the treated mitochondria and not in the control mitochondria.

54 **Thomas G. Huff, Michael J. Bruno**

***Bacillus subtilis* Membrane and Lipid Raft Composition Dependence on Growth Conditions and DOXP Synthase Inhibition**

Department of Chemistry, Guilford College, Greensboro, NC

The lipid composition of the *B. subtilis* membrane varies significantly with growth condition and phase. The conditions of the culture environment may also effect the composition of lipid rafts in *B. subtilis*. Lipid rafts, normally studied in eukaryotes, are typically associated with higher levels of cholesterol or other steroids. As *B. subtilis* has no mechanism for producing cholesterol, it is significant that evidence for *B. subtilis* lipid rafts has been show. Nystatin and surfactin induced biofilm formation is dependent on the phosphorylation of Spo0A by histidine kinase KinC, a membrane protein. Inhibition of squalene synthase YisP with zaragozic acid inhibits biofilm formation, and inhibition of DOXP synthase with clomazone has an identical effect. To understand what causes the failure of lipid microdomain formation and delocalization of KinC in *B. subtilis*, we focus on profiling the qualitative variations of lipid classes present in detergent resistant membranes and their dependence on growth environment and DOXP inhibition. We use thin-layer chromatography and gas chromatography-mass spectrometry to associate specific lipid profiles with various pressures on *B. subtilis*.

55 **J.M. Ross[1], H.H. Doyle[1], B.D. Picou[1], J. Schulz[1], C. Tavares[1], S. Bryant[1], A.K. Helton[2], B.L. Dawson[1], S.A. Lloyd[1], R.A. Shanks[2]**

Adolescent exposure to psychostimulants cross-sensitizes adults to methamphetamine with a drug and sex specific effect

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Behavioral sensitization, which is a hallmark of addiction, is indicative of enduring alterations that result from previous drug exposures. The current study explores the effect of psychostimulants, including d-amphetamine, methylphenidate, methamphetamine, and cocaine, on cross-sensitization to another drug of abuse, methamphetamine, using a consistent dosing and testing protocol. Each of these psychomotor stimulants enhances synaptic dopamine concentrations, but does so with distinct mechanisms of action. Cocaine and methylphenidate inhibit the reuptake of dopamine by blocking the dopamine transporter while methamphetamine and amphetamine increase the amount of dopamine released into the synapse. Male and female C57Bl6/J mice were exposed to one of the psychostimulants or saline during adolescence (P22-32) followed by a washout period without drug exposure (>8 weeks). After reaching adulthood, mice were challenged with a subacute dose of methamphetamine or saline and tested in an open-field chamber to assess changes in locomotor activity as a result of DAergic pathway alterations. Mice exposed to a stimulant preexposure and methamphetamine challenge exhibited higher total activity than their controls in a drug-specific fashion. Additionally, locomotor activity was altered differently in males and females within drug conditions. Males were more susceptible to amphetamine-induced activity changes while females were more susceptible to methylphenidate-induced changes. These results suggest that adolescent exposure to psychostimulants during the critical developmental window have a lasting neurobehavioral effect into adulthood. The novel drug and sex-specific alterations in locomotion have clinical implications and warrant further investigation to elucidate the molecular mechanisms underlying the observed changes.

56 **Manuella Cotton, Matthew Harlan, Dwayne Wise**

Behavior of centromere- kinetochore fragments during mitosis without chromosomes

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In Chinese hamster ovary (CHO) cells treated with hydroxyurea and caffeine, cells arrested at the beginning of S-phase are forced into an unscheduled mitosis. This treatment produces dividing cells in which unreplicated chromatids are fragmented and detached from their single kinetochores. In spite of these deficiencies, cells so treated build a normal mitotic spindle to which kinetochore fragments attach and are distributed during anaphase. We have examined these cells using immunofluorescence staining and confocal microscopy to assay attachment of kinetochore fragments to spindle microtubules and their orientation and segregation behavior. In spite of the fact that most kinetochore fragments are mal-oriented, little evidence of mis-segregation of kinetochore fragments can be found. In this paper we detail our latest results with regard to presence or absence of known kinetochore proteins and those involved in obedience of the cell to cell cycle checkpoints. So far, it appears that most kinetochore proteins are present in these cells. This indicates that chromosomes themselves are not necessary for proper orientation and segregation on the mitotic spindle. A notable exception is the unusual behavior of a mitotic motor molecule (CENP-E) necessary for anaphase B (spindle elongation). We discuss the implications of these findings for the control of proper mitotic distribution of chromosomes and the avoidance of aneuploidy in somatic cells.

57 **Jimmy K. Triplett[1], Brian R. Ingram[1], Jesse W. Jamison[1], Jami L. Atchley[1], Heather M. Scott[2], Lynde L. Nanson[2], Monica Trifas[2], Janice L. Case[2]**

When evolutionary paths cross again ... and again! Hybridization, polyploidy, and speciation in bamboos and other grasses

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Bamboos (Poaceae: Bambusoideae) encompass over 1400 species worldwide and represent the single major grass lineage to diversify in association with forest habitats. Recent phylogenetic evidence suggests that modern day bamboos are the products of hybridization and genome doubling (polyploidy) events that predate the origins of major taxonomic lineages, including the tropical, temperate and herbaceous bamboo clades. Combined analyses of nuclear and chloroplast DNA sequence data suggest that bamboo ancestors experienced several episodes of hybridization and polyploidy, resulting in independent origins of allopolyploid lineages. Subsequent speciation occurred at the polyploid level to produce a diversity of new taxa. Moreover, new species have been produced by ongoing hybridization among allopolyploids. Thus, bamboos present a model system in which polyploid speciation has been "caught in the act." Similar phylogenetic networks have been discovered in other grasses, including *Panicum*, *Oryza*, and *Spartina*. This new evidence, combined with previous phylogenetic studies using chloroplast DNA and AFLP data, reveals that hybridization and polyploidy have had important and recurrent roles in the evolution of the bamboos and may represent a relatively common phenomenon in grasses.

58 **Amelia P. Harris, J. Hill Craddock, Joey Shaw**

A flora of Bendabout Farm, Bradley County, Tennessee and survey of native *Castanea dentata* (Marsh) Borkh. (Fagaceae, American Chestnut)

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Bendabout Farm is a 1,467 ha privately-owned farm in Bradley County, Tennessee that lies in the Southern Ridge and Valley physiographic province. Floristics of the Ridge and Valley region and Bradley County are comparatively understudied and the botanical body of knowledge is small. The human population in Bradley County has grown steadily over the past two decades, which inevitably leads to increased development and destruction of natural habitats. This is especially important when considering rare and threatened species. The primary goal of this study was to inventory the flora of Bendabout Farm in order to enhance the existing body of botanical knowledge of Bradley County. A second goal was to develop a better understanding of the population and distribution of Special Concern Species *Castanea dentata* (Marsh)Borkh. within the study area by conducting a census. Both natural/semi-natural and altered habitats were described in the initial habitat assessment of the study area. Natural habitats include Allegheny-Cumberland Dry Oak Forest, Appalachian Riparian Systems, and wetlands. Altered habitats include managed pine plantation, pasture, and agricultural fields. Thirty-two collection trips were made from June 2010 until October 2012. The study recorded 425 species from 261 genera in 106 families. This study documented 246 new records for Bradley County. One other Special Concern Species, *Panax quinquefolius* L. was vouchered, as were 45 non-native species. *C. dentata* were censused in the dry oak forest. Three hundred thirty hectares were surveyed and 180 *C. dentata* were documented using the sweep census method.

59 **L. Dwayne Estes[1], C. Theo Witsell[2], Mason Brock[1], Kelly A. Anderson[1]**

Riverscour communities of eastern unglaciated United States: floristics, community classification, and biogeography

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Southeastern U.S. riverscour communities are rare, insular, small-patch or linear communities associated with rocky, high-gradient, flood-scoured riparian zones of streams that originate in mountainous uplands or plateaus. Examples are known from the Interior Highlands, Interior Low Plateau, Appalachian Plateaus, Ridge and Valley, Blue Ridge, and Piedmont Plateau Physiographic Provinces. The intense flooding associated with these stream systems, which can exceed 150,000 cfs in some systems, inhibits tree growth in favor of perennial grasses, herbs, and low shrubs. Due to their grassy nature they are often referred to as riverscour prairies. In spite of intense flood-related disturbance, these communities are probably quite stable over long-periods of time due to their bedrock, cobble, or cobble/boulder substrate that is not as dynamic as gravel/sand bars, communities that mostly support annual and often weedy species. This long-term stability makes them ideal refugia for rare plants,

many of which are narrowly endemic or disjunct from other provinces. Riverscour communities across the Southeast are also known to harbor at least half-a-dozen undescribed species. Many riverscour communities have been severely altered or destroyed by river impoundment and reservoir creation. Modern threats include runoff from mining activities and invasive species. This presentation is the first in what we anticipate to be a series on the floristics and vegetation of these little-studied communities. Our objectives were to (1) identify river systems supporting riverscour vegetation, (2) identify different types of riverscour communities, (3) compile existing information about their flora, vegetation, rare species, endemics, undescribed taxa, and (4) summarize their biogeographic affinities.

60 **George P. Johnson**

***Yucca* (Asparagaceae) in Arkansas**

Biological Sciences, Arkansas Tech University, Russellville, AR

Yucca (Asparagaceae) is a genus of rosette shrubs and small trees of North America and the Carribean. Although typically thought of as plants of the American and Mexican deserts, yuccas are widely distributed in the western, eastern and southeastern United States. While the genus is easily recognized by a suite of vegetative and reproductive characters, identification to species is often problematic, especially from herbarium specimens, both in Arkansas and beyond. Variability in species may be both from intrinsic (heteroblastic, ecophenic) and extrinsic (hybridization, introgression) sources that cloud species boundaries. Herbarium, field and common garden studies indicate that four species occur in the state outside of cultivation; two native (*Y. arkansana* Trel., *Y. louisianensis* Trel.) and two naturalized (*Y. filamentosa* L., *Y. flaccida* Haw.). *Yucca arkansana* is widely distributed in northern and western Arkansas, and is a plant of rock outcrops, dry hillsides and prairie remnants. *Yucca louisianensis* has a more restricted distribution in the state, and is mostly found in the sandhills region of southern and southwestern Arkansas. Of our two non-native taxa, *Y. flaccida* is the most commonly naturalized; both *Y. flaccida* and *Y. filamentosa* occur sporadically over the state and occur in areas where cultivation is not apparent. To increase the likelihood of successful identification, collections should be made from flowering and fruiting plants and digital photos of whole plants and flowers (including pistils), and fruits, should be included with traditional pressed specimens.

61 **Sabrina D. Setaro[1], Juan Pablo Suárez[2], Paulo Herrera[2], Darí Cruz[2], Ingrid Kottke[2]**

Coexisting Ericaceae and Orchidaceae are associated with different guilds of mycorrhizal Sebacinales (Basidiomycetes) in a neotropical mountain rain forest

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Sebacinales have repeatedly been shown to be important mycorrhizal fungi of diverse plant families such as Ericaceae and Orchidaceae. Structurally, mycorrhizae involving Sebacinales are distinct, with specific structures largely depending on the individual plant family. In Orchidaceae, Sebacinales form typical orchid mycorrhizae, whereas in Ericaceae, they produce various distinct structures, which correlate with the phylogenetic position of the host plant.Previous phylogenetic analyses revealed that Sebacinales associated with Ericaceae and autotrophic Orchidaceae belong to the same subclade of Sebacinales (clade B). Many plant species associated with Sebacinales occur in the same habitats. It has been questioned whether these plants share a common pool of mycobionts or whether they are associated with different Sebacinales guilds of clade B. This paper presents a study of Sebacinales associated with Ericaceae and Orchidaceae, which coexist in two different habitats in a tropical mountain rain forest in southern Ecuador: pristine forest and regenerating landslides. We used transmission electron microscopy in combination with DNA sequencing to identify the mycorrhizal fungi from environmental root samples. In addition to phylogenetic analyses, we analyzed our dataset with UniFrac, a tool for comparison of microbial communities using phylogenetic information. Transmission electron microscopy confirmed the presence of Sebacinales in mycorrhizae of Orchidaceae and Ericaceae, and also indicated their unique mycorrhizal structures. Phylogenetic relationships resulted in separate well-supported clades of Sebacinales associated

with Ericaceae and Orchidaceae. Phylogenetic cluster analyses reveal the occurrence of different Sebacinales guilds in Ericaceae and Orchidaceae.

62 **Katharine B. Gregg[1], Larry Klotz[2]**

The Flora of Beavers' Meadow, Barbour County, WV, Revisited after 25 Years

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Since the early 1980s Beavers' Meadow in Barbour County, WV, has been well known for large populations of the orchids *Cleistes bifaria* and *Platanthera ciliaris*. Eight taxa of special concern in West Virginia were present at that time: *Andropogon glomeratus* var. *glomeratus, Athyrium filix-femina* subsp. *angustum, Cleistes bifaria, Rhynchospora recognita Sericocarpus linifolius, Scleria triglomerata, Spiranthes tuberosa,* and *Xyris torta*. We present a description of the 7.6-hectare meadow today, an inventory of its current species, and some comparisons to the flora as it was reported 25 years ago. Collections were first made in June 2007; parallel transects approximately every 3-5 m were walked once each in May and June 2009, twice monthly in July through September 2009, and once each in May and June 2010. Additional specimens were collected in June 2011. We identified 296 vascular plant taxa in 180 genera and 63 families. Of the eight species of concern 25 years ago, only *S. tuberosa* was not observed between 2007 and 2011. Non-native taxa numbered 54 (18.4% of the flora), 12 of which have been reported as invasive in WV. Seasonal wetness of much of the meadow and annual mowing from the early 1950's through 2003, which resumed again in 2009, have probably played major roles in preserving and maintaining a diverse flora.

63 **C. Theo Witsell, Thomas L. Foti, Brent T. Baker**

Floristic inventory of native grassland remnants in the grand prairie region of Arkansas: a baseline for restoration efforts

Arkansas Natural Heritage Commission, Little Rock, AR

The Grand Prairie Region of the Mississippi Alluvial Plain in east-central Arkansas covers approximately 900,000 acres, of which approximately 400,000 acres were open grassland at the time of Euro-American settlement. This stands in stark contrast to the surrounding Mississippi Alluvial Plain, which was covered primarily by bottomland hardwood forests. The region is now largely converted to agricultural production and ecological processes that occurred historically (e.g. fire and seasonal flooding) are impaired. Approximately 450 acres of unplowed prairie remain in widely scattered remnants of varying quality, a loss of nearly 99.9%, making this one of the most highly degraded ecosystems in North America. Despite knowledge of the area by botanists for nearly two centuries, no intensive floristic inventory of prairie remnants in the Grand Prairie has ever been undertaken. The current work was conducted from 2000-2012 and relied on extensive field work as well as inventory of specimens in state and regional herbaria. The authors' collections focused on protected prairie remnants in the area but also covered selected roadsides, ditches, and other areas where native prairie and marsh flora have persisted. More than 600 taxa of vascular plants were documented from remnant prairies and associated woodlands and wetlands in the region. This total includes 75 non-native taxa and 30 taxa of state conservation concern. These data provide the best available baseline for ecological restoration work in the region. A summary of this research will be presented along with an overview of the flora, geomorphology, and ecology of the region.

64 **C. Theo Witsell, Brent T. Baker, Cindy Osborne**

The significance of cliff and talus communities as habitats for rare plant species in the interior highlands of Arkansas

Arkansas Natural Heritage Commission, Little Rock, AR

Cliff and talus communities in Arkansas are known to support a large number of state and globally significant plant species of conservation concern, yet no systematic analysis of these habitats and of the rare species they support has been conducted. Cliff and talus habitats in the Interior Highlands (the Ozark Plateau, Arkansas Valley, and Ouachita Mountains) are typically associated with medium- to large-sized streams, but also occur in association with faults and other geologic contacts. These

habitats have been heavily impacted by inundation following the construction of several large reservoirs on many of the larger stream systems, most notably the White River system in the Ozark Plateau, and the Ouachita River system in the Ouachita Mountains. However, remaining habitat still supports rare species. An analysis of the flora of conservation concern in these communities will be presented in terms of ecoregion, geologic substrate, ecological gradient (mesic to xeric), and physical site characteristics such as slope and aspect. Several of the plants of conservation concern in these habitats are endemic to the Interior Highlands and others represent significant range disjunctions. Biogeographical patterns of these rare species present will also be discussed. Important endemic plant taxa found on bluffs in the region include *Amorpha ouachitensis*, *Claytonia ozarkensis*, *Dirca decipiens*, *Elymus churchii*, *Elymus glaucus* ssp. *mackenzii*, *Heuchera villosa* var. *arkansana*, *Houstonia ouachitana*, *Liatris compacta*, *Quercus acerifolia*, *Solidago ouachitensis*, *Streptanthus maculatus* ssp. *obtusifolius*, *Streptanthus squamiformis*, *Tradescantia ozarkana*,and *Valerianella ozarkana*. Appropriate management of these sites will be discussed.

65 **W. Michael Dennis[1], Joey Shaw[2]**

Taxonomy of *Clematis* subgenus *Viorna* and speciation is subsection *Viornae*.

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Clematis subg. *Viorna* (Ranunculaceae) is largely a North American taxon with only three species of this subgenus from temperate Eurasia. Most taxonomists recognize subg. *Viorna*; however, infrageneric classification has been dubious and largely based on habit (viny or erect). The *Viornae* subsection of the genus *Clematis* includes perennial vines having thick-sepaled, urn-shaped flowers arranged in solitary or few-flowered cymes borne on axillary peduncles subtended by leafy bracts. The subsection has been studied by Erikson (1943) and Dennis (1976). Dennis took a conservative approach and recognized eight taxa. In the last 30 plus years three additional taxa have been described based on various floral and leaf characters. Many of the taxa are endemic or locally restricted to areas of special geologic formations known for their endemism. A series of studies are being conducted to address the question of speciation in this subsection particularly as to what should constitute a species; and when and how did these species differentiate especially in the areas of high endemism.

66 **Joey Shaw[1], Meredith Montgomery[1], Casey Carpenter[1], W. Michael Dennis[2]**

A preliminary phylogeny of *Clematis* subg. *Viorna* (Ranunculaceae): toward the understanding of the complex biogeographic patterns of this taxon

[1] University of Tennessee at Chattanooga; [2] Breedlove, Dennis Associates Inc.

Clematis (Ranunculaceae) consists of about 300 species worldwide and 32 native or naturalized species were recognized in the *Flora of North America*. The genus is highly diverse with respect to floral and vegetative characters and a relatively longstanding classification for this genus divides the species up into three easily separable subgenera (subg. *Atragene*, *Clematis*, *Viticella*, and *Viorna*) that have also been treated as genera. The focus of our research is on subg. *Viorna* because this subgenus is the largest and its taxonomy is still uncertain. Erikson's (1943) classification for this subgenus largely divided species based on habit, i.e., he placed most of the viny species into section *Euviornae* and most of the erect species into section *Integrifoliae*. To clarify species relationships and test Erikson's subgeneric classification scheme we have employed DNA sequences from a suite of chloroplast gene regions, nuclear ribosomal ITS, and a low-copy nuclear *G3pdh* gene. Preliminary results indicate that habit is not a good character for sectional classification as the viney and erect habits are scattered across the phylogeny. In the end, infrageneric classification of this subgenus needs to be reevaluated. However, beyond testing hypotheses of classification, this subgenus contains a large number of relatively rare narrow endemic species, disjunct populations of species, species that are widespread from the eastern USA to Texas yet absent in the Mississippi embayment and we are more focused on generating a data set to illuminate the underlying causes of these complex biogeographic patterns.

67 **Kyle A. Palmquist**

Species frequency patterns in the longleaf pine (*Pinus palustris* Mill.) ecosystem: characterizing the identity and dynamics of infrequent plant species

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The core-satellite species hypothesis (Hanski 1982) separates species into two groups based on abundance and distribution: core species, which are regionally common and locally abundant, and satellite species, which are regionally and locally rare. Here, I use two vascular plant data sets to show the core-satellite species hypothesis is not supported in the longleaf pine ecosystem. In other words, while the number of infrequent (satellite) species is extremely high (72% of species occur in <20% of plots), there are very few core species (only 2.7% of species occur in >80% of plots). This pattern remains constant when the spatial and temporal extent of sampling changes (e.g. across different sampling years and latitude) and when taxonomic resolution changes (e.g. species to genus). The identity of infrequent species spans many genera and families, but some of the most infrequent species include: *Asclepias*, *Dichanthelium*, and *Rhynchospora*. The three most frequent taxa across 858 vegetation plots were: *Pinus palustris* (frequency=90%), *Pityopsis graminifolia* (frequency=72%), and *Gaylussacia dumosa* (frequency=70%). I then quantified the dynamics of infrequent species over time and space using data from 31 permanent plots in NC. Annual temporal turnover was extremely high in longleaf pine communities, especially at small spatial scales (mean species gained=3.7, mean species lost=3.1 at 1m^2). The magnitude of these dynamics changed with environmental context, with greater turnover on mesic, silty sites than on xeric, sandy sites. The high temporal turnover of infrequent species may be one mechanism that allows for species coexistence in these species-rich grasslands.

68 **Frank S. Gilliam[1], Radim Hedl[2], Marketa Chudomelova[2]**

Variation in biotic linkages with slope aspect in a temperate hardwood forest

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Most studies of north- versus south-facing aspects of montane forests have focused on differences in overstory and herbaceous layer vegetation, with less emphasis placed on soil microbial communities. This study compared plant and soil microbial communities between north and south slopes in a second-growth hardwood forest of West Virginia. As expected, there were notable differences in both soil characteristics and biotic community composition between aspects. Moisture, organic matter, pH, extractable NO_3^-, and net nitrification were all significantly higher in north-aspect soils, whereas extractable NH_4^+ was significantly higher in south-aspect soils; net N mineralization was virtually identical between aspects. Nearly 30 tree and 150 herb layer species were encountered in the study, with the overstory dominated by sugar maple and white oak in north and south slopes, respectively. The herb layer of the north aspect was predominantly forbs, whereas graminoids dominated south slopes. Important microbial groups for north-slope soils were Gram +/– bacteria; south-slope soils were predominantly fungal groups. Using correlations of ordination axes of each biotic community, linkage was only detected between soil microbes and herb layer, and only on the south slope. We suggest that higher net radiation to south slopes has resulted in more weathered soils, selecting for microbial groups both adapted to—and maintaining—low N availability, with predominance of NO_3^- in more mesic north-slope soils and NH_4^+ in more weathered south-slope soils. Greater spatial heterogeneity in soil conditions in more weathered soils generates more pronounced environmental gradients to which soil microbes and herb species respond.

69 **Matthew S. Hansen[1], Roland P. Roberts[2]**

Urban and rural population structures of the invasive Tree-of-Heaven (*Ailanthus altissima*) along the eastern seaboard of the United States

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This study investigated the genetic structure of 716 individuals of *Ailanthus altissima* collected along two 1,000km transects between New Hampshire and North Carolina. Specifically, we assessed the extent of gene flow within and among populations of *A. altissima* found along Interstate 95 (I-95) and a parallel transect established 100km west of I-95. The study employed the use of nine neutral genetic markers to ascertain the degree of population admixture. Pairwise F_{ST} values ranged from 0.0079 to 0.096, with most comparisons (52%) exhibiting $F_{ST} < 0.050$. Thirteen comparisons exhibited $F_{ST} > 0.050$, these comparisons involved at least one rural population and six were between two rural populations. Pairwise Jost D_{est} values ranged from 0.040 to 0.38 and followed a similar pattern of distribution as F_{ST}. Bayesian analyses conducted with Structure and BAPS estimated fewer genetic clusters along the I-95 transect (two and one, respectively) compared to the rural transect (six and four, respectively). There was indication of significant isolation by distance among the I-95 (R^2= 0.13, p = 0.00010) and rural (R^2 = 0.086, p = 0.00020) populations based on Rousset's distance against geographic distance with regression slopes of 0.019 and 0.063, respectively. These different patterns of population structuring may be due to varying introduction histories or unequal levels of contemporary gene flow.

70 **Michael Held[1], Susan Jones-Held[2]**

Long – term forest changes in northeastern Pennsylvania

[1] Department of Biology, Saint Peter's University, Jersey City, NJ; [2] Department of Plant Biology and Pathology, Rutgers University, New Brunswick, NJ

The forest communities of northeastern Pennsylvania are diverse due to variation in climate, geologic history, soil types, and topography. This research specifically surveyed the forest communities of the Bear Creek region of southeastern Luzerne County, Pennsylvania. The purpose of this study was two – fold: (1) To document the current forest community composition and to compare the forests of today to the last known forest survey in this area completed by Donahue in the early 1950s, and (2) To propose explanations for the differences observed between the two survey periods. The upland forest community surveyed by Donahue was dominated by red maple (*Acer rubrum*) and oaks (*Quercus alba* and *Q. rubra*) with these three species accounting for 78.4% of all stems recorded. In contrast, the contemporary upland forest is now dominated by oaks (*Q. alba* and *Q. rubra*) with a subdominant layer composed of *A. saccharum*, *A. rubrum* and *Sassafras albidum*. In the lowland, wetter forest communities, *Tsuga canadensis* was the dominant species at both time periods; however, in the 1950's, *Fagus grandifolia* was an important subdominant species but by 2010 this species was not recorded in this forest type at Bear Creek. There has been a shift in the forests at Bear Creek in the six decades since Donahue's survey. In that time, beech bark disease was reported in Pennsylvania and deer browsing was noted as having a major impact on tree regeneration. We will discuss these factors in relation to our site – specific changes in these forest communities.

71 **Jessica Beard, Deborah Waller**

Dragonfly perch selection related to perch height and location.

Department of Biological Sciences, Old Dominion University, Norfolk, VA

A community of dragonflies (Odonata) was studied in July and August, 2011, at Hoffler Creek Wildlife Preserve, Portsmouth, VA. Male dragonflies patrol territories to secure food and mates and rest on perches. Two experiments were conducted with bamboo poles to study perch selection by adult males in relation to perch height and location, respectively. Four out of eight species present competed for the experimental perches (*Pachydiplex longipennis, Brachymesia gravia, Celithemis eponia, and Libellula needhami*). In the first experiment, two species used short perches (30cm) most frequently and two species used tall perches (90cm) over short perches. Perch height selection was not related to dragonfly size. Pole tops were preferred perching sites for all species but *L. needhami* frequently perched mid-pole. *Brachymesia gravida* was the dominant perching species in the beginning of the season and the least common species at the end of the season. In the second experiment, perches farther from shore (2m) were selected more frequently than

those closer to shore (0.5m), regardless of perch height. Time occupying perches was also analyzed for each species. Overall, species differences in perch height and seasonal use of perches could have implications in niche partitioning and competition among these species.

72 **Ray S. Williams, Peter W. Blum**

Insect pollinator visitation between genotypes of a dominant old-field plant species, *Solidago altissima*

Department of Biology, Appalachian State University, Boone, NC

Host plant choice by herbivorous insects has been investigated in many studies, with special attention given to effects of plant species diversity and phytochemical constituents important to insects. More recent investigations focus on the importance of genetic variation within species (intraspecific) as a feature of colonization by insects. Pollinators play a key role in ecosystems and have received less attention in the field of community genetics. This study reports on pollinator choice in *Solidago altissima* genotypes collected across landscapes. A common garden design, using plants of different genetic identity from different elevations, allowed us to determine the role of intraspecific variation on key pollinators in a dominant old-field plant. Pollinators were identified to the lowest taxa and observed for five minutes on sunny days in replicated $1m^2$ plots of 14 genotypes. Observation was standardized by observing plots with a minimum of 75% of plants in full bloom and by focusing on five inflorescences within a plot that were later harvested and dried. Flowers were collected for volatile terpene analysis. Previous studies at this site show little response of leaf nutritional constituents to genotype but large differences in defensive compounds like terpenoids. Within taxa, significant effects of genotype were found only in Hymenoptera. Total bees, insects in the genus *Bombus*, and all Hymenopterans combined showed clear preferences for certain genotypes. When all insects observed were considered, including beetles, flies and moths, similar responses to genotype were observed. Pollinator abundance expressed as per gram of inflorescence resulted in greater differences between genotypes.

73 **Jamil Ghazal, Frank A. Romano III, Lori R. Tolley-Jordan, Robert Carter**

The distribution of marine benthic meiofauna in the northern Gulf of Mexico

Department of Biology, Jacksonville State University, Jacksonville, AL

CANCELLED

74 **James E. Russell, Hui Peng, Heimy Rojas, Solomon Matovu, Erinah Mbabazi**

The effect of habitat disturbance on arthropod community biodiversity and the distribution of *Wolbachia* bacterial infection

School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA

The generally negative impact of habitat fragmentation on biological diversity (or biodiversity) is a well-studied phenomenon among the world's ecological communities of macro-organisms: the vertebrates, invertebrates, and plants. However, little is known about the effect of habitat disturbance on the communities of parasitic and infectious organisms that prey on these macro-organismal hosts. We have investigated the effect of habitat disturbance on arthropod community biodiversity and the distribution of *Wolbachia* bacterial infection. *Wolbachia pipientis* is a bacterial infection among arthropods and nematodes and is estimated to infect over 3 million species worldwide; making it, by some accounts, the most infectious microbe in the world (Zimmer 2001, Stahlhut et al. 2010). We found that biodiversity and the distribution of *Wolbachia* infection varied across scales of disturbance, though not in concert. We discuss the relevance of the observed patterns in terms of ecological community dynamics and the spread of infectious microbes like *Wolbachia*.

75 **Ashley B. Morris[1], Nicole Millsaps[1], Kelsi Mason[1], Jacquelyn S. Howell[2], James H. Speer[3]**

The beech gaps revisited: Determining reproductive strategy using nuclear microsatellite loci

[1] Department of Biology, Middle Tennessee State University, Murfreesboro, TN; [2] Department of Biology, University of South Alabama, Mobile, AL; [3] Department of Earth and Environmental Systems, Indiana State University, Terre Haute, IN

In the Southern Appalachians, American beech (*Fagus grandifolia*) is the dominant component of a unique forest community known as "beech gaps". These communities typically occur above 4500-5000 ft in elevation, and they are most distinctive where they occur as deciduous islands within a matrix of spruce-fir forests. Beech gaps are nearly monotypic, although associates may include buckeye, sugar maple, and yellow birch. These unique pocket communities have been hypothesized to be a consequence of clonal maintenance, although few studies have directly addressed this issue. Here we test the hypothesis that high-elevation beech gaps are more dependent on clonal reproduction than mid- or low-elevation beech forests in Great Smoky Mountains National Park. We genotyped 108 trees from six stands (two at each elevation) using seven nuclear microsatellite loci. Thirty-eight clones were defined using a two-step mutational threshold, with no genotypes shared across sites. One high-elevation site, Jenkins Knob, was monoclonal. One low-elevation site, Grassy Branch, was entirely sexual. All other sites exhibited a mixed strategy (both asexual and sexual reproduction), with a dependence on clonality. We conclude that elevation alone is not well-correlated with clonality in beech, and alternative hypotheses are discussed, and implications for forest management in the context of beech bark disease are considered.

76 **Caleb Matthews, Cindy Bennington**

Staying alive in the face of herbivory: Genetic variability and tradeoffs in defense traits of *Passiflora incarnata*

Department of Biology, Stetson University, DeLand, FL

Plants have evolved chemical, morphological and biological mechanisms to defend against attack by insect herbivores, with virtually all plants employing more than one strategy. *Passiflora incarnata,* a perennial vine native to the southeastern United States, employs a suite of traits to defend against both generalist and specialist (larvae of Heliconian butterflies) herbivores. We asked whether leaf area removal affects leaf thickness, trichome characteristics, extrafloral nectar (EFN) production and/or cyanide production and whether those traits vary among genotypes of *P. incarnata*. We also asked whether there were genetic tradeoffs among defense characters. In the summers of 2011 and 2012, we exposed clonal replicates of nine and six *P. incarnata* genotypes to herbivory and control treatments. We quantified specific leaf area, trichome density and length, EFN volume and solute concentration and volatile cyanide (CN) levels. We found that plants increased leaf thickness and EFN in response to herbivory, but that there was no inducibility of trichome characteristics or CN level. There were large differences among genotypes in their constitutive expression of all traits except EFN characteristics. In 2011, there was a negative genetic correlation between leaf thickness and EFN volume. There was no evidence for a tradeoff between either EFN trait and volatile CN production. Quantifying genetic variability in, and tradeoffs among, defense characteristics reveals ways in which a plant might optimize its overall defense strategy and allow us to make predictions about evolutionary response to the selective pressure of herbivory.

77 **Robert Hopkins II[1], Bradley Altier[2], Derek Haselman[1], Andrea Merry[2], Jacob White[2]**

Exploring the legacy effects of surface coal mining on stream chemistry

[1] Biology Program, University of Rio Grande, Rio Grande, OH; [2] Chemistry Program, University of Rio Grande, Rio Grande, OH

Surface coal mining results in dramatic alterations of the landscape in central Appalachia and is leading to a myriad of environmental problems. In this study, we explore the long-term effects of surface coal mining on stream chemistry and endeavor to gain a better understanding of the efficacy of reclamation efforts. We examined 30 sites in the Raccoon Creek watershed in southeastern Ohio, where the majority of surface mine sites are in various stages of reclamation. Our results show that conductivity ($r = 0.862$; $p = 0.000$), sulfate ($r = 0.619$; $p = 0.000$), and aluminum ($r = 0.469$; $p = 0.009$) levels increase linearly as a function of the areal extent of reclaimed mines in each subwatershed, suggesting a general failure of reclamation to restore natural stream chemistry. In contrast, pH was not significantly linearly correlated with the areal extent of surface mines. This suggests that local acid mine drainage remediation projects are able to regulate acidity levels in the watershed but

not conductivity and heavy metal concentrations. In many cases sites had conductivity levels high enough to impair aquatic biota via ionic and osmoregulatory stress. In sum, surface coal mining appears to have a strong legacy effect on stream chemistry in the Raccoon Creek watershed.

78 **Deborah K. Beutler**

The effects of using crushed limestone to treat acid mine drainage on the invertebrates in Morris Creek, Kanawha Co., WV.

Department of Biology, WVU Institute of Technology, Montgomery, WV

Crushed limestone (fines) is used to buffer streams against the effects of acid rain and acid mine drainage (AMD). After the failure of the AMD mitigation systems, 340 tons of fines were added over a 2 year period to Morris Creek in an attempt to mitigate the damage from AMD. Prior to the addition of fines, macroinvertebrates, particularly Ephemeroptera, Plecotera, and Trichoptera (EPT) taxa, were significantly more common upstream of the source of AMD than downstream. After the addition of fines upstream from the sample site, there was a decrease in macroinvertebrates upstream of the source. There was no significant change in the number of macroinvertebrates downstream of the AMD source. The site of the fines dump has been moved farther upstream of the sample site and we will continue to monitor the effects of the fines on macroinverterbrates.

79 **Erica R. Teasley[1], Alan P. Covich[1], Steve W. Golladay[2], Daniel G. Mead[3], Mark S. Blackmore[4]**

Humans impacting the disease landscape: mosquitoes and West Nile virus in southwestern Georgia wetlands

[1] Odum School of Ecology, University of Georgia, Athens, GA; [2] Joseph W. Jones Ecological Center, Newton, GA; [3] Department of Population Health, University of Georgia, Athens, GA; [4] Department of Biology, Valdosta State University, Valdosta, GA

Anthropogenic land use has many effects on the landscape including the habitat destruction/degradation which leads to the loss of biodiversity and increased transmission of disease. In southwestern Georgia, agriculture is one of the main anthropogenic land uses. Agriculture has impacted wetlands and made them potentially more suitable as larval mosquito habitat due to nutrient enrichment from fertilizer inputs, higher water temperatures, and altered hydrology. Few studies in the southeastern United States have examined the prevalence of mosquito-borne diseases in a rural landscape, focusing instead on urban areas. This study examined adult mosquito assemblages and arbovirus incidence in southwestern Georgia in four reference and five agricultural wetlands to determine 1) how agriculture affects adult mosquito populations; 2) how drought affects adult mosquito populations; and 3) if there is a difference in the incidence of WNV in reference and agriculturalwetlands. Mosquitoes were trapped from dusk to dawn weekly using CDC miniature light traps and CDC gravid traps. From June 2012 to November 2012, over 13,000 mosquitoes across all sites were trapped, with twice as many mosquitoes trappedin reference wetlands compared to agricultural wetlands. More *Culex* mosquitoes, important arbovirus vectors, were found in agricultural sites. Only one mosquito pool (1-25 individuals) in the reference wetlands tested WNV positive whereas 4 pools from agricultural wetlands tested WNV positive. This indicates that agricultural land use may increase the prevalence of arboviruses in agricultural areas.

80 **Charles E. Beard**

The unexploited habitat: Why are no trichomycete fungi in the mosquito midgut?

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The commensal zygomycotic fungi known as trichomycetes are common in the guts of aquatic Diptera. Mosquitoes often have trichomycetes in their hindguts but not in their midguts. We asked why are no trichomycetes found in mosquito midguts, whereas they are common in the midguts of black flies and midges. Midgut trichomycetes are not culturable; therefore, we have to use a host inoculum. We brought field-collected black fly hosts into the lab and allowed them to release *Harpella melusinae* spores from their midguts into water in jars. Mosquitoes were placed in this spore water and allowed to

feed. The ingested *Harpella melusinae* spores germinated and grew in the mosquitoes *Aedes albopictus* (prevalence up to 66%) and *Culex* sp., but not in *Aedes aegypti*. We interpret these results to indicate that the mosquitoes do not prevent ingestion or germination of the trichomycetes. Thus, environmental factors might be most important in determining colonization of the midgut.

81 **Neil Billington, Sirisha Bethala, Janet Gaston**

Population genetic structure in walleye

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Walleye (*Sander vitreus*) a predatory picivore commonly lives in fresh water and this species are largely associated with cool temperate climates in North America. This study examined genetic variation and population structure of 1214 walleye in 10 populations from the Midwest and Great Plains regions of North America. Attention was paid to assess stock structure to identify genetic markers that may be useful in walleye population management. Samples of liver and muscle tissue from walleye were screened at three polymorphic loci by protein electrophoresis. The percent polymorphic loci (P) 8.57% and mean heterozygosity (*H*) was 0.029. There was significant gene flow among walleye populations (*Nm* = 3.596) and moderate population subdivision was detected (F_{ST} = 0.065). Walleye showed highly significant among population heterogeneity; the heterogeneity chi-square value in walleye was χ^2 = 465.827, 42 df, p<0.001. Rogers' genetic distances showed that walleye populations were divided into two groups, with populations from Montana fitting into one group and the other populations into a second group; this may reflect the fact that Montana populations are not native but were stocked. Walleye should not be transferred among populations as it may cause stock admixture and possible loss of local adaptations. Information on genetic variation will be useful for the fisheries management of this species and of potential use in aquaculture development.

82 **Daniel Hoffman[1], Troy Mutchler[1], Mark McCarthy[2]**

Comparison of nitrogen transformation rates in vegetated and un-vegetated marine sediments of St. Joseph Bay, FL

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Estuarine and associated coastal ecosystems are highly productive and support diverse faunas of both ecological and economic significance. These ecosystems are susceptible to numerous anthropogenic stressors, particularly cultural eutrophication. Thorough characterization of this threat requires detailed understanding of the fate of nutrient inputs to determine the residence time within the system and identify metabolic pathways that govern system response to eutrophication. Bacterial nitrogen (N) transformations in the sediments likely drive the fate of N in seagrass systems, but estimates of N transformation rates within vegetated sediments rarely have been measured. To characterize these rates, sediment cores from vegetated (containing *Thalassia testudinum*) and un-vegetated sites in St. Joseph Bay, FL were collected and incubated in a continuous flow system. ^{15}N-labeled NO_3^- and NH_4^+ were added to the cores to track the fate of N in the cores. Samples from the inflow and outflow of the cores were collected and analyzed for nutrient concentrations and net N_2 fluxes via membrane inlet mass spectrometry. Initial results indicate low PO_4^{3-} concentrations throughout the experiment; however, time and treatment interacted to affect nutrient concentrations. PO_4^{3-} concentrations were higher in control cores than cores spiked with ^{15}N-labeled nitrogen sources. The rates of N transformations in vegetated and un-vegetated sediments will be examined to assess the role of seagrass on the fate of nitrogen in coastal systems.

83 **David Mason Brendle[1], Megan Chapman[2], Dennis C. Haney[1]**

Effects of different rural land covers on stream morphology and stream biotic integrity in the piedmont of South Carolina

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The overall health of a stream and its inhabitants is greatly affected by the surrounding watershed. Our project focused on the effects of pastured land on the health of streams and stream fishes in the Piedmont region of South Carolina. We

chose 26 different sites that varied in the percent of pastured or forested land cover in the streams drainage area. Sediment samples (for grain size analyses), along with incision and entrenchment measurements, were taken at each site over a 100 m stretch along our sampling transect. Fish were then sampled along this transect using a Smith-Root backpack electrofisher and seine, identified to species, and used to determine abundance and diversity of the fish population. Heavily pastured sites were significantly more incised, entrenched, and exhibited greater grain sizes than forested sites, with turbidity significantly less at these pastured sites (Kruskal-Wallis, $p < 0.01$). The overall health of the stream was determined using an Index of Biotic Integrity (IBI) that was significantly negatively correlated with percent pasture and with incision and entrenchment (Spearman's correlation, $\rho < 0.05$). Fish abundance (especially of benthic fish) and diversity were also lowest in pastured land covers. Thus, heavily pastured sites exhibited greater anthropogenically-derived problems than did more forested rural sites. We hypothesize that the large percentage of land covered by pasture has resulted in the loss of fine grain particles and erosion of the streams, resulting in lower levels of biotic integrity and habitat degradation.

84 **Chelsea Jacobs, David Vandermast**

Control of Kudzu (*Pueraria montana*) on Elon University Forest with seasonal shading techniques

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Kudzu (*Pueraria montana*) is an important invasive plant species in the southeastern United States, occupying approximately 3 million ha in the United States. In the United States $26.4 billion dollars are spent to control and remediate damage caused by introduced weeds. Even more economic damage can occur in attempting to eliminate Kudzu from residential locations by use of herbicides, which can cause damage to surrounding plants and cause further biological damage. These damages could be avoided by using non-chemical means to eradicate or reduce Kudzu. To determine if shading of Kudzu crowns would hinder growth, 30 Kudzu sprouts were clipped at ground level in May 2012 to see if shading would have an effect on the growth of the Kudzu population in Elon University Forest in the Town of Elon College, North Carolina. Ten root crowns were left unshaded and 20 were shaded with layers of black plastic for the rest of the summer. It was hypothesized that covered plants would have a decreased growth amount (cm) and decreased growth rate. Accumulation of regrowth from the clipped root crowns was significantly higher ($p<0.05$) in the unshaded group starting on June 21 (37 days after clipping). Regrowth of the unshaded root crowns was significantly higher on the last day of measurement ($p = 0.04$). Our results indicate that in areas where kudzu abundance is low, clipping and shading root crowns is an environmentally safe control method.

85 **James C. Haynes[1], Jeffery Duguay[2], Kim Marie Tolson[1]**

A management approach to nocturnal habitat of the American woodcock (*Scolopax minor*) in south-central Louisiana

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The American woodcock (*Scolopax minor*) is considered a popular game bird in eastern North America. Since the beginning of Singing-ground Surveys in the late 1960's, woodcock have experienced long-term (1968-2011) population declines on the breeding grounds. Wing collection surveys from hunters also show long-term declines. These population declines are believed to be largely due to habitat loss created by current agriculture and societal land practices creating a reduction in adequate early successional habitat. Low survival rates reported during the winter season may partially explain the long-term declines in woodcock populations. Suitable nocturnal habitat availability, not hunting mortality, is suspected to play the largest role in survivability of woodcock on wintering grounds. Nocturnal habitat selection of the woodcock on the wintering grounds was examined using four popular land management techniques: mowing, burning, disking, and a mow/burn combination. A total of 144 woodcock were captured from November 2011 to February 2012 with an additional 174 flushes recorded. Mowed and burned treatments were selected more frequently ($P < 0.008$) than mowed/burned and disked treatments, accounting for 84.3% of activity observed when considering all woodcock

captures and flushes. Mowed treatments were more frequently utilized by juvenile male woodcock than all other treatments ($P < 0.006$). The 2012-2013 field season is expected to conclude mid-February and final results will be included.

86 **Claire Stuyck[1], Ron Johnson[1], William Bridges[2]**

Swallow predation of fly pests around cattle: climate change asynchrony?

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Barn swallows, cattle, and various fly species have lived in close association for >2,000 years. Flies breed in manure and are harmful pests of cattle. Barn Swallows consume flies (~82% of nesting diet) and likely disturb fly activity. We investigated whether swallows might be enhanced to offer an additional tool to reduce fly impacts. Climate change, however, may differentially affect flies that respond largely to local temperature and swallows that migrate and respond to photoperiod. We used Barn Swallow nesting records, from citizen science databases, and growing degree-days (GDD) to predict swallow nesting in relation to fly emergence. We expected nesting to occur when sufficient flies are present as a food resource. If GDD indicate high fly populations prior to swallow nesting, then asynchrony between swallows and flies would be suspected. Proportional hazards analysis indicates that GDD (base 50F, January 1st accumulation) are a stronger indicator of when Barn Swallows nest (x^2 = 227.425, p<0.0001) than Julian days. The use of GDD provides a more precise tracking method of swallow nesting and comparisons with fly emergence over time.

87 **Krisha Faw[1], Duke Rankin[2]**

Creating a GIS model for prediction of restoration areas for the Georgia aster (*Symphyotrichum georgianum*)

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The Georgia aster (*Symphyotrichum georgianum)* is a rare plant species found mostly in the Piedmont of the Southeast and is a candidate for protection under the Endangered Species Act. Only 127 known populations are known to persist, with only 42% on public lands. Habitat was historically maintained by fire and, because of fire suppression and land conversion, is very rare. Recent observations estimate each population to contain less than 50 stems. Although there is GPS information on existing populations of Georgia aster, plus historical records of varying accuracy, identifying restoration areas is currently based on a best guess of appropriate locations. A well-defined GIS model based on available spatial layers (soil, elevation, etc.) and identification of potential restoration sites would add rigor to the restoration process. We used Maximum Entropy modeling in this study using presence-only data and spatial data for the state of Georgia. The program MaxEnt worked well with a small sample size and had low omission rates. After validating the results and conducting a sensitivity analysis, we used the MaxEnt information in ArcGIS to produce distribution maps. By using this approach, land managers will be provided with easy to use maps for field biologists, locations of potential restoration areas, and a ranking of suitable habitat.

88 **Patrick Sullins[1], Eva Gonzales[2], Zack Murrell[1]**

Are *Liatris helleri* and *L. turgida* the same species?

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Liatris helleri Porter (Asteraceae), a narrowly distributed endemic perennial and its more common congener, *L. turgida*, have been traditionally distinguished based on a single morphological character (pappus to corolla tube length), yet this character has been shown to be overlapping. Consequently, a broadened concept has been proposed by Nesom (2005) to include both species in the same taxon, potentially expanding the distribution and invalidating legal protections for *L. helleri*. Genetic information can often provide additional characters for taxonomic distinctions between two closely related taxa when morphological characters are ambiguous or overlapping. We sampled all nine known *L. helleri* populations and seven populations

of *L. turgida*, sequencing fourteen chloroplast DNA fragments (7281bp) in order to test the hypothesis that these species are genetically indistinguishable. Results show surprisingly high chloroplast haplotype diversity within both species and among populations, with several unique lineages apparent in each of the taxa. In addition, one haplotype is shared by both species. Phylogenetic analyses do not support a monophyletic relationship among *L. helleri* and *L. turgida* populations. Shared haplotypes and polyphyletic relationships can be explained by retention of ancestral polymorphism or by recent gene flow since speciation. These two routes are difficult to distinguish on the basis of genetic data. However, in light of the ecological distinctiveness and the geographical disjunction between these two taxa, shared ancestral polymorphisms and incomplete lineage sorting may be the more likely explanation for our data.

89 **Jacqueline R. Wagner, Zack E. Murrell**

Morphometric, Geographic, and Genetic Analyses of Dwarf Flowered Heartleaf (*Hexastylis naniflora*): A multidisciplinary approach to conservation and management

Department of Biology, Appalachian State University, Boone, NC

In conservation biology there is a need to determine the autecology of imperiled species in order to implement appropriate management efforts. *Hexastylis naniflora (Dwarf Flowered Heartleaf)* is a perennial evergreen, native to the Piedmont of North and South Carolina, that has been recognized as federally 'threatened' since 1989. Due to intraspecific plasticity and overlapping congeneric geographic ranges, differentiating *H. naniflora* from closely related species has proven problematic. In order to minimize adverse effects due to ongoing environmental changes and significant impacts from urbanization, it is vital to understand the geographic range of *H. naniflora* and distinguish it from co-occurring congeners and putative hybrid populations via morphological and molecular tools. We have created site suitability models and updated distribution maps. Morphological analyses included comparisons of leaf venation patterns and internal calyx ridges. These findings support anecdotal evidence of hybridization within the genus and aid in the identification of *Hexastylis* in a vegetative state. Measurements of calyx ridges provide quantitative support for previous qualitative observations. To develop quick and economical molecular tools for identification, we have developed microsatellite markers for *H.naniflora*. These markers, coupled with morphological characters, are generating a greater understanding of the genetic structure of this species. New molecular, morphological, and geographic tools will update Elemental Occurrence data, help USFWS in their re-assessment of the status of *H. naniflora* and save the NCDOT time and money when developing new highway projects in compliance with the Endangered Species Act.

90 **April P. Punsalan, Beverly Collins, Laura DeWald**

The germination ecology of *Helonias bullata* (swamp pink)

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Poor sexual recruitment is a major conservation concern for the federally threatened, obligate wetland species, *Helonias bullata* (swamp pink) L. *Helonias* predominately occurs in forested wetlands amongst hummock-hollow topography where extreme hydrological conditions can occur. This degree of patchiness creates a high level of unpredictability for seed landing, germination, and subsequent establishment. To determine what hydrological conditions seeds encounter during the dispersal phase promote the sexual regeneration of *Helonias*, germination responses were compared among seeds placed in flooded, saturated, and dry conditions in a controlled (floating, submerged, and dry) and natural (floating, submerged, stream margin, and dry) environment for various periods of time. Germination significantly decreased after exposure to dry conditions for five days and was completely eliminated after 30 days in controlled conditions. Lag time before germination increased with extended exposure to dry conditions in natural and controlled conditions. Final germination percentages and rates were high for seeds floating and submerged for 1-30 days in controlled and natural conditions. After 16-30 days in natural conditions, seeds floating on water, submerged underwater, and in the stream margin germinated while in treatment. Overall, *Helonias* seeds appear to have a short germination window (13-30 days) heavily dependent upon moisture availability for rapid germination.

91 **Angela H. Getz, Daniel Gaillard, Aaron Holbrook, Brian Kreiser, Carl Qualls**

Parentage in two populations of federally protected gopher tortoises, *Gopherus polyphemus*

Department of Biological Sciences, University of Southern Mississippi, Hattiesburg, MS

The gopher tortoise (*Gopherus polyphemus*), a terrestrial turtle native to the southeastern United States, has been greatly reduced from its historical range. Because of severe population declines and habitat fragmentation, gopher tortoise populations in the western portion of the species' range are listed as threatened under the Endangered Species Act. Success of gopher tortoise populations depends not only on the protection and persistence of adult tortoises, but also on the ability of those adults to produce successful offspring. Across the species' range, only two other paternity studies have been conducted on the mating systems of gopher tortoises, and far less is known about the mating systems of populations within the protected portion of the species' range. Small populations can become more susceptible to the effects of inbreeding, and mating between closely related individuals can have negative effects on fitness of offspring. We conducted a microsatellite-based parentage assessment to investigate the mating systems of two populations of gopher tortoises in south Mississippi. Adult tortoises from Hillsdale and Camp Shelby (T44) were collected along with clutches of eggs in the 2010 and 2011 nesting seasons. Hatchling and adult gopher tortoises were genotyped at 13 microsatellite loci. We present our findings on the patterns of parentage in these clutches and characteristics of successful reproducing adults in these populations.

92 **Melissa D. Caspary**

Using Spatial Analysis to Predict Habitat Threats and Rare Species Occurence in Granite Rock Outcrops

Georgia Gwinnett College, Lawrenceville, GA

The granite rock outcrops of the southeastern Piedmont host a unique plant community rich in endemic and rare flora. The center of these rock exposures lies within the developing reach of the Atlanta urban center and this close proximity poses a constant threat for the rock outcrop habitat and its associated flora and fauna. Landcover data, tree canopy data, and impervious surface data produced by the University of Georgia Natural Resources Spatial Analysis Laboratory was used to observe a thirty-three year snapshot of landcover change surrounding Georgia outcrops. A one km buffer was analyzed around outcrops and quarries in Georgia, to determine land use patterns, assess present habitat threats, and predict future development behavior. Predictive models of species geographic distributions were used to determine the key environmental variables that inform local and regional species patterns. These models were used to assess the relevance of patch size and distribution, habitat complexity, and population density for rare plant occurrence and outcrop occurrence. Landcover trends reveal increasing urban development and deforestation in all areas that were analyzed. Impervious surface surrounding rock outcrops significantly increased from 1991 to 2005. Latitude, longitude, elevation, and outcrop spatial complexity were predictors of rare plant occurrence whereas outcrop size or isolation were not reasonable predictors of rare species occurrence. These models may be applied to specific habitats to assist in identifying threats. These models suggest outcrop habitats that are more irregular and located toward the southeast at higher elevations are more likely to have associated rare plant species.

93 **Nicholas G. Stewart, Mark A. Schlueter**

Fluctuations in species abundances of major apple pollinating native bees during progessively earlier apple blooms over a three year period in north Georgia

Georgia Gwinnett College, Lawrenceville, GA

Concerns over climate change have prompted research into its effects on natural systems; however, little effort has been devoted to investigating how such climactic variability affects pollination of commercial agriculture. Over the 2010-12 seasons, the native bees vital to the pollination of apples were identified. These native bees include: *Andrena crataegi* and several species in the sub-genus *Melandrena* (Family

Andrenidae); *Xylocopa virginica* (Family Apidae), and several species in the genus *Osmia* (Family Megachilidae). These native bees were shown to contribute to the bulk of native pollination services in North Georgia apple cultivation. Andrenids were overwhelmingly dominant during the 'typical' 2010 bloom (spanning mid-April through early-May), while *Xylocopa* and *Osmia* both exhibited low abundance. The following year, 2011, blossoms began to open two-weeks earlier than the 'typical' apple bloom of previous years. Andrenid abundance was significantly reduced during the early apple bloom, since many of the Andrenids had not yet emerged. However, the abundance of both *Xylocopa* and *Osmia* species were much greater than that of the previous year. Then, in 2012, the earliest apple bloom in recorded Georgia agricultural history (early-March through early-April), the Andrenids again experienced deflated abundance values, while both the *Xylocopa* and *Osmia* were collected in the highest recorded numbers of the study. These results indicate that even during aberrant seasonal conditions which adversely affect certain native bees, others within the same guild can compensate for a lapse in pollination. These findings help promote the feasibility of creating native bee based pollination systems for commercial agricultural systems.

94 **Eric E. Lamont[1], Richard Stalter[2]**

Flora of Plum Island, Suffolk County, New York.

[1] The New York Botanical Gardens, NY; [2] Department of Biology, St.John's University, NY.

Plum Island, encompassing approximately 340 hectares is located in eastern Long Island Sound, New York (41.175295 Lat.,-72.198715 Long). For much of the past 100 years. The island has remained relatively undeveloped. Some prevoiusly cleared areas have succeeded into shrublands and woodlands. Plum Island's highly restricted use as a secure government facility limits human access and reduces some of the associated negative environmental impacts. The purpose of the present study was to document the vascular flora of Plum Island and discuss the island's plant diversiy. Plum Island was visited monthly for the purpose of collecting vascular plant species during the growing season, May to October 2002 to 2008. The island's vascular flora consists of 404 species in 268 genera in 104 families. The Poaceae (60 species) and Asteraceae (47 species) are the largest families in the flora. One hundred forty nine taxa, 37% of the flora are not native to the region. Forty one of the species are listed as rare or endangered in New York.

95 **Jillian Kelly, David Vandermast**

The effect of beaver herbivory on forest composition on the Haw River, central North Carolina

Department of Biology, Elon University, Elon, NC

The American beaver (*Castor canadensis*) resides in rivers and ponds and is known as an ecosystem engineer because of the way it alters riparian ecosystems through the consumption of the inner bark of some trees and use of others for construction material in their dams. It has long been known that beavers discriminate in the trees they consume. The purpose of this study was to determine how this feeding selectivity affects the composition of riverside forests along the Haw River in the Piedmont of North Carolina. We recorded the identity, size and percent damage of all trees with signs of beaver herbivory in five locations constituting approximately 6 km of river frontage. We also recorded saplings growing in a 5.6 m radius around each beaver-damaged tree. The 43 damaged trees included seven tree species. Sweetgum *(Liquidambar styraciflua*) was, by far, the most commonly damaged species (58.1% frequency) and had the greatest average damage (73.5%). Furthermore, our results show that only 6.2% percent of the saplings recorded were sweetgum, while the most abundant saplings were southern sugar maple (*Acer barbatum*) at 26% frequency and boxelder (*Acer negundo*) at 20%. Beavers seem not to prefer these species as none were recorded with beaver damage in this study. Our results indicated that beaver feeding selectivity has the potential to create forests of different compositions than would occur in the absence of beaver herbivory.

96 **Emily Neidhardt, David Vandermast**

Geographic Variation in the Allelopathic Potential of American Beech (*Fagus grandifolia*)

Elon College Fellow, Elon University, Elon NC

In Great Smoky Mountains National Park, relatively small monodominant stands of American beech (*Fagus grandifolia*) trees called beech gaps exist in a larger, high-elevation forest matrix dominated by spruce and fir (*Picea rubens-Abies fraseri*). This phenomenon has been explained in part by previous research that has identified American beech as having allelopathic qualities against spruce and fir. The purpose of this research is to determine if red beech (a race found in the Piedmont region of North Carolina whose range does not overlap with red spruce or Fraser fir) is as allelopathic as the high-elevation gray beech. This is one of the few studies that seeks to determine whether allelopathy is a species-wide trait or whether it varies geographically. Abscised beech leaf litter and beech forest soils were collected from beech forests near Elon, North Carolina. Six treatment combinations (d-H2O and two leachate concentrations X beech soil and topsoil) were used to germinate red spruce, Fraser fir, and lettuce (*Lactuca sativa*) seeds. Our dependent variables were germination rate and aboveground biomass (AGB). Our results indicate that, in combination with beech forest soils, beech leaf leachate can lower AGB and reduce germination significantly ($p<0.05$) in red spruce and lettuce seedlings, yet no significant effects were observed on Fraser fir. In our study, the inhibitory effect of red beech was less than that of gray beech, suggesting that variations in competition intensity may lead to a greater production of allelopathogens in geographically distinct populations.

97 **David R. L. Burge[1], Travis D. Marsico[1], Jennifer Cobb[1], Jennifer L. Bouldin[2]**

Land-use practices in relation to wetland water quality of the Cache River, AR, USA

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Floodplain depression wetlands play an important role in significantly reducing sediment and phosphorus concentrations in low-gradient riverine systems. Increased nutrient concentrations and other alterations in water chemistry have been shown to alter community structure in wetlands. In some wetlands, alterations to community structure have resulted in a decrease of ecosystem services. Geographic Information Systems (GIS) have been used in many eco-regions to efficiently identify stressed wetlands and guide wetland restoration and mitigation efforts. Over the last century, the lower Mississippi Alluvial Plain (MAP) has been converted from an area of bottomland hardwood forests to an area dominated by agricultural land-use/land-cover (LULC) practices. The Cache River Watershed, in eastern Arkansas, is representative of the natural and altered land uses found in the lower MAP. Within this watershed we examined the relationship among two LULC buffers, percent agriculture and percent vegetation cover, and the concentrations of water quality parameters including nitrates (mg/L), nitrites (mg/L), total nitrogen (mg/L), conductivity (µs), orthophosphates (mg/L), and total phosphorus (mg/L). We predicted that a decrease in forest buffer would correlate with an increase in water chemistry parameters. Forest and agricultural LULC were useful when explaining the variation in nitrates and conductivity by 46.4% and 58.4% respectively ($\alpha \leq 0.01$, $n=24$). Using GIS can increase efficiency when implementing wetland monitoring, restoration, and mitigation efforts to improve water quality in the lower MAP.

98 **Claire Tipton, Danielle Whitman, Janet MacFall**

Enzyme activity in hyporheic soils of Piedmont streams

Environmental Studies and Biology, Elon University, Elon NC

Streams and rivers are the source of our drinking water, scenic beauty, recreational opportunities and wildlife habitat. Land use practices such as agriculture, urbanization and development have caused erosion and habitat loss to some Piedmont streams, with about 10% of NC streams considered impaired. The goal of this research was to

establish biochemical and microbial baseline measurements that could be used as assessment tools in the evaluation of stream restoration initiatives. Hyporheic soils are ecologically important as zones of active exchange between ground and surface water and terrestrial and aquatic ecosystems. Five major soil enzymes involved in nutrient cycling within soil were examined using methods modified for hyporheic soils. All assays were done on freshly collected soil cores. Enzymes studied included phenol oxidase, protease, acid phosphatase, β-glucosidase, and β-galactosidase. There was a correlation between degree of erosion—determined by bank height—and enzyme activity for phenol oxidase, acid phosphatase, β-glucosidase, and β-galactosidase (R values ranged from 0.3 to 0.6). Bank height ranging from 15 to 244 cm was used as a measure of erosion. There was a significant effect for depth of soil cores for β -galactosidase, protease, β -glucosidase, and acid phosphatase but not for phenol oxidase. Higher activity was measured in surface soils than at 20 cm. These results suggest the possibility of significant roles for the microbial community in nutrient cycling within hyporheic soils which may be related to degree of erosion. Furthermore, preliminary observations indicate a relationship between soil organic carbon and enzyme activity.

99 **M. Shea Harrison, Jennifer T. Thomas**

An Examination of AIM2 Expression in Response to Human Papillomavirus and Infectious Microbes in Cervical Cancer Cell Lines

Biology Department, Belmont University, Nashville, TN

Cervical cancer, affecting over 12,000 women in the US every year, typically requires a Human Papillomavirus (HPV) infection as a precursor. Some HPV infections can evade the immune system and progress to cervical cancer. It remains unclear why only 1% of HPV infections are able to do so, Recent research has suggested chronic inflammation or an additional infection may be necessary for the development of cervical cancer following HPV infection. AIM2 is a human antiviral proinflammatory protein that may have a role in HPV's immune evasion. The levels of AIM2 were compared in HPV-positive and HPV-negative cervical cancer cell lines. Additionally, AIM2 levels were compared when cancer cells were exposed to four infectious agents. In this study, AIM2 levels were too low for detection by Western analysis; therefore, comparisons of AIM2 expression were unable to be made. Understanding the expression of AIM2 may provide insight into HPV's mechanism of immune evasion and into the role of inflammation as a factor in HPV's progression to cervical cancer.

100 **Kathryn E. Rush, Jennifer T. Thomas**

IRF-3 Levels Decreased in Human Papillomavirus Positive Cervical Cancer Cell Lines Infected with Bacteria and Fungi

Biology Department, Belmont University, Nashville, TN

Cervical cancer is commonly linked with Human Papillomavirus (HPV) infection; however, HPV infection alone appears to be insufficient for cancer development because less than 1% of women infected with HPV progress to malignancy. Some have hypothesized that additional microbial infections, in addition to HPV infection, may lead to carcinogenesis that otherwise would not occur. Furthermore, some researchers speculate that HPV's ability to disrupt the normal immune response, causing a persistent infection, contributes to the development of cancers. Therefore, we questioned whether the levels of interferon regulatory factor-3 (IRF-3), an important protein in the anti-viral immune response, are altered in the presence of HPV alone or in combination with different microbes. We examined HPV-positive and HPV-negative cervical cancer cell lines individually infected with Gram-negative bacteria (*Escherichia coli*, *Pseudomonas aeruginosa*), a Gram-positive bacterium (*Staphylococcus aureus*.) or a fungus (*Candida albicans*). Using Western Blot protein analysis, we determined that the HPV-positive cell line has a reduction in levels of IRF-3 when compared to the HPV-negative cell line. In addition, our results indicate a further reduction in IRF-3 levels in HPV-positive cells that were infected with all bacteria and fungi tested. This study provides additional supporting evidence for altered immune proteins in the presence of HPV and, interestingly, suggests a role for the contribution of other microbes in immune evasion.

101 **Brad Gill, Nick Ragsdale**

The effect of temperature on the mortality rate of *Caenhorbditis elegans* infected with *Staphylococcus aureus*.

Department of Biology, Belmont University, Nashville, TN

The purpose of this experiment was to test the relationship between temperature and the infection rate of an organism with *Staphylococus aureus* bacteria. As many as twenty five percent of people carry the *S. aureus* bacteria in their body, and it is the number one cause of the deadly "staph infection" common in humans and animals. The objective was to expose *Caenorhabditis elegans* with *S. aureus*, place them in varying temperatures, and determine the mortality rate. *C. elegans* exposed to *S. aureus* and placed in warmer temperatures died faster than those in cooler temperatures. From these results, it can be concluded that temperature does have an effect on the mortality rate of *C. elegans* exposed to the *S. aureus* bacteria.

102 **Tasha Samborski, David Wessner**

Analyzing the cytotoxicity and anti-viral properties of trizole nucleoside analogues

Department of Biology, Davidson College, Davidson, NC

HIV has been a persistent global problem since the early 1980s. Nucleoside analogue therapy has been used for many years in order to reduce HIV replication, however due to the high mutability of HIV and the side effects associated with current treatment, new nucleoside analogue compounds need to continue to be synthesized. The Stevens lab at Davidson College has synthesized a number of new nucleoside analogues. In the Wessner lab, these compounds have been tested for cytoxicity using the neutral red assay and LDH assay. Both assays have shown that none of the compounds are cytotoxic. Antiviral testing, using reovirus, has also been preformed and premliminary results show that neither Compound 3 nor Compound 4 have antiviral properties.

103 **Sophia Stone[1], Angela Gupta[1], April Lao[1], Maria Craig[2], Paul Deeble[1]**

LL-37 and CpG oligonucleotides increase growth, migration, and invasion in a prostate cancer cell model

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LL-37 is an antimicrobial DNA-binding peptide that has been implicated in anti-self DNA and anti-tumor immune responses. LL-37 is found throughout the body and in higher amounts in breast, lung, and prostate cancer tumors, and the combination of CpG and LL-37 has recently been shown to enhance the anti-tumor effects seen with CpG in ovarian cancer in mice. Unmethylated CpG sequences are known to activate Toll-like receptor 9 (TLR9) pathways and promote weak antitumor TH1 immune responses that are enhanced by LL-37. However, the interaction between LL-37 and DNA is not well-characterized. We tested the effects of LL-37 and CpG on two prostate cancer cell lines: LNCaP, derived from an androgen-responsive lymph node metastasis of prostate cancer, and PC-3, derived from an androgen-independent bone metastasis of prostate cancer. By electrophoretic mobility shift assay (EMSA) and western blotting, we observed that LL-37 aggregates (low gel mobility) in the absence of DNA. Further, adding CpG DNA results in reduced mobility suggesting that CpG binding disrupts LL-37 aggregation by forming a CpG/LL-37 complex. CpG/LL-37 complexes were found to increase prostate cancer cell growth (PC-3 cell line) and invasion through a matrigel matrix (LNCaP cell line). CpG/LL-37 had no effect on cell migration in the LNCaP cell line, however LL-37 increased cell migration in the PC-3 cell line. Also, we found that the pro-migratory effects of LL-37 in the PC-3 cell line were significantly reduced by inhibiting the MAPK/ERK pathway. These results indicate that CpG/LL-37 should be considered with caution as a cancer therapy.

104 **Elene Clemens, David Wessner**

Characterization of Ammonium Chloride Resistant Reovirus Mutants

Department of Biology, Davidson College, Davidson, NC

Reovirus is a non-enveloped dsRNA virus which, while non-pathogenic to humans, is closely related to disease-causing rotavirus. Reovirus enters cells through receptor-mediated endocytosis, during which viral particles are taken into vesicles within the cell. Once in the acidic environment of these intracellular compartments, the outer coating is disassembled to expose the protein core of the virus, which can then replicate by entering the cytoplasm of the cell and translating viral proteins. While weak bases such as ammonium chloride typically inhibit this process, as low pH is necessary for disassembly to occur, some mutant strains of reovirus have been shown to exhibit resistance to increased pH. Preliminary data suggest that previously studied ethanol-resistant strains of reovirus might also be resistant to ammonium chloride. Viral replication in the presence of ammonium chloride was quantified by fluorescent focus assay to examine whether or not these strains exhibit resistance to higher-pH conditions. Results thus far are inconclusive; further assays as well as characterization of mutants will be refined and performed.

105 **Matthew Boyce, Philip Rock**

A Metagenomic Comparison of the Microflora from Vermicompost with the Intestinal Microflora from the Composting Worm *Eisenia foetida*

Department of Biology, Virginia Wesleyan College, Norfolk, VA

Eisenia foetida, commonly known as 'red wigglers', is the most widely used worm species in the organic recycling process known as vermicomposting. Vermicompost is a valuable soil amendment often reported to contain microbes beneficial for agriculture. Precisely which microbes are beneficial and how microbial composition may vary with the type of compost is not known. There is a small vermicompost project at Virginia Wesleyan, with the worms recycling vegetable scraps from the dining facility. In this study we examined the microbiomes from vermicompost, normally fed worms, and worms that had been starved for 24 hours. DNA was extracted from each source and subjected to PCR for 16 rRNA, followed by 454 sequencing of the amplified products. A BLAST search revealed considerable differences between the samples, though some species were common to all samples. The search generated over 6000 operation taxonomic units (OTU's). Of these, about 180 were named species. Surprisingly *Methylibium petroleiphilum*, a bacterial species found in soil contaminated with aromatic hydrocarbons, was present in all three samples and represented the major bacterial species from the vermicompost. Another species found in all three samples was *Sorangium cellulosum*,a cellulose degrading organism, known to produce a variety of antibacterial and antifungal compounds. *Chitinophaga arvensicola* present in all three samples similarly is reported to have antifungal activity. The presence of organisms such as these lends credence to the 'beneficial microbes' claims for vermicompost.

106 **D. B. Wilson, K. A. Harris, H. G. Spratt**

Mineralization of the herbicide simazine in golf course pond sediment: Comparison of passive bioremediation, biostimulation, and bioagumentation

Department of Biological and Environmental Sciences, University of Tennessee at Chattanooga, Chattanooga, TN

The number of golf courses in the U.S. has increased by 21.5% in the past 20 years. As of 2012, there were 15,619 golf courses in the U.S. With the increase in golf course construction and the maintenance of existing ones, there is raised concern of pesticide contamination in surface and groundwater due to the intensive management needed for turf grass. To address this concern, many golf courses are involved in environmental stewardship programs to improve water quality, reduce their environmental impact, and provide wildlife sanctuaries. This study compared the efficacy of three bioremediation treatments on mineralization of the herbicide simazine in pond sediments from a golf course enrolled in an environmental stewardship program. Biostimulation treatment consisted of adding sterile tryptic soy broth (TSB) to a soil slurry sample. Bioaugmentation consisted of adding

approximately 10^6 cfu of *Pseudomonas aeruginosa* (PA) along with sterile TSB. Passive bioremediation was used as the control with saline used instead of TSB or PA. Microcosms containing slurries of these treatments and tracer ^{14}C-simazine were used to calculate maximum mineralization rates. Rates of simazine mineralization ranged from 0.39 to 1.36 mg/g/d. Bioaugmentation significantly ($p<0.05$, Students T-test) increased the rates of simazine mineralization compared with either the control or biostimulated samples. The use of bioaugmentation treatment on areas of golf courses heavily contaminated with water-soluble herbicides could greatly reduce the amounts of herbicides migrating off the courses via streams. Institution of such an environmental stewardship program could help golf course managers alleviate some public concern.

107 **H. G. Spratt, M. M. Brown, T. M. Gann, D. B. Wilson**

The influence of bacterial growth in pores of pervious concrete on the flow of water through pervious pavements

Department of Biological and Environmental Sciences, University of Tennessee at Chattanooga, Chattanooga, TN

Pervious concrete use to manage storm water runoff has increased in recent years. A problem limiting use of pervious concrete is clogging of pavement pores over time. This study focuses on determining the role bacteria play in this clogging. Bacterial cultures used here were isolated from a limestone quarry, with seven spore-forming bacterial cultures obtained using heat treatment (80 °C for 15 min). To test potential clogging of pervious concrete, these cultures were added to sterile construction substrates - pulverized concrete, limestone, and sand (sieved to between 0.85 and 2 mm) packed into 50- or 100-cc burettes. Porosity was determined by timing the flow of sterile saline through the columns both before and after the growth of cultures on the substrates. The presence of any of the cultures resulted in some clogging of the pores. Clogging in the pulverized concrete ranged from 43% to 68%, in the limestone ranged from 3% to 74%, and for the sand ranged from 6% to 97%. To assess causes of clogging of pervious concrete *in situ*, concrete cores were obtained from a local stadium parking lot that has shown symptoms of clogging. Cultures growing within pores of this concrete, a chemical analysis of material removed from clogged pores, along with scanning electron microscopy will be used to determine the nature of agents involved in the clogging of this concrete. A determination of the incorporation of chemicals that may inhibit bacterial growth on the porosity of freshly poured pervious concrete is also being made.

108 **T. Saray Smalls[1], Patricia A. Koplas[1], Jill Perry[2], Jessica Braswell[3]**

Uptake of HPV vaccination in traditional undergraduate students at Queens University of Charlotte: Knowledge, behaviors and barriers

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Human Papillomavirus (HPV) is the most common sexually transmitted infection in the United States (Ratanasiripong 2012). After the approval of a HPV vaccination for females in 2006 and for males in 2009 by the Food and Drug Administration, research has been done to assess knowledge regarding both the virus and the vaccine, the effectiveness of educational interventions, along with the barriers to uptake in both male and female populations. This study investigates factors influencing whether or not college-aged students have had the HPV vaccine. Researchers hypothesize that lack of knowledge and cost have negatively impacted HPV vaccine uptake. Approximately 125 traditional undergraduate students at Queens University of Charlotte completed questionnaires concerning demographics, HPV knowledge, and HPV related behaviors. These data will be analyzed to determine whether lack of knowledge or other factors are most strongly influencing vaccination rate of college-aged students.

109 **Alan S. Weakley**

Variety or subspecies? Or, for that matter, species, or nothing at all?

UNC Herbarium (NCU), N.C. Botanical Garden, Biology Department, University of North Carolina, Chapel Hill, NC

No ready and operational consensus has emerged on fundamental issues of what is a species, what is a variety or subspecies, and what is (mere) variation not warranting taxonomic recognition. Neither traditional morphologic approaches nor newer molecular techniques have succeeeded in producing authoritative answers to these basic questions, yet fundamental issues of scientific enquiry and conservation policy depend on this basis. I will review the fuddled history of these issues and suggest some ways forward.

110 **Jayne A. Lampley, Jimmy K. Triplett**

A phylogenetic analysis of the medicinal plant *Polygonatum biflorum* in the Southeastern United States

Department of Biology, Jacksonville State University, Jacksonville, AL

The genus *Polygonatum* (Asparagaceae *sensu* APG III) contains a total of about 57 plant species commonly called Solomon's Seal. *Polygonatum* species are native from boreal to warm-temperate areas of North America, Europe, and Asia and many of those species are used as edible herbs or medicinally to treat a host of ailments. Two species, *Polygonatum biflorum* (Walter) Elliott and *Polygonatum pubescens* (Willdenow) Pursh, are native to the Southeastern United States. The *Polygonatum biflorum* complex, which includes *Polygonatum biflorum* var. *biflorum*, *Polygonatum biflorum* var. *commutatum*, and *Polygonatum biflorum* var. *hebetifolium*, is in need of taxonomic revision and further morphological, cytological, and molecular analysis at the population level. *Polygonatum biflorum* (*sensu lato*) is a polyploid complex, which results in plants that vary in size and ecology. The current study employs molecular and cytological methods to test the current taxonomy, to provide an overview of phylogenetic relationships, and to investigate the origin of polyploidy in the *Polygonatum biflorum* species complex. This will be accomplished by detecting genetic variation among field collected specimens from populations of *P. biflorum* and *P. pubescens* ranging from Ohio to Alabama using AFLP data, flow cytometry, and sequence data from five chloroplast DNA intergenic regions. Resolution of hypotheses of evolutionary history and phylogeography of the *P. biflorum* complex will be discussed.

111 **Kevin L. McDonald, Jimmy K. Triplett**

Vascular flora of the Frank Spain Scout Reservation in Cleburne County, Alabama

Department of Biology, Jacksonville State University, Jacksonville, AL

Alabama is the fifth highest-ranking state in terms of biodiversity, but unfortunately it is also a leader for the high levels of at-risk or recently-extinct species. Moreover, Alabama's current species distributions and life histories are relatively poorly understood. In light of these issues it is increasingly vital to advance our knowledge of Alabama's biodiversity for the goal of responsible stewardship. The purpose of the current study is to improve the floristic knowledge of Northeastern Alabama by documenting the vascular plant species on the Frank Spain Scout Reservation, a mixed mesophytic forest community encompassing 1,477 acres in Cleburne County, Alabama. This research will culminate in the production of a regional flora that enhances the cumulative plant data of a historically under-collected area. The specific objectives are to (1) determine all vascular plants growing in the study area; (2) document all species with herbarium voucher specimens; (3) collect data to assist with conservation decisions; and (4) utilize these data to assist with the development of educational outreach programs. The research will expand upon documented botanical knowledge of the Piedmont Upland region and the northeast section of Alabama. Collected data will complement ongoing research by the Alabama Herbarium Consortium to develop the Alabama Plant Atlas, an online project aiming to catalog the plant species throughout the state. The presentation will discuss the importance of floristic surveys, Alabama's plant biodiversity and the threats these populations face, discoveries made at the study site thus far, and the benefits this research offers for educational outreach programs.

112 **Christine Gang[1], Samantha Tessel[2], Alan S. Weakley[3]**

Additional species in southeastern *Trichostema* (Lamiaceae): another mint genus gone woody and wild in the southeastern Coastal Plain

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The genus *Trichostema* is limited to North America and has two centers of distribution. With the exception of *T. brachiatum*, eastern North American *Trichostema* has been considered to include 1-3 species, *T. dichotomum*, *T. setaceum*, and *T. suffrutescens*. Morphological analyses support the recognition of additional taxa: a perennial species on stabilized barrier island dunes of the Carolinas ("*nesophilum*"), and an additional perennial species of near-coastal maritime situations of Georgia, Florida, and Alabama ("*floridanum*"). Additional populations may warrant taxonomic status: morphologically distinctive perennials associated with various ridges of the Florida peninsula and dry sandy habitats of the Florida Panhandle. All putative taxa are being analyzed with a combination of morphological analysis and molecular phylogenetic analysis, in order to understand the evolution of *Trichostema* in the southeastern United States and determine the appropriate taxonomic treatment of hypothesized entities.

113 **Scottie D. Berk, Roland P. Roberts**

Leaf and stem anatomical features as indicators of evolutionary relationships in *Chrysothamnus* and related genera

Department of Biological Sciences, Towson University, Towson, MD

The phylogenetic relationships among species of *Chrysothamnus* have been investigated using morphology, chloroplast restriction site data, and DNA sequence data. However, relationships among the species of *Chrysothamnus* are still unclear. This research examined anatomical features of species of *Chrysothamnus* and related genera to determine if these features inform the relatedness of these taxa. Leaf and stem samples were collected from herbarium specimens and taken through a dehydration series, embedded in paraffin, sectioned and stained. The slides were examined using compound light microscopy to identify anatomical features of the epidermis and mesophyll of the leaf samples. Stem sections were analyzed for vascular bundle arrangement and the presence of secretory ducts and other inclusions. Preliminary observations reveal several features that might be indicative of evolutionary relationship and thus useful for evaluating phylogenetic relatedness in this group of plants.

114 **Clayton M. Costa, Roland P. Roberts**

Molecular phylogeny of the goldenasters, subtribe Chrysopsidinae (Asteraceae, Astereae), based on nuclear ribosomal and chloroplast sequence data.

Department of Biological Sciences, Towson University, Towson, MD

The goldenasters, subtribe Chrysopsidinae, is a group of common wildflowers distributed from North to South America, inclusive of eight genera sensu Nesom. Historically, phylogenetic inference of the Chrysopsidinae has been based on morphological criteria, resulting in the proposition of multiple different classifications by different researchers. Some studies based on chloroplast DNA restriction site data have been inconclusive in the delimitation of relationships among all the genera and species in the group. Furthermore, no single study has sampled among all genera or all known species of the Chrysopsidinae for assessment of evolutionary relationships. In this study, we estimated phylogenies based on molecular data from *ETS*, *ITS*,and *ycf1* regions for most known taxa of the Chrysopsidinae as the basis for addressing questions related to subtribal and generic monophyly, the relationship of *Osbertia, Noticastrum*, and *Tomentaurum* to other genera, morphological trait evolution and the frequency of convergence among morphological features commonly used to delimit species boundaries. Preliminary results from analysis of *ycf1* support the monophyly of the Chrysopsidinae. Additional analyses of *ETS* and *ITS* data in combination with *ycf1* will be utilized to further resolve the relationships of taxa within the Chrysopsidinae and evaluate patterns of character evolution.

115 **Rebecca N. Johnson, L. Dwayne Estes**

Systematics and biogeography of the Australasian *Gratiola* *nana* (Plantaginaceae, Tribe Gratioleae) complex

Department of Biology and Center of Excellence for Field Biology, Austin Peay State University, Clarksville, TN

A recent molecular phylogenetic study of the wetland-adapted genus *Gratiola* investigated seven currently described species native to Australia and New Zealand, but the non-coding chloroplast DNA regions investigated proved to be of low utility for the closely related taxa. Although time constraints limited a deeper investigation, the polyphyletic relationships prompted a preliminary morphological assessment, which uncovered the possibility of as many as five morphological extremes all resembling *G. nana* in their short-statured procumbent to creeping habit, small orbicular-ovate leaves, and sessile to subsessile flowers. Mirroring the current confusion, the taxonomic circumscription of *G. nana* has been unclear for the past 100 years because some botanists have chosen to recognize *G. concinna* of New Zealand as distinct whereas others recognize *G. nana* sensu lato as including *G. concinna*. Further complicating matters between these two taxa, previous botanists have studied this group only from a local perspective and not holistically. This is especially critical as the range for *G. nana* sensu lato is quite broad, including southeastern mainland Australia (portions of New South Wales, Victoria, Australian Capital Territory), Tasmania, and New Zealand's North Island, South Island, and Stewart Island. Therefore, it is the objective of this study to resolve the relationships of this complex by using a combination of herbarium specimen examination, morphometrics, scanning electron microscopy, and GIS.

116 **Sabrina Y.S. Sewell, Wendy B. Zomlefer**

Floristic inventory and quality of Georgia Piedmont Gabbro upland depression forests.

Department of Plant Biology, University of Georgia, Athens, Georgia

The Piedmont gabbro upland depression forest is a globally imperiled (G2) forest association endemic to a few scattered locations in the Piedmont regions of Georgia and South Carolina. These distinctive but poorly understood communities occur in relatively level upland situations on mafic shrink-swell clays, particularly Iredell soils, derived from gabbro bedrock. Their hydrology features a "perched" water table that seasonally saturates the land and sustains ephemeral pools. Intriguing and rare plant species occur in these forests, including calciphiles, prairie relicts, and taxa more typical of the Coastal Plain. Ongoing field work will result in a comprehensive floristic inventory of three sites in Jasper County, Georgia, including the Monticello Glades. These properties are insufficiently protected from anthropogenic threats such as logging, development, and hydrological disturbance. Plot-based Floristic Quality Assessments (FQA) will provide a baseline for conservation and management decisions. This project overall will provide necessary documentation to justify improvement in long-term stewardship of the study sites, as well as discovery and acquisition of other representative areas of this scarce and unique forest type.

117 **Diego Fajardo[1], Emily Gillespie[2], Juan Zalapa[3], Kathleen Kron[4]**

Systematic and functional implications of structural rearrangements in whole chloroplast genomes of Ericaceae

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Sequence data from the chloroplast (cp) genome has been a standard source of data for phylogenetic studies of plants for more than two decades and structural rearrangements, such as gene order or modifications of the inverted repeat have been reported for some taxa using Sanger sequencing or restriction site data. With the development of Next Generation Sequencing (NGS) several whole cp genomes have been sequenced across the angiosperms. These studies have indicated that major structural rearrangements such as inversions and gene losses have occurred

over the broad history of flowering plants. However, as of yet, there is a lack of targeted studies of cp genome structure within a particular family or order. We have investigated the cp genome structure of selected Ericaceae using NGS methods. Data for assembly and comparison was obtained from 454 sequencing (*Vaccinium macrocarpon*) and Ion Torrent PGM (*Rhododendron mucronulatum*) platforms. To detect possible cp gene rearrangements the data were analyzed and compared to other published genomes available in GenBank using Mauve v. 2.0 genome alignment software. Major structural differences were found within Ericaceae. These include gene losses (e.g., *ycf* in cranberry) and major differences in gene order among representatives of major clades (subfamilies) within Ericaceae.

118 **Whitney Senn, Michael Woods**

The genus *Dalea* (Fabaceae) in Alabama

Departmental of Biological and Environmental Sciences, Troy University, Troy, AL

Dalea, commonly known as prairie clover, is a member of the legume family Fabaceae (Leguminosae) and the tribe Amorpheae. The genus consists of approximately 160 species worldwide. Sixty-two species have been reported from the United States. Of these, 15 species have been reported from the southeastern United States and seven species and three varieties from Alabama. Based on the results of this study, eight species of *Dalea* occur in Alabama. The most common species of *Dalea* inAlabama is *D. pinnata* var. *trifoliata*, represented in 17 counties. *Dalea purpurea* var. *purpurea* is represented in 15 counties. *Dalea candida*, the third most common taxon, is represented in 13 counties. *Dalea albida* is represented in seven counties, while, *D. gattingeri* is represented in six counties and *D. gracilis* is represented in five counties. The least common taxa are *D. foliosa* (two counties) and *D. cahaba* (one county). Dichotomous keys and descriptions are modifications from earlier authors; however, all measurements are based on morphological features of the vegetative and reproductive structures of the plants studied during the project. Data for the distribution maps were gathered from personal collections and plant specimens deposited in the herbaria of Troy University (TROY), J. D. Freeman (AUA), The University of Alabama (UNA), Anniston Museum of Natural History (AMAL), Jacksonville State University (JSU), University of North Alabama (UNAF), University of West Alabama (UWAL), and Southern Methodist University (SMU) and Vanderbilt University (VDB), both of which are housed at the Botanical Research Institute of Texas (BRIT) in Fort Worth.

119 **Spencer N. Bissett, Donald R. Young**

Vines in coastal environments: Distribution, diversity, and succession on two barrier islands

Department of Biology, Virginia Commonwealth University, Richmond, VA

Coastal habitats are inherently vulnerable to global change, as the first areas to be impacted by sea level rise and to experience more frequent and intense storms. Barrier islands are among the most susceptible, with exaggerated interfaces between the aquatic and terrestrial free surfaces. Shrubs and vines dominate the climax communities in these environments, and with comparatively long regeneration periods, are highly vulnerable to shifting geography and climate. We investigated abiotic and biotic components of two barrier island landscapes to clarify relationships between physical factors, woody plants, and vines. On Hog Island, VA, a diverse landscape encompassing multiple seral stages, intra-site comparisons with reference to distance from shoreline and elevation (landscape position), and soil age were made to evaluate relationships between woody communities, vine communities, and edaphic characteristics. At Duck, NC, comparisons were made across transects with reference to landscape position, edaphic characteristics, and woody and vine communities. Between sites, areas of similar landscape position were compared.Woody community composition was primarily determined by landscape position. Vine presence followed woody plants in establishment, primarily due to dispersal mechanisms; these are only indirectly dependent on landscape position. Vine species diversity was a larger contributor to site diversity than was woody diversity at both sites, despite near-zero vine presence in young plots. Plant community relationships serve as indicators of responses to global change, and greater understanding of ecological processes in these environments will aid observation of the effects as shifts continue to occur.

120 **Gary E. Schultz, Jr., Jeff J. Kovatch**

Microbial beta diversity patterns in the Ohio River watershed as determined by pyrosequencing

Department of Biological Sciences, Marshall University

The diversity of lotic freshwater bacterial communities is still being explored. Bacterioplankton, by definition, go where the river goes. As there is no known mechanism for bacteria to swim upstream, at the microbial level, rivers are conveyor belts of bacterial communities continually flowing downstream. Tributaries continually load new microbial communities to this conveyor belt, but whether these loads significantly impact the larger river is currently unknown. These conveyor belts, although complex mixtures of communities, are not random, and patterns are likely to exist that govern the content of each river. As the Ohio River consists of the waters from many different sources, this study is an an attempt to lay the basis for an accurate description of lotic microbial community dynamics by determining how the microbial communities from tributaries impacts the microbial community of larger and larger systems. 16s rRNA universal probes and 454 pyrosequencing was used to determine microbial community structure at a taxonomic level within several pools of the Ohio River and over seasonal scales at a single site in the Ohio River. Samples from the Guyandotte River, the Mud River, and Laurel Creek (all within the Guyandotte/Ohio River watershed) were also analyzed. Beta diversity between the bacterial communities at all sites was determined. Results of microbial diversity are discussed, and the beta diversity patterns are examined.

121 **Matthew R. Semcheski[1], Todd A. Egerton[1], Wesley Myers[2], Harold G. Marshall[1]**

Benthic microalgal composition in lower Chesapeake Bay intertidal wetlands

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Benthic microalgal communities have long been recognized as significant components of estuarine and coastal systems. Traditionally these algae have been treated as a singular functional element of benthic habitats, however, recent evidence suggests that these communities are comprised of phylogenetically diverse algal groups, each with varying physiological and metabolic characteristics. Considering their capabilities of nitrogen fixation, nutrient flux regulation, and sediment stabilization, as well as their basal position in aquatic food webs, the characterization of microphytobenthic structure is an important aspect in understanding these communities. In Chesapeake Bay, the presence of expansive shallow shorelines, intertidal, and subtidal zones facilitate the development of large microphytobenthic assemblages. This project surveys the taxonomic composition of intertidal microphytobenthic communities at eight sites around lower Chesapeake Bay, along with the composition of neighboring phytoplankton communities over a two-year period. Several environmental variables were examined at each site as possible predictors of microphytobenthic community structure, with special emphasis on sediment type. While exhibiting similar seasonal trends in abundance and biomass, microphytobenthic community composition was significantly different than planktonic communities. Within the benthos, community structure varied across sites, and seasonally within sites, with pennate diatoms constituting the majority of biomass throughout much of the year, becoming co-dominant with cyanobacteria and chlorophytes during summer months. Algal biomass was highest at all sites in summer. Additionally, sites with similar sediment type showed similar taxonomic structure, indicating sediment grain size as a possible driver of sediment microalgal composition.

122 **Meghan Foard, Travis D. Marsico**

Understanding the role of hydrology in the invasion of Chinese privet (*Ligustrum sinense* Lour.)

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Chinese privet (*Ligustrum sinense* Lour.) is a broad-leaved, semi-evergreen shrub that is invasive in many temperate riparian habitats throughout the world. It has been

shown repeatedly that when privet is present in an ecosystem it is accompanied by a substantial decrease in native biodiversity. Unfortunately, it has become one of the top invaders of the southeastern United States where it occupies land in nearly every county in the region. The exact cause of invasion success is unknown, but rapid growth, large reproductive output, dispersal by animals, broad environmental tolerance, and superior competitive ability have all been implicated. In addition to privet invasions, southeastern forests have declining numbers of healthy, unaltered rivers. As a result natural flooding regimes cease, and wetland species that once thrived struggle in the less suitable, altered conditions. Here we aim to identify the factors that contribute to the initial establishment of privet by identifying mechanisms of seed recruitment and hydrologic conditions that support maximum germination of seeds. We hypothesized that hydrologic alteration of riverine wetlands and water dispersal play key roles in the establishment and success of privet. Using seed trapping techniques, we determine that water dispersal is a major mechanism for privet introduction. To investigate the effect of the altered flooding regime on the establishment of privet we conducted a controlled inundation experiment. Our results showed that more privet fruits survived in simulated altered hydrologic regimes when compared to natural regimes. Thus, our data support that hydrologic alterations create novel niches for privet invasion.

123 **Dennis D. Tarasi[1], Robert K. Peet[2]**

A test of the community saturation hypothesis at multiple spatial scales in Southeastern U.S. forests

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The community saturation hypothesis suggests that more diverse communities should be more resistant to invasion than low diversity communities. The rationale is that in these communities, resources are almost completely utilized, and new resources are not readily available for novel species to consume. This leads to the prediction that exotic species should be most frequent in low diversity communities due to lower competition and greater access to resources. Experimental and theoretical studies have provided mixed results. Support for the community saturation hypothesis has come from small-scale observations where neighborhood crowding may be a major factor in limiting exotic establishment. We analyzed over 4600 vegetated plots, representing 515 unique community types from a broad range of habitats across North and South Carolina, for native and exotic species richness at 5 spatial grains:0.01, 0.1, 1, 10, and 100 m^2. The data were first analyzed with each individual plot representing a single data point. Further analyses have grouped plots to mean richness values according to community type and partitioned plots into 4 physiographic forested groups (Coastal, Piedmont, Montane, Riparian). The results of these analyses suggest that across all scales, exotic richness is positively correlated with native richness. This positive relationship between natives and exotics was generally consistent throughout all analyses and plot grouping procedures. These findings indicate that even at very small spatial scales, the community saturation hypothesis does not seem to apply to species-rich communities.

124 **Emily C. Price, John F. Walker**

Seasonal change in root fungal communities associated with *Rhododendron maximum* in the southern Appalachian mountains

Department of Biology, Appalachian State University, Boone, NC

Recently, *Rhododendron maximum* has increased its range in the southern Appalachian mountains and has become a dominant part of the forest ecosystem. These plants alter nitrogen cycling in the soil where they grow by prolific deposition of litter containing phenolic compounds. Some nitrogen lost this way is recaptured for *R. maximum* by ericoid mycorrhizal (ERM) fungi that can break down the compounds. The ERM fungi provide nitrogen from organic soil sources to their host in exchange for carbon, and are thought to be a large part of the fungal communities associated with *R. maximum* roots. These communities can be considered critical to the success of *R. maximum*, allowing the plant to thrive in nutrient poor soils. This study is an attempt to characterize the diversity of fungi associated with *R. maximum* roots and investigate whether the composition of their communities changes in response to seasonal shifts in their environment. Root samples from 20 *R. maximum* plants at the

Robert Gilley Research Station in North Carolina were taken in the spring, summer, and fall of 2011. Fungi were cultured from fresh roots and DNA identified using amplification and sequencing of the ITS region. Soil samples taken during the spring, summer, and fall were analyzed for carbon, nitrogen, and cation content. Most of the fungi identified had clear affinities with known or suspected mycorrhizal species within Helotiales. Ordination techniques revealed that there may be a shift in fungal community structure in response to environmental changes during the growing season.

125 **Daniel C. Parker, John F. Walker**

Community composition and diversity of ericoid root associated fungi at different elevations in the southern Appalachian Mountains

Department of Biology, Appalachian State University, Boone, NC

Mountains are among the most floristically diverse areas on earth. This is due to the mountain's perturbation of weather fronts frequently causing increased precipitation, and the temperature gradient caused by ascending higher into the atmosphere. Due to the changes in temperature and precipitation across elevational gradients, associated differences in edaphic conditions such as C/N are also expected to occur. Differences in moisture, temperature, and edaphic conditions may drive changes in the diversity and composition of root associated fungi. *Rhododendron maximum* is an endemic species found at all elevations in the Southern Appalachians. This study focuses on the dynamics of ericoid mycorrhizal fungal diversity and colonization levels in *R. maximum* roots along elevational gradients in the southern Appalachian Mountains. To address this we sampled roots and soils from three iso-elevational transects from high to low elevations at two locations. Root associated fungi were cultured from the roots. DNA amplified from these cultures was typed by restriction fragment length polymorphism (RFLP) analysis of the ITS regions and representatives from each group were sequenced. Root colonization was quantified by counting mycorrhizal hyphae at random locations within the root using light microscopy. Analysis indicates that colonization, diversity, and species composition of fungi within *R. maximum* roots are correlated with changes in elevation. This research will provide valuable information on how *R. maximum* interacts with fungi that inhabit the range of environments in which this species is found.

126 **Kellen Arlinghaus, Timothy Griffith**

Will northern range shifts impact photosynthetic capacity? A study of longer day lengths on the leaf architecture of multiple grassland species

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As global temperatures increase, the geographic ranges of many plant species are shifting north to remain within a similar climate envelope. However, these species now experience longer daylengths that could negatively impact the timing of developmental processes during the spring and summer growing periods. In particular, relatively little is known about how altered daylength cues will effect vegetative development and resulting photosynthetic capacity. Northern and southern populations of common grassland species including two grasses (*Andropogon geradii* and *Schizachyrium scoparium*) and a composite (*Coreopsis lanceolata)* were grown under three different daylengths corresponding to the locations of the source populations and the edge of the North American grassland in Saskatchewan. Northern populations of all three species had significantly higher stomatal densities than southern populations, suggesting that northern populations may be adapted to higher latitudes. Daylength also had an effect on stomatal architecture. At the longest (northernmost) daylength both populations of *S.scoparium* had a higher stomatal index than at the other two shorter daylengths. Therefore, if populations of this species shifted northward to remain within the same temperature envelope, the longer daylenghts could change stomtal architectures so that populations produce more stomata than necessary for that climate. Interestingly, there were no similar daylength effects for the closely related *A. geradii*, and distantly related composite *C. lanceolata*. Ultimately, range shifts could have deleterious consequences for the photosynthetic capabilities of at least some abundant plant species.

127 **Teresa Moody[1], Graham Hickling[1], Richard Gerhold[2]**

Skinks are 'dilution hosts' for the Lyme disease bacterium in the southeastern U.S.

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Lyme disease is the most commonly diagnosed tickborne disease in the United States. It is caused by the bacterium *Borrelia burgdorferi* and vectored by the blacklegged tick, *Ixodes scapularis*. In the Northeast, where lizards are scarce, rodents are important reservoirs for the Lyme bacterium and key hosts for the immature ticks. In the Southeast, immature *I. scapularis* prefer to feed on lizard species. Some researchers have suggested that lizards are not reservoir competent for *B. burgdorferi*, so lizard-feeding by ticks will inhibit Lyme disease cycles. Other studies have challenged this conclusion. We undertook a laboratory study to assess the prevalence, persistence, and transmissibility of *B. burgdorferi* in three species of southeastern skinks - *Plestiodon laticeps*, *P. inexpectatus* and *P. fasciatus* - from Florida, Tennessee, Alabama and North Carolina. We assayed naturally attached and xenodiagnostic ticks for infection with *Borrelia burgdorferi* using PCR. Six percent of skinks were naturally infected with an unidentified *Borrelia* species. However, when *B. burgdorferi*-infected nymphs were placed on lab skinks, 0% of the skinks became infected, and *Borrelia* prevalence in the challenge ticks dropped from 74% before feeding to 6% after feeding. In contrast, 100% of a group of control mice became infected, and their challenge ticks remained *Borrelia*-positive after feeding. The absence of *B. burgdorferi* infection in these skinks, despite infestation with infected blacklegged ticks, supports the hypothesis that skinks are 'dilution hosts' that help reduce Lyme disease risk in the Southeast. Further investigation of the novel *Borrelia* species found in these skinks is underway.

128 **Todd L. Scarlett**

Foraging and movements of Great Blue Herons below hydroelectric dams

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Great Blue Herons (*Ardea herodias*) most commonly forage in shallow waters capturing fish by sight. Operations at hydroelectric dams produce large and frequent changes in water depth, velocity and turbidity in tailwater rivers downstream of dams, yet herons forage in uncharacteristically high densities immediately below hydro dams. I observed Great Blue Herons below the Lake Wylie Dam near Rockhill, South Carolina, USA to determine how the altered flow regime affects heron foraging and movements. Great Blue Herons that perched on or near the base of the dam, surrounding the generator outflow, foraged at higher densities when the dam was generating electricity than when generators were off. Herons in this area captured small live shad schooling adjacent to the dam structure or skimmed dead or stunned fish off the surface. Dead fish had been entrained through the dam during generation and varied greatly in size. Herons on a rocky shoal 400m below the dam reached highest density during periods of non-generation after water had receded. Prey species were more diverse in this area and included mostly small fish and crayfish, often isolated in rocky pools when the water level decreased after generation stopped. The Lake Wylie Dam, and presumably other dams in the southeastern US where rainfall patterns and energy generation schedules are similar, provide a predictable and plentiful food source during the Great Blue Heron breeding season. The abundance and predictability of food below the dam may affect nesting location, nest colony size and distance travelled to the foraging site.

129 **Peter E. Schweizer, Glenn R. Matlack**

Natural and anthropogenic determinants of forest dynamics on the outer coastal plain of Mississippi, USA

Department of Environmental and Plant Biology, Ohio University, Athens, OH

To what extent is forest cover change influenced by natural features of a site, and to what extent by human-imposed landscape structure? We describe land cover history of an urbanizing area on the coastal plain of the Gulf of Mexico, an area contrasting with previous studies in natural and cultural history. Land cover was described at 300 point locations near the small city of Hattiesburg, Mississippi, USA. Aerial

photographs from 1940, 1958, 1970, 1982, 2000, and 2010 illustrate a progression in dominant land cover from cutover pine forest to pasture, mixed pine-hardwood forest and built-up land, with low-density residential development beginning to encroach in rural areas in 2000. Examination of point-transitions showed that both reforestation and clearcut occurred in abandoned agricultural land, and pine savanna declined by introgression of hardwood species. Logistic regression identified small stands, flood plains, and zones bordering arterial roads as the most likely locations for recent urban expansion. Conversely, points at higher elevation and more distant from streams and roads were likely to convert to forest. The effect of human land use has been to decouple land cover from natural landscape features. Modern land cover reflects synchronization of forest regeneration by the early 20th century lumber boom, suppression of naturally occurring fire in mid-century, and a relatively recent pattern of residential and commercial expansion along transportation corridors.

130 **Katrina Lustofin**

Analysis of UV fluorescence by two common millipede species from Southeastern Ohio

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UV fluorescence by arthropods was first reported in the 1950s but little research has been conducted on this phenomenon. Much of the research on UV fluorescence in arthropods involves scorpions, although fluorescence has also been reported in termites and other insects, horseshoe crabs, and millipedes. Several species of millipede found in Southeastern Ohio have been discovered to fluoresce, including *Euryurus leachii, Pseudopolydesmus serratus,* and *Semionellus placidus*. Specimens of *S. placidus* and *E. leachii* were field-collected from the Barbara A. Beiser Field Station or obtained from collections maintained by the Marietta College Biology Department. Whole specimens, dried specimens extracted with ethanol, and ethanol from stored specimens were analyzed with a UV spectrophotometer. The peak wavelength of light emitted was approximately 465nm, which is shorter than the published data for scorpions, suggesting that millipede fluorescent compounds are different from those found in scorpions.

131 **Peter A. Van Zandt[1], John-Paul Tortorich[1], Aisha Bonds[1], Grant Gentry[1], Richard L. Brown[2]**

A comparison of the moth communities of forested, glade, and urban habitats in Bibb and Jefferson Counties, Alabama

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Regional diversity of moth species remains understudied and unexplored in much of the southeastern United States. Their ability of moths to utilize different habitats depends on both the presence of important host plants and the relative distances separating biological communities. The Bibb County Glades and Cahaba River National Wildlife Refuge, both rural habitats located in Bibb County, account for a large portion of the fauna which characterize Alabama as the fifth most biodiverse state in the U.S. In this study, we surveyed moth species diversity of these two rural habitats and compared them to the moth community of an urban woodlot. We sampled each location from May 7th - October 27th, 2011 on 10 nights using black light traps. We found that moth species richness was not significantly different between the two rural habitats, but that they were considerably more diverse than the urban woodlot. Approximately 41% of species were found in both the rural sites; however, each rural site had many unique species, despite only being 3.5 km apart. Although the urban woodlot had lower numbers of species overall, it still had many species not found at the rural sites. Combined moth community composition in these habitats also appears to be strongly influenced by seasonal change. Thus, while proximity and homogeneity of local vegetation may explain commonality in species occurrence between the sampling sites, unique host plant occurrence and habitat distinctiveness seem to account for differences in moth species distribution within the urban and rural habitats.

132 **Jacob Brooks, Lori Tolley-Jordan**

The effects of barriers and carrion size on the diversity of adult insects among four stages of decomposition

Department of Biology, Jacksonville State University, Jacksonville, AL

Although the types and timing of insects found on decomposing carrion are described, differences in diversity due to animal size or barriers preventing direct carrion access by insects are not well understood. In September 2012, we tested how insect barriers used on two sizes of rodents affected attraction of adult insects during the initial, bloat, putrification, and dry phases of decomposition. In the lab, eight individuals of *Mus musculus* (17g-22g) and eight individuals of *Rattus norvegicus*(160g-220g), were randomly assigned to either insect exclusion or control (insects not excluded) containers with 1000g of pre-mixed soil. Insect exclusion containers were then covered with a spun-woven cotton mesh cover. For each size class of rodents, a control and exclusion container were placed into a stainless steel live animal trap (n=8) that was randomly assigned to one of the four decomposition stages. In a nearby flat, grassy field each trap was buried with specimens flush with the ground surface in plots about 6 m apart. Visual surveys (including photographs) of cages were made daily and insects on specimen or on mesh for each stage of decomposition were recorded. In the lab, adult insects found on the animal or in the soil were also recorded. Preliminary results suggest that more insects were associated with control mice and rats than excluded specimens. In addition, a more diverse assemblage and greater abundance of insects were found on large versus small rodents. Regardless of carrion access, or animal size, the putrification stage attracted the largest abundance and diversity of insects.

133 **Anthony Abbate, Joshua Campbell**

Parasitic beechdrops (*Epifagus virginiana*): A possible ant pollinated plant

High Point University, High Point, NC

Epifagus virginiana (Beechdrop) is an annual flowering plant that parasitizes beech tree roots. The pollination biology of the chasmogamous flowers of *E. virginiana* is unknown. In September 2011-2012 we observed insect visitors to *E. virginiana* flowers. Insect visitors included *Bombus impatiens*, *Crematogaster* spp. and *Prenolepis imparis*, but was dominated by *P. imparis*. In September 2012 we captured ants (*Crematogaster* and *P. imparis)* on *E. virginiana* flowers in three different areas found in the Coastal Plain and Piedmont physiographic provinces. With the use of 2,5-diphenyl tetrazolium bromide (MTT), we tested *E. virginiana* pollen from flowers and ant integuments for viability. We observed no significant difference (P> 0.05) between the viability of pollen taken directly from *E. virginiana* flowers and pollen removed from the ants. Our data suggests that *Epifagus virginiana* chasmogamous flowers may be ant dependent for cross-pollination and geitonogamy.

134 **Zachary J. Loughman**

Should I stay or should I go? Determining the movement patterns of male New River crayfish through use of telemetry

Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV

To better understand the daily activity and macrohabitat preference of male *Cambarus chasmodactylus* (New River Crayfish), a study was performed in Anthony Creek, Greenbrier County West Virginia utilizing radio telemetry. Nine 0.8 g transmitters were fitted to the chelae of *C. chasmodactylus* (6 IM/3 IIM) which were released at their initial point of capture. Animals were tracked for five consecutive days, after which a 20 day non-interaction period was initiated, followed by six additional days of tracking. Upon location of each individual, water depth, current velocity, substrate type, and distance travelled over the previous 24h were noted. Robinson et al.'s ephemeral home range concept applied to the majority of movement patterns indicating individual *C. chasmodactylus* have multiple home ranges over the course of their lives. Beginning in July, Form I males maintained more permanent territories under slab boulders, which was theorized to be behaviorally mediated by reproductive receptivity of females. Smaller males moved longer distances and more frequently than larger adults. Macrohabitats preferred by *C. chasmodactylus* were allied with moderate depths and

velocities and the presence of slab boulders. Adult *C. chasmodactylus* appear to be habitat specialists that utilize slab boulders exclusively as daily retreats. Results from this study exhibit the utility of telemetry as a means to determine macrohabitat and basic ecological data on crayfishes, which currently is lacking for this group of animals.

135 **Raquel Fagundo[1], Evan Lau[1], Nolan E. Joseph[1], Roger Thoma[4], Zachary Loughman[1]**

Taxonomic standing of *Cambarus sciotensis* (Teays River Crayfish) in West Virginia

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Cambarus sciotensis and *Cambarus angularis* are morphologically similar crayfishes, with *C. sciotensis* occurring in the Scioto, New, and Gauley river basins and *C. angularis* occurring in the Greater Tennessee River basin. The New and Gauley River systems of Virginia and West Virginia are known to contain populations of *C. sciotensis* that are morphologically distinct from the type population found in the Scioto River in Ohio. Survey efforts in 2009 discovered a new isolated population of *C. sciotensis* in West Virginia's Tug Fork (which neighbors the New and Clinch River basins) and these crayfish also appear morphologically distinct. To determine the taxonomic status of West Virginia populations, maximum likelihood phylogenetic analyses were performed on a dataset of Cytochrome Oxidase I (COI) sequences in order to compare Tug Fork and New River *C. sciotensis* to the type populations of both *C. sciotensis* and *C. angularis*. The resulting tree supports the Tug Fork (99%) and New River (82%) *C. sciotensis* populations as evolutionary significant units, but they were not distinct enough (< 5.0%) to be considered separate species. Morphologically, several characters have been identified that can differentiate each population, which only adds to the taxonomic confusion surrounding populations of *C. sciotensis* in West Virginia. Interestingly, the New River population was most closely related to the Scioto River population than to the geographically proximal Tug Fork population. This result lends further support to the hypothesis that *C. sciotensis* evolved in the preglacial Teays River prior to its invasion of the Scioto and New River.

136 **Mandy Pearson, Lori Tolley-Jordan**

The effects on insect exclusion and animal size on the stages of decomposition

Department of Biology, Jacksonville State University, Jacksonville, AL

Although the types and timing of insects found on decomposing carrion are well known, the effects of animal size or barriers preventing direct carrion access by insects on decomposition rates is unclear. In September 2012, we tested how the exclusion of insects from two size classes of rodents affected rates of the initial, bloat, putrification, and dry phases of decomposition. In the lab, eight individuals of Mus musculus (17g-22g) and eight individuals of Rattus norvegicus (160g-220g), were randomly assigned to either insect exclusion or control (insects not excluded) containers with 1000g of pre-mixed soil and a temperature logger. Containers in the exclusion treatment were then covered with a spun-woven cotton mesh. For each size class, a control and exclusion container were placed into a live animal trap (n=8) that was randomly assigned to one of the four decomposition stages. In a nearby field, each trap was buried with the rats flush with the ground surface in plots about 6 m apart. Upon reaching a set decomposition stage, each specimen was removed and frozen for further processing. Preliminary results showed that rodent size had little influence on decomposition rate. However, regardless of size, the exclusion of insects significantly slowed decomposition in each of the four stages similarly for both mice and rats. These results suggest that insect access to carrion significantly facilitates the process of decomposition in terrestrial animals.

137 **Travis D. Marsico[1], Matthew P. Hardin[2], Anastasia M. Woodard[2], Xiuzhen Huang[3]**

Comparison of gene expression profiles between a native cactus borer (*Melitara prodenialis*) and an invasive cactus borer (*Cactoblastis cactorum*) to assess unique responses to food source

[1] Department of Biological Sciences, Arkansas State University, State University, AR; [2] Molecular BioSciences Program, Arkansas State University, State University, AR; [3] Department of Computer Science, Arkansas State University, State University, AR

Gene expression studies are now available to ecologists researching non-model organisms. Through recent advances in gene sequencing technology, even organisms without annotated genomes can be investigated at the genomic scale. We are interested in understanding the similarities and categorical differences in gene expression between fed and unfed (i.e., neonate) larvae of an eastern North American native cactus borer (*Melitara prodenialis*) and a co-occurring invasive cactus borer (*Cactoblastis cactorum*). This research was initiated because our prior research showed that pricklypear host plants eaten by these insect species respond to the feeding in remarkably different ways: vigorous defense against feeding from *M. prodenialis* and no to little defense against *C. cactorum*. We hypothesized that these host plant defenses would cause the up-regulation of counter-defense genes when compared with larvae that had not fed. To begin exploring this hypothesis, we asked how similar *M. prodenialis* and *C. cactorum* are with respect to their gene expression profiles when larvae had not yet fed and when larvae had fed for up to two weeks on living *Opuntia humifusa* hosts. Illumina sequence data resulted in 238-368 million contigs for each of the four samples. Preliminary results presented include the outcome of transcriptome assembly using the software Bowtie. Additionally, we present the identification of functional classes of differentially expressed genes by aligning our sequence data to the annotated silkworm (*Bombyx mori*) genome. These results allow exploration of insect counter-defense responses to host plant defenses at a molecular level and will inform the design of future genomic studies.

138 **John T. Evans, Maynard H. Schaus, Jeffrey J. Illinik, Victor R. Townsend, Jr.**

Observations of leg injuries and wound healing in a Neotropical cosmetid harvestman

Department of Biology, Virginia Wesleyan College, Norfolk, VA

Many arachnids and insects employ leg autotomy as a secondary defense. In sclerosomatid harvestmen, self-amputation of the leg generally occurs at the trochanter-femoral joint, involves little or no loss of blood, and features rapid healing. In cosmetid harvestmen, leg autotomy has not been previously reported as an anti-predator defense. In Clarissa Falls, Belize during July 2012, we collected three adult male *Erginulus clavotibialis* that exhibited severe leg injuries, resulting in the loss of distal segments on leg IV (generally mid-femur or mid-tibia). These individuals were captured and observed for six days prior to preservation. To assess the impact of leg injuries upon locomotion, we measured walking speed of these individuals and compared them with walking speeds of uninjured conspecific adults. Although limited by our small sample size, our data revealed little or no impact of leg injures upon terrestrial locomotion. In Fall 2012, we dissected and removed the leg segments from all three specimens and examined them with scanning electron microscopy. Two individuals had fully formed scar tissue covering the injured region of the tibia or femur. We observed many setae growing on the end of the fully healed stub of one specimen. In the third individual, the injured leg region was covered in a scab, with a dense assortment of rod-shaped bacteria. This injury was caused by the mandible of an ant, which was observed during field collection.

139 **David A. Foltz II[1], Thomas G. Jones[1], Zachary J. Loughman[2]**

Life history and seasonal demography of *Cambarus cf. robustus* from the Twelvepole Watershed in West Virginia

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Crayfish are the third most endangered animal group globally behind freshwater snails and unionid mussels. A better understanding of each species' life history is vital to aid in crayfish conservation; however, little to no life history information is available for most crayfish. Recently, an undescribed member of the *Cambarus robustus* complex, *Cambarus (cf.) robustus*, was discovered in the Cumberland Mountains of West Virginia and Eastern Kentucky. In conjunction with the species description, life history data for *C.* (cf.) *robustus* was collected from May 2012 through April 2013 from two sites located within the Twelvepole watershed, Wayne County West Virginia. Reproductive and molt states along with morphometrics were recorded for all individuals, after which the majority of animals were returned to the stream. Monthly, 10-20 females along with any ovigerous individuals encountered carrying eggs/instars served to determine egg/instar complement number. Non-reproductive females were dissected in the laboratory to determine monthly gonadic development. Life history results for females indicated that mature females showed signs of glare in May. Egg extrusion was noted in early June, with instars occurring July through August, before becoming free living juveniles in September. Mature female TCL in this study ranged from 27.9-52.9mm. Ovigerous females averaged 159 eggs per clutch, with an average egg diameter of 2.66 mm. Form I males were collected throughout the year, and reached their highest densities during May through August. Form I male TCL ranged from 30.6-50.6mm. Age histograms using TCL length cohorts estimated life expectancy of *C. cf. robustus* at 5 years.

140 **Spencer Bell, Zachary Loughman**

Life history of *Orconectes obscurus* (Allegheny Crayfish) in northern West Virginia

Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV

Orconectes obscurus is common in West Virginia's northern and eastern panhandles and the greater Monongahela River system. Though common in West Virginia, *O. obscurus* is protected in neighboring Ohio and Maryland, and susceptible to eradication by invasive crayfishes. Understanding *O. obscurus* life history where it is not imperiled will assist conservation actions directed toward imperiled populations. Seasonal life history parameters were determined for *O. obscurus* in North Fork and Short Creeks, Ohio Co. West Virginia monthly from March 2012 through April 2013. Reproductive and molt states along with morphometrics were recorded for all individuals encountered. All ovigerous females were vouchered to determine egg/instar compliments. Each month 10-20 non-ovigerous females were dissected to determine monthly gonadic development. Form state frequency for males was determined monthly. Age histograms were created each month from total carapace lengths, and dominant size cohorts noted. Results indicated that at least four size cohorts were present within both populations monthly. Males enter winter aestivation as form I and molt to form II by the end of May, and molt back to form I in late July. Female egg compliment was positively correlated to total carapace length (r^2 = 0.87).Females deposited eggs beginning in late March and maintained instars through the end of May. Young of the year entered the population in late May and were capable of reproducing the following fall. Results of this study indicate that O. obscurus in northern West Virginia likely have a two year life span.

141 **Andrew Bentley**

Collaborative digitization workflows with Specify 6

Biodiversity Institute, University of Kansas, Lawrence, KS

The Specify Software Project supports more than 400 museum and herbarium collections with open source software and technical support services for digitizing and

mobilizing specimen data. Most collections utilizing Specify are repositories at universities or smaller colleges with holdings in the tens to hundreds of thousands of collection objects, but Specify also supports collections with over a million data records, as well as large multinational projects.Specify aligns with goals of the NSF ADBC Program, iDigBio HUB, and the Thematic Collection Networks to promote collaborative cataloging, by offering interfaces which can be individualized to local collection data workflows, as well as functions associated with collaborative data entry, duplicate specimen discovery, data reconciliation, and publishing records to species occurrence data aggregators.We will touch on Specify 6's capabilities for data entry, bulk data uploading and validation, as well as the integration of specimen images and labels into digitization workflows. We will nimbly show Specify technologies for image, label and OCR data archiving, duplicate data discovery and re-use (Scatter Gather Reconcile), and for data publishing. We will preview a new generation of Specify which moves specimen data management to the web. Finally, we will re-affirm our commitment to support curation and research with biological specimen data, and to collaborative development and co-ownership of open source software for biodiversity collections.

142 **Zack E. Murrell**

So many herbaria, so little time: Challenges and opportunities in biodiversity informatics

Department of Biology, Appalachian State University, Boone, NC

Major issues facing the museum informatics community are 1) the cost/benefit of obtaining specimen data from small collections and 2) the data quality needed to be useful to scientists. The SouthEast Regional Network of Expertise and Collections (SERNEC) was developed from the southeastern herbarium community. With six years of funding from the NSF Research Coordination Network program, we developed an inventory regarding the number, size, distribution and curatorial expertise of the 232 southeastern herbaria. We also organized curators, through workshops and symposia, to develop a community well-versed in current biodiversity informatics methods. We are now poised to address "dark data" and the "long tail of science", as we gather metadata and specimen data from smaller regional collections. Additionally, we are working to access the collective expertise of the regional curatorial community in order to accomplish the higher-end specimen processing of georeferencing and concept mapping. The goal of our efforts is to generate a research dataset at a fine scale, by accessing all the collections in the region, and at a scope that is large enough to address significant biogeographical, conservation and climate change questions. We face substantial challenges in this effort. We plan to meet these challenges by using tiered expertise of citizen scientists, students, and herbarium professionals, coupled with cutting-edge efficiencies in data acquisition, to generate high quality specimen metadata. Through these efforts, we intend to provide information to the greater museum community regarding the value of small collections and resident curatorial expertise to global biodiversity informatics efforts.

143 **Chris Dietrich[1], John Hart[2], David Raila[3], Umberto Ravaioli[4], Nahil Sobh[5], Omar Sobh[6], Chris Taylor[6]**

InvertNet: A new paradigm for digital access to invertebrate collections

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InvertNet, one of the three Thematic Collection Networks (TCNs) funded in the first round of the U.S. National Science Foundation's Advancing Digitization of Biological Collections (ADBC) program, is tasked with providing digital access to ~60 million specimens housed in 22 arthropod (primarily insect) collections at institutions distributed throughout the upper midwestern USA. The traditional workflow for insect collection digitization involves manually keying information from specimen labels into a database and attaching a unique identifier label to each specimen. This remains the dominant paradigm, despite some recent attempts to automate various steps in the

process using more advanced technologies. InvertNet aims to develop improved semi-automated, high-throughput workflows for digitizing and providing access to invertebrate collections that balance the need for speed and cost-effectiveness with long-term preservation of specimens and accuracy of data capture. The proposed workflows build on recent methods for digitizing and providing access to high-quality images of multiple specimens (e.g., entire drawers of pinned insects) simultaneously. Limitations of previous approaches are discussed and possible solutions are proposed that incorporate advanced imaging and 3-D reconstruction technologies. InvertNet couples efficient digitization workflows with a highly robust network infrastructure capable of managing massive amounts of image data and related metadata and delivering high-quality images, including interactive 3-D reconstructions in real time via the Internet.

144 **Kimberly Watson[1], Robert Naczi[2], Melissa Tulig[1], Randall Schuh[3], Katja Seltmann[3]**

Plants, herbivores, and parasitoids: Tri-trophic digitization strategies

[1] The William and Lynda Steere Herbarium, The New York Botanical Garden, Bronx, New York; [2] Institute for Systematic Botany, The New York Botanical Garden, Bronx, New York; [3] Division of Invertebrate Zoology, American Museum of Natural History, New York, NY

Integrated data on insect herbivores, their plant hosts, and their insect parasitoids are currently not accessible, nor are comprehensive data on their relationships available online. The primary goal of the Tri-Trophic Digitization TCN (Thematic Collections Network), funded in July 2011, is to digitize, integrate, and make accessible online ±4 million specimen records (±2 million de novo) representing three major groups of organisms from the North American biota: the phytophagous and economically important insect order Hemiptera, 20 of their target host plant families, and their insect parasitoids in the Hymenoptera. With the combined expertise and resources of 32 collaborating museums (14 herbaria and 18 entomological institutions), we are implementing streamlined workflows for specimen data capture, imaging, and georeferencing in order to maximize digitization efficiency. Complete insect specimen data is captured in a centralized database via a web portal hosted by the American Museum of Natural History, with representatives for each species imaged. Conversely, all herbarium specimens are imaged and minimal data captured initially, with remaining data captured later from the images through the use of OCR software, duplicate matching, or manual entry. All data and images will be made available through web portals including the TCN project website, GBIF, iDigBio, and Discover Life, the latter providing animal-plant data integration and mapping tools. By assembling and integrating data on geographic distributions, host associations, and phenologies, our tri-trophic approach will benefit a wide range of research questions and practical applications in such fields as agriculture, systematics, conservation, ecology, climate change studies, and biogeography.

145 **Hank Bart**

Efficiencies and challenges of organizing an ADBC TCN project on southeast freshwater macrofauna

Tulane University Biodiversity Research Institute, Belle Chasse, LA

This presentation reports on an effort that is underway to organize an ADBC TCN project on freshwater macrofauna of the southeastern US. The project would involve collections of fishes, crawfishes and aquatic mollusks at institutions in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Texas and Virginia. Digitization efforts would focus mainly on crawfishes and mollusks, as fish collections of the southeast are largely digitized and networked. The project would benefit from the availability of digitized and georeferenced SE fish collection localities and the locality matching features of GEOLocate's Collaborative Georeferencing Platform. The project will also benefit from records of SE macrofauna being digitized in other TCN projects (e.g., InvertNet). The resulting integrated resource on freshwater macrofauna of the southeast would be used to explore the biotic impacts of river modification. However, the project is not without challenges. A number of the collections lack permanent curators, a situation that poses issues for institutional leadership. An approach to the project is presented that capitalizes on the efficiencies and attempts to address the challenges.

146 **Jennifer T. Thomas**

Collaborative learning in biology: a sexually transmitted disease seminar for non-majors

Biology Department, Belmont University, Nashville, TN

As part of Belmont University's general education program, students take a seminarin their junior year that focuses on developing collaboration and problemsolving skills in an area outside of their major. Students work in teams to complete projectsand share the results of their collaborative efforts in a manner that isreflective of the discipline. I have hadthe opportunity to develop a three hour, non-laboratory course in my areas ofexpertise, sexually transmitted diseases (STDs). Because this course lacks a laboratorycomponent, the theme for the course is public education as a wayfor students to think about how biologists approach the problem of STDs outsideof the laboratory. Basic biology contentis a foundation for the course, including themes in biology, an understandingof the reproductive system, and a fundamental study of microbiology. In addition, we examine the biology of eachof the microorganisms associated with STDs and the clinical outcomes ofinfection. In an effort to make thematerial more relevant, I have also integrated discussions of popular media's reportingof the STD literature, the impact of culture on transmission and treatment ofSTDs, as well as an examination of sex education practices. In this presentation, I will discuss thestructure of the class, the texts used, and the reward of observing studentsdevelop and execute projects ranging from student surveys to sex education curriculumdevelopment.

147 **Chris Barton[1], Kacie Hittel[2]**

Learning community courses: bridging the gap across disciplines

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As an undergraduate, students are engaged in a plethora of courses, many of which may seem quite different from each other with regards to the concepts learned from courses and educators across collegiate disciplines. As science educators, one of the challenges we face is teaching students to integrate and apply core scientific concepts from our courses in other, seemingly different, disciplines. At Belmont University, we are confronting this challenge with "Learning Community Courses," or "Linked Cohort" courses that are part of our first year core curriculum. During this first year, students are concurrently enrolled in I) an Introductory Biology course and II) a "linked" course from another discipline, both of which stress core concepts from their respective disciplines while focusing on a core theme of study. Through this experience, students are learning core biological concepts and skills and applying these tools in order to gain a better, more thorough, understanding of different disciplines. This "linked" curriculum is allowing students to bridge the perceived gap between multiple departments while, more importantly, allowing intracollegiate faculty the opportunity to interact and collaboratively educate our undergraduates. As one example, I will present ideas from a "linked" cohort of Introductory Biology and an English literature course, *Reading Biology in Literature*. Through this link, students are learning basic biological concepts and using these ideas to gain a better, more thorough, understanding of selected literary works.

148 **Darlene Panvini**

Tree tours, photo books, and arboretum adventures

Department of Biology, Belmont University, Nashville, TN

Current efforts to reform undergraduate biology education focus on interactive classrooms that promote cooperation and collaboration while allowing students to engage in relevant biological inquiry. The AAAS *Call to Action* also encourages learning opportunities that "convey the wonder of the natural world and the passion and curiosity of scientists." An arboretum project for a botany course with a service learning component exemplifies these goals. The ongoing arboretum project has provided students with opportunities to inventory trees, collect and catalog herbarium tree specimens, and develop tools to educate about the importance of trees and arboreta. Products of their educational outreach included a campus tour, informational audio files, a photo poetry book, and a booklet for children and parents

to learn about trees. Student reflections, as well as informal and formal assessments of the project, indicate that key learning goals were met. Campus recognition brought positive attention to the work of students and faculty engaged in the project. Details of the project will be shared, including the process of applying for arboretum status, assessment of student work, and relevancy to national biology education reform efforts.

149 **Claudia L. Jolls[1], Ronald V. Preston[2], Rose Sinicrope[2], Frank E. Crawley[2], Anthony D. Thompson[2], Heather D. Vance-Chalcraft[1]**

ECU Noyce Scholars: recruiting STEM majors into public education

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The East Carolina University (ECU) Noyce Scholars program, supported by the National Science Foundation, recruits mathematics and science majors and supports their development as highly-qualified teachers of high school mathematics and science. ECU's program is one of several hundred programs nationally. Scholars enroll in either a Master of Arts in Teaching (MAT) program for one year or the last two years of an undergraduate program in mathematics or science education. Noyce Scholars receive 1-2 yr of scholarship support in exchange for teaching in a high needs school district upon graduation and certification. By the second full year of the program, we have recruited 33 ECU Noyce Scholars, most in mathematics (42%) and in biology (33%). It is a challenge to recruit STEM undergraduate students into mathematics or science teaching. While most of our Noyce Scholars decided on a career in teaching before or shortly after enrolling in college, the MAT program also successfully attracts STEM majors. The ECU Noyce program has attracted "career changers" into teaching (33%), largely from biology (9 of 11 or 82%). Extensive recruiting efforts result in few applications, yet we see high acceptance, funding and job placement rates of our applicants in high needs schools. Surveyed Noyce Scholars express interest in "doing more" within mathematics and science education—something beyond course work, including research. Lessons learned include the importance of logistics and effective collaborations across campus and K-20 education networks. Induction and mentoring are key to the successful recruitment, retention and success of Noyce Scholars.

150 **Roger Sauterer**

Introducing column chromatography in the classroom by a simple and inexpensive lab exercise.

Department of Biology, Jacksonville State University, Jacksonville, AL

Column chromatography is an important method for the purification of biological molecules but is often underemphasized in instructional labs in favor of molecular genetics exercises. A simple exercise involving gel filtration chromatography using small plastic columns and colored molecules introduces basic concepts of column chromatography to students and fits in a two to four hour lab. Unlike commercially available chromatography experiments,this exercise is both inexpensive and gives students experience in pouring the column, loading samples, generating an elution profile and calibrating the column. This exercise requires only visible light spectrometers, re-usable columns, and relatively inexpensive colored molecules. The column is assembled from a 1 x 20 cm plastic column, with a bed support, column extender and valve. Students assemble the column, pour and pack the column bed of Sephadex G-100, load a sample of cytochrome C, catasase and Blue Dextran, then elute the column, measuring elution volumes by drops. Using a spectrophotometer, they generate an elution profile and then a molecular weight v. elution volume calibration curve. In 3 - 4 hour labs, students can then run an unknown protein such as hemoglobin on their calibrated column and obtain a crude native molecular weight for their unknown. Therefore in a single lab, students experience a complete chromatography experiment from column preparation to data collection and analysis.

151 **Holland M. Hedrick, Devin L. Carter, C. Brian Odom**

Mendel's Dice: A simple method for simulating genetic crosses

Department of Biology, Wingate University, Wingate, NC

Traditionally, Mendelian principles have been demonstrated in genetics laboratories by either using *Drosophila melanogaster* crosses or, more often today, by the flipping of coins. Drosophila use requires tremendous amounts of preparatory work; maintaining stock, collecting virgins for crosses, etc. It is also difficult (or practically impossible) to demonstrate each mode of Mendelian inheritance using the strains normally employed for teaching purposes. Coin flipping, while easy to perform, requires multiple coins to be flipped for more complex genotypes and has the problem of trying to represent homozygotes with a traditional two-sided coin. Also, how many coins can a student flip simultaneously? This leads to long, often tedious periods of collecting "data" when large numbers of offspring are to be "collected" for a single cross. A method will be presented, using modified six-sided dice, which will generate simultaneous data for multiple allelic pairs representing virtually any combination of inheritance patterns. Additionally this method can generate relatively large data sets (genotypes) in a short amount of time, making it an ideal simulation for use in both major and non-major laboratory exercises.

152 **Jennifer S. Borgo, M. Valeria Avanzato, Paula S. Bailey, Joseph E. Flaherty**

The evolution of a biology capstone seminar

Department of Science and Mathematics, Coker College, Hartsville, SC

Coker College is a small comprehensive college with a liberal arts core that focuses on the development of skills in analytical thinking, public speaking, and writing. The capstone sequence of the biology major at Coker puts heavy emphasis on those skills through a three semester series of seminar courses. The end result is a 45-50 minute presentation and written thesis on a topic of current research in the biological sciences. Preparation for "Senior Seminar" is very time consuming for both faculty and students, but the improvements we see in our students' abilities to thrive after Coker outweigh the cost. We are constantly reevaluating the capstone to improve our outcomes and increase the preparedness of our students. This talk will explain the basic set-up of our seminar series, how we have changed it over the past five years, and what those changes have meant as far as student outcomes. We are constantly reevaluating our seminar series and anticipate further changes will be necessary to continue meeting the ever changing needs of our students.

153 **Andrew N. Ash[1], Lacey D. Huffling[2], Terry M. Tomasek[3], Ann B. Somers[2]**

A demographic analysis of participants at The Herp Project HREs (Year 1, 2012)

[1] UNC Pembroke; [2] UNC Greensboro; [3] Elon University

The HERP Project (Herpetological Education in Rural Places and Spaces, THP), funded by the National Science Foundation, is a collaboration between UNC Greensboro, Elon University and UNC Pembroke providing informal herpetological educational opportunities to underserved demographic groups in North Carolina. Our target audience is rural, ethnically diverse populations who are often marginalized in the sciences. THP provides a coherent curriculum of four integrated programs: Herpetological Research Experiences (HREs), Celebrations, the Cyberhub and Studies. The three HREs are curriculum centerpieces involving summer residential herpetological research experiences for high school-aged participants and selected high school teachers that emphasize herp natural history and science. Attendees capture, mark, measure and release reptiles and amphibians in their native environments. Hopefully, HRE participants become more aware of herpetological diversity, lifestyles and habitats, and more desirous of protecting and preserving herps and herp habitats. Teachers are encouraged to incorporate practical activities of HREs into their classrooms. As THP targets underserved minorities, project leadership felt it was important to critically assess the demographics of the three HREs presented in summer 2012 to ensure that our target audience was reached. Results of that analysis are presented here. Demographic assessment criteria included: gender, public school grade, ethnicity, and income level. Our findings

suggest that broad target goals for identifying and enrolling minorities in the 2012 HREs were met, but that further fine tuning of enrollment might be necessary to even out the presence of the various underrepresented groups between HREs for 2013.

154 **Jennifer T. Thomas, Nick Ragsdale, Darlene Panvini**

Integrating undergraduate research into a biology curriculum

Biology Department, Belmont University, Nashville, TN

Undergraduate research (UGR) inthe sciences is arguably one of the most engaging and transforming forms oflearning and teaching. Students canexperience the scientific process from developing questions to data collectionand analysis. Moreover, it encourages dissemination of information throughposter and oral presentations, a common learning goal for science programs. The sustained nature of undergraduateresearch allows for connections to be made and results in commitment to thework not typically found in traditional courses and labs. The ability to integrate undergraduateresearch into the curriculum emphasizes the value of the experience, while facilitatingstudent mentoring and supporting faculty professional development. At Belmont, we have developed such anundergraduate research program consisting of courses over three semesters for atotal of 5 credit hours. Undergraduateresearch has been a requirement for all of our biology majors since 2004; weare in our 6th year of the program in its current form. We will discuss the history of the program,the sequence of courses, challenges such as workload issues, and stories ofsuccess.

155 **Joseph Flaherty**

Science Twitteracy at Coker College: Incorporating Twitter in biology courses to enhance student engagement and learning

Department of Science and Mathematics, Coker College, Hartsville, SC

Twitter has become one of the most widely adopted tools to share information across a global network, with over 500 million users posting 340 million tweets per day. Accordingly, scholars in higher education have sought to apply this technology to the classroom setting (Chamberlain and Lehman, 2011; Greenhow and Gleason, 2012). In the fall and spring semesters of 2012 and 2013 at Coker College (Hartsville, SC), a Twitter-based assignment was implemented into six courses, including a first-year experience course, a freshman biology lab, a non-majors biology course, and an advanced biochemistry course. Students were required to tweet at least four times per week: a question related to class discussion, an answer to another student's posted question, a hyperlink to an article related to class discussion, and a relevant re-tweet of an entity outside of the class. Tweets were evaluated weekly using a rubric and all tweets, including evaluation scores, were accessible via a shared document (maintained on a cloud environment). Students (n=100) reported a variety of positive impacts related to the Twitter assignment. For example, 92% of students surveyed viewed the Twitter assignment helped increase their overall classroom performance and 63% would recommend the course to other students because of the Twitter assignment. Comparisons of student performance metrics support many of the indirect measures. This presentation will focus on my experiences developing, managing, and analyzing various aspects of the Twitter assignments and associated assessment measures during this academic year.

156 **Michael Erwin, Judy Awong-Taylor, Latanya Hammonds-Odie**

Introducing research skills into the introductory biology curriculum

School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA

The School of Science and Technology at Georgia Gwinnett College recently implemented an initiative to enhance STEM instruction and STEM education by implementing a 4-year Undergraduate Research Experience (4-yr URE) for all SST students. In addition to the traditional junior and senior-level research opportunities, we also wanted to introduce systemic investigation and authentic research experiences much earlier in a student's educational career. As part of this initiative, modules of the introductory biology lab curriculum were modified to include opportunities for students to experience the processes of science and to develop basic research skills (communication, quantitative reasoning, critical thinking, collaboration, creativity). The new modules included traditional micro-pipetting

techniques, gel preparation, gel electrophoresis, DNA restriction digestion, and DNA restriction mapping procedures, but were designed to be research-based and taught with an inquiry-based approach. Preliminary analysis of content assessment data indicates an increase between pre- and post-content assessment for STEM sections compared to control sections. For questions related to the micropipetting and DNA modules, both STEM and control groups indicated a significant improvement in confidence levels between pre and post surveys. We observed improvements in students' ability to incorporate new skill sets and utilize information from previous lab experiments to interpret new results. Students also operated more efficiently as a group and gained confidence in their ability to perform molecular experiments with modern lab techniques and equipment.

157 **Christopher G. Brown**

Hands-on microevolution activity for lab or classroom

School of Science and Technology, Georgia Gwinnett College, Lawrenceville, Georgia

Evolution is one of the most fundamental explanatory forces in biology, yet it is often the most misunderstood by a general audience, including freshmen and sophomore students. Evolution at its simplest (i.e., microevolution) can be defined as a change in allele frequencies in a population over generations. Allele frequencies can be changed by five mechanisms, known as the assumptions of Hardy-Weinberg; mutation, gene flow, nonrandom mating, natural selection, and genetic drift. I have designed a hands-on lab that can easily be performed in a non-lab classroom that allows students to see the effects of four of these mechanisms on allele frequency changes. Using beads and very specific instructions, students are shown that mutations change allele frequencies but not much, gene flow makes populations more similar, natural selection depends on the environment, and how population size and initial allele frequency affects genetic drift.

158 **Charles N. Horn**

The genus *Rhododendron* (Ericaceae) in South Carolina

Department of Biology, Newberry College

Eleven species of the *Rhododendron* are known to be native to South Carolina. These species are relatively easy to identify when in flower. However, vegetative and fruiting specimens have been difficult to identify. Through a study of herbariummaterial and field trips, an attempt was made to produce two seasonal taxonomic keys based on morphological features. The spring key allows for flowering or budding material to be identified through features of sepal pubescence and corolla shape, pubescence and color. The fall key emphasizes leaf surface pubescence patterns and floral bud surface pubescence and margin features. Challenges were encountered in developing the fall key in that species pairs such as *Rh. eastmanii* and *Rh. calendulaceum* (that are easily distinguished in flower) are extremely difficult to separate in fruit. Geographicaldistribution may work to separate these species, but the concern of transplanted individuals and missed disjuncts have created problems. Further, concerns arose over the dogma that some species, such as *Rh. canescens* and *Rh. periclymenoides*, flower before or as leaves develop. It was realized that much variation occurs within and between populations.

159 **Bruce A. Sorrie**

Bigger is Better? -- One-square-kilometer vegetation plots in central North Carolina

NC Natural Heritage Program and UNC Herbarium, Chapel Hill, NC

Vegetation sampling in North America has been based primarily on 20x50 meter plots. What can a much larger plot size say about local biodiversity and floristics? Vegetation was sampled in three plots of 1 square km (100 ha, 250 acres), two in the North Carolina Sandhills and one in the adjacent Piedmont. Vascular plant taxa were recorded during a minimum of five visits spanning several annual growing seasons. Native species totals were: Sandhills Game Land-409; Fort Bragg Terraces-496; Pee Dee Gabbro Slopes-401. Using Sorensen's Index, comparing SGL to FBT gave a similarity value of 0.66; comparing FBT to PDGS gave a value of 0.31; comparing SGL to PDGS gave a value of 0.16. Although both in the Sandhills physiographic region, SGL and FBT differed largely due to the Little River which provides habitat for

many Piedmont species on FBT. Despite being only 24 km apart, SGL is highly dissimilar to PDGS, which is in the Piedmont physiographic region. SGL supports 32% of Richmond County's native flora; FBT supports 49.5% of Hoke County's native flora; PDGS supports 31.4% of Richmond County's native flora.

160 **Sarah Marie Noble, Steven D. Carey**

Survey of the calcicolous bryoflora of south Alabama and south Mississippi.

Department of Natural Sciences, University of Mobile, Mobile, AL

Bryophytes were collected, over the course of thirty-six months, from twenty-one sites within the Lime Hills physiographic region of south Alabama and south Mississippi. Sites ranged in substrate moisture level from fully aquatic, to relatively dry. Light levels ranged from full sun to the twilight zone of caves. Collections were identified to species and the primary bryofloristic components of each collection were recorded. Mosses, leafy liverworts, thalloid liverworts, and hornworts were present at all sites. Thalloid liverworts are dominant by amount of surface coverage, and mosses by number of taxa. Assemblages of the most common taxa were also delineated.

161 **Brad R. Ruhfel[1], Matthew A. Gitzendanner[2], Pamela S. Soltis[3], Douglas E. Soltis[2], J. Gordon Burleigh[2]**

Inferring the phylogeny of green plants (Viridiplantae) using coding data from the plastid genome

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The rise of next-generation sequencing has produced a wealth of plastid genome data from an increasingly diverse set of taxa. Although these data have been useful for reconstructing the phylogeny of numerous clades of photosynthetic organisms (e.g., angiosperms, algae, and gymnosperms), their usefulness for inferring relationships across green plants (Viridiplantae) is unknown. Viridiplantae originated 700-1500 million years ago and contain an immense diversity of lifeforms, including some of the smallest and largest eukaryotes. Here we explore the limits and challenges of inferring a comprehensive green plant phylogeny from plastid genome data. We analyzed protein coding data from 360 taxa with complete or near complete plastid genome data available from GenBank. Our analyses recover well-supported backbone relationships across the clade and reveal relationships that were not observed in previous analyses of subclades of Viridiplantae. However, very long branches, extreme rate heterogeneity, and base composition biases can influence the results, and we obtained strongly supported, conflicting results due to the use of nucleotide or amino acid characters. We highlight the challenges of using plastid genome data in deep-level phylogenomic analyses and provide a conceptual and phylogenetic framework for future analyses that will likely incorporate plastid genome data for thousands of species.

162 **J. M. Herr, Jr., Erika Balogh**

The Hydro-microtome: A modification for sectioning leaves.

Department of Biological Sciences, University of South Carolina, Columbia, SC

The original hydro-microtome was designed for sectioning stems and roots. The modification for sectioning leaves requires attachment of a flat stage to the original stage. The flat stage has a central channel that extends to the aperture and through which the leaf specimen can be advanced so to extend a section thickness beyond the cutting surface. As with the original instrument, section thickness is determined by use of a special gage that consists of a standard glass slide onto which strips of thick to thin aluminum foil are attached on either side of a central space. The gage is placed against the surface over which the cutting blade will pass, and the leaf specimen is advanced forward to contact the central space Thus, the thickness of the section is equal to the thickness of the side mounts. Throughout the operation, the leaf specimen is held rigidly in place by the sides of the channel and by a flat metal cover placed over it. The leaf specimen is sandwiched between the flat stage and the flat metal cover. Leaf cross sections from *Coleus blumei* Benth. *Sinningia sellovii* (C. Mart.) Wiehler, *Ruellia strepens* L., *Arundo donax* L., *Kalanchoe daigremontiana* Raym.-Hamet & H. Perrier and *Ligustrum japonicum* Thunb. serve to illustrate the

application of this modified instrument and are less subject to distortion than those produced by other methods.

163 **Emily Gillespie[1], Kathleen Kron[2]**

Toward a robust phylogeny of *Rhododendron*

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Rhododendron L. is comprised of approximately 1,000 species of shrubs and trees in the Ericaceae. *Rhododendron* is divided into eight subgenera, which represent formerly recognized genera such as *Azalea*, *Hymenanthes* and *Tsutsusi*. Flowers of rhododendrons are generally slightly zygomorphic but vary in color and stamen number. The presence of abaxial scales and/or structurally complex hairs has been the basis for classifications at the subgeneric level. *Rhododendron* is distributed nearly worldwide, with centers of diversity in the Malay Archipelago, the Himalayas, and to a lesser extent the southeastern United States. The large size and widespread distribution of the group have made it difficult to amass the necessary quantity of data to generate a strongly-supported phylogeny. Work has been done routinely within subgenera and sections. The purpose of the current study is to compile all available data for *Rhododendron* and to ascertain the remaining obstacles to generating a solid phylogeny for use in downstream studies. Currently, some of the major challenges include resolving short branches at the base of the phylogeny and sampling enough taxa within larger groups to evaluate monophyly of various lineages within *Rhododendron*. Here, we discuss the current state of the *Rhododendron* data set and phylogeny, and identify priorities for further improvement in the near future.

164 **Ronald L. Jones[1], B. Eugene Wofford[2]**

New book on the woody plants of Kentucky and Tennessee

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A new book on the woody plants of Kentucky and Tennessee is scheduled to be published in Fall, 2013 by the University Press of Kentucky. The book is titled "Winter Guide to the Woody Plants of Kentucky and Tennessee." This book represents the first attempt to treat the woody plants of the two-state region, and is based on over 5 years of research and writing. It will include accounts of 172 genera (142 native and 30 non-native) and 457 species and lesser taxa (381 native and 76 non-native). Of the 76 non-native woody species, about 40 are listed by the state exotic plant councils. Of the rare woody plants known from 6 or fewer counties, 5 are known from KY only, 35 from TN only, and 7 from KY and TN. The book includes sequential sets of keys—key to keys, keys to genera, and keys to species, all based on winter features of bark, twig, leaf, and fruit. Detailed generic descriptions are provided, and the species accounts include information on distribution, rarity, invasiveness status, and wetland status, as well as the uses of the species for food, medicine, fiber, and weapons. The book also includes 55 color images of vegetative and reproductive features, and 630 color images encompassing about 90% of the species covered in the text. The book is aimed at those with interests in woody plant identification, as well as those desiring to learn more about the practical uses of wild plants in winter.

165 **Kathy Hornberger**

Collections at local science museum reveal connections to 19th century explorer, Ferdinand V. Hayden.

Environmental Community Outreach, Widener University, Chester, PA

The Delaware County Institute of Science was founded in 1833 by five local men interested in natural history. For several of them, botany was a passion that resulted in the development of a herbarium, to which specimens were added throughout the 19th century. Reorganization of this herbarium for better access of specimens has revealed forgotten collections of plants from the Colorado and Wyoming Territories made by several Institute members and associates during the 1860s-70s. Their names are cited along with other contributors in the 1874 government publication *Flora of Colorado* (Porter & Coulter), based on collections from Hayden Expeditions to the Western Territories. These herbarium specimens are accompanied by other artifacts housed at DCIS from Hayden Expeditions including 40 photographs from

Colorado and the Yellowstone region, as well as Native American pottery fragments from the Southwest. While none of these materials are priceless, their presence in the Institute and subsequent appreciation of their origin has increased our knowledge about several local residents and their contributions to the national understanding of the natural history of the West.

166 **Mac H. Alford, S. Brittany Singley**

Flora of the Gopher Farm Sandhill, Wayne County, Mississippi

Department of Biological Sciences, University of Southern Mississippi, Hattiesburg, MS

A survey of the vascular plants and common bryophytes and lichens of the Gopher Farm sandhill, Wayne County, Mississippi, was undertaken in 2011 and 2012. The Gopher Farm sandhill is located within the Chickasawhay Ranger District of the DeSoto National Forest and is one of the most northerly located sandhills in the Coastal Plain of Mississippi. Unlike the sandhills of the Carolinas and Georgia, the sandhills of Mississippi are rather patchy, poorly studied, and commonly mapped incorrectly. The sandhill was surveyed 13 times from the spring of 2011 to the fall of 2012. The survey resulted in 182 species, including 15 lichens, 2 mosses, 1 fern, 2 conifers, and 162 flowering plants. Collections included several rare species (e.g., *Carex tenax*, *Rhynchospora megalocarpa*) and new range extensions.

167 **Hayden L. Shafer, Mark S. Schorr, Margaret J. Kovach, Joey Shaw**

Whole genome chloroplast variability and implications for low level phylogenetic or phylogeographic inference

Department of Biological and Environmental Sciences, University of Tennessee - Chattanooga, Chattanooga, TNN

Noncoding chloroplast DNA sequences are valuable sources of information when developing plant phylogeographic or phylogenetic studies. This research follows up on previously published papers (Shaw et al. -2005, 2007), which sought to identify variable regions of noncoding DNA in the chloroplast genome. The 2005 study showed that different non-coding regions of the chloroplast genome accumulated mutations at different rates, and the rates were fairly consistent across the phylogenetic breadth of angiosperms. The 2007 paper, sought to identify any previously unstudied regions of the genome that might have been more variable than any of the former study. At that time, only three related species pairs' genomes were available from GenBank, and these were used as replicates to screen the genome for potential variable regions. The 2007 study identified 13 regions that were more variable than any formerly studied. Since the 2007 study, 131 new chloroplast genomes have been published to GenBank, providing data to test the inferences of the former studies. Our present project includes 17 congener pairs of species that represent all of the major angiosperm lineages. By aligning the entire genomes of each pair, we were able to compare the variability of all noncoding regions across all major lineages of angiosperms. In addition to comparing each noncoding region separately, we have also compared 42 2000-bp sections of the genome using a sliding window approach. The ultimate goal of this research is to finally determine which is the most variable region of the chloroplast genome.

168 **Hayden L. Shafer, Mark S. Schorr, Margaret Kovach, Joey Shaw**

Chloroplast DNA sequence utility for the inference of low-level phylogenetic or phylogeographic studies among plants

Department of Biological and Environmental Sciences, University of Tennessee - Chattanooga, Chattanooga, TN

Noncoding DNA sequences from the chloroplast genome are valuable sources of information when developing plant phylogeographic or phylogenetic studies. Historically, it was believed that the chloroplast genome lacked variation enough to infer infraspecific relationships. This project is a follow up on two previously published papers (Shaw et al. 2005, 2007), which sought to identify highly variable regions of non-coding DNA in chloroplast genomes. At the time of the former studies, there were few published whole chloroplast genome sequences; the 2005 study was based only on 21 gene regions that had previously been used by researchers, and the latter,

2007 paper, was based on comparing the entire chloroplast genomes of three pairs of species. Both papers indicated that rate heterogeneity exists among noncoding chloroplast DNA regions. Since the 2007 study, 131 new chloroplast genomes have been published to GenBank, providing new research opportunities to continue the above mentioned studies. Our present project adds broader statistical support for the previous studies by including 17 new plant species pairs that are representative of the major angiosperm lineages. By comparatively aligning these congener species pairs, we have analyzed all noncoding regions of the small single copy and large single copy sections of the chloroplast genome for their difference in mutational variability. Our data provides a list of the top 10 most variable noncoding regions for each of the 17 congener pairs, as well as the overall most variable noncoding intergenic spacers of the chloroplast genome. Additionally, we have developed 42 series of 2000 base pair sliding gene windows, which illustrate the areas of the chloroplast genome that are most variable. The purpose of these analyses is to finally determine which is the most variable non-coding region of the chloroplast genome.

169 **Alyssa L. Teat[1], Howard S. Neufeld[1], Eva Gonzales[2], Ronald J. Gehl[3]**

Biochar increases biomass in *Miscanthus* × *giganteus* under drought conditions

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Miscanthus × *giganteus* has emerged as a potential high-yield biofuel crop due to its ability to grow in marginal soils. However, water availability is reported as a limiting factor worldwide for biofuel crop production and drought conditions can significantly decrease productivity in *M. giganteus*. One possibility to alleviate drought stress is to improve the water status of soils with biochar soil amendment, a black carbon compound with the ability to sequester CO_2 in the soil. A greenhouse study was conducted to test the effect of biochar on drought responses of *M. giganteus* using two treatments, water stress and biochar amendment.Biochar was added at a rate of 15 t ha^{-1} to 8 replicate pots per treatment combination and plants were grown for 100 days before taking measurements. Although water potential between biochar-amended and soil-only grown plants was not significantly different, plants grown in biochar under drought conditions had significantly greater total aboveground biomass and significantly lower specific leaf weight. Droughted plants also exhibited a lower efficiency of photosystem II, indicated by lower chlorophyll fluorescence, yet photosynthetic rates remained high (15 µmol m^{-2} s^{-1}) for biochar-grown plants. These positive effects were likely caused by an increase in soil water status due to the highly porous nature of biochar. Utilization of biochar when growing *M. giganteus* could increase competitiveness of biofuel production by improving crop yields in drought conditions, while also sequestering CO_2 to mitigate rising greenhouse gas concentrations.

170 **Benjamin Hagen[1], Benjamin Rausch[1], Richard Phillips[1], Kristin Cline[2]**

The effects of 4,4'-DDE egg accumulation on kingsnake (*Lampropeltis mexicana*) embryo development and egg shell thickness

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Polychlorinated biphenyl (PCB) pesticides exhibit toxic, bioaccumulative, semi-volatile, and persistent properties and are of considerable environmental concern. Several studies have investigated the impacts of PCBs in bird species and their eggs, but few have examined their effects in reptiles. Previous studies have shown that pesticides can penetrate reptile eggs, therefore exposing developing embryos to these chemicals. To investigate the effect of PCBs in reptile development, kingsnake eggs were incubated in moss contaminated with either 0 ppm (n=10), 10 ppm (n=10), or 30 ppm (n=10) 4,4'-dichlorodiphenyldichoroethylene (4,4'-DDE) for 0, 10, 20, 30, and 40 days. Eggs were removed from the treatments at designated time intervals and frozen at 3-4°C for later analysis. Photographs of each embryo and corresponding eggshell thickness measurements were evaluated using microscopy. Solid phase extraction coupled with gas chromatography-mass spectrometry was utilized to determine internal 4,4'-DDE concentrations. Trace concentrations of 4,4'-

DDE were found in both 10 ppm and 30 ppm treatments, but only the eggs exposed to 30 ppm for 40 days and 10 ppm for 30 days contained quantifiable internal concentrations, 3.7±2.5 ppm and 1.4±0.6 ppm, respectively. The concentrations of 4,4'-DDE tested did not induce any changes in eggshell thickness (x_{10ppm}=0.171378, x_{30ppm}=0.171193, x_{cont}=0.179753), but regardless of treatment, the eggshells thinned over time (x_0=0.219462, x_{10}=0.165120, x_{20}=0.188857, x_{30}=0.173680, x_{40}=0.123420). Our results suggest that although 4,4'-DDE penetrated into the egg, the internal concentration did not induce any developmental deformities or effect the physiology of the egg.

171 **Z. Carter Berry, William K. Smith**

Utilization of fog water through foliar water uptake: a unique strategy in southern appalachian spruce-fir cloud forests

Wake Forest University

Ecosystems where the plant community experiences cloud immersion occur worldwide and often act as first responders to climate change. Recent work in areas that experience frequent cloud immersion has suggested that water deposition on leaves can be directly absorbed during these events. The high elevation spruce-fir communities of the southern Appalachian Mountains are considered endangered, endemic, and relic boreal forests that may persist due to frequent cloud immersion (~60%). Our study provides the first examination of foliar water uptake in the southern Appalachians and demonstrates that this is a strategy during cloud immersion events. We compared the changes in foliar water capacity, xylem water potentials, and the stable isotope value for plants before and after a 24 h period of cloud immersion. The changes were compared against control plants which experienced no cloud immersion. Both species in these forests (Red Spruce and Fraser Fir) exhibited foliar uptake ability contributing 3-7% of total leaf water content. Changes in stable isotope values moved directionally towards the signature of the cloud mist and were significantly greater than controls. Water potentials significantly improved in cloud-immersed plants over control plants demonstrating that foliar uptake improved overall plant water status. These results demonstrate that foliar water uptake is a strategy for utilizing cloud water and improving overall plant health. With climate models predicting less frequent clouds with higher cloud ceilings, the survival of these relic forests that utilize cloud immersion for improved water status and carbon gain could depend on the magnitude of future changes to cloud regimes.

172 **Sheri A. Shiflett[1], Julie C. Zinnert[2], Donald R. Young[1]**

Physiology of *Myrica cerifera* is conserved across a barrier island chrono-sequence of shrub thicket development: a mechanism of shrub expansion

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Woody encroachment into grasslands is emerging as a key issue in the study of global change. While many studies have documented the causes of encroachment (e.g., fire suppression, reduced grazing, rising atmospheric CO_2 concentrations), few address unique morphological and physiological mechanisms leading to woody expansion. Myrica cerifera, an evergreen N-fixer, is the dominant shrub on many barrier islands of the southeastern United States. It has expanded its cover by up to ~400 % on Hog Island, Virginia in the past 50 years. Accretion of the northern end of the island has resulted in a chronosequence (i.e., space for time substitution) of both soil age and shrub thicket development. We investigated morphological and physiological parameters related to light capture, processing and water balance of M. cerifera across shrub thickets of four age classes from ~10 - ~50 yrs. We hypothesized that light harvesting capabilities and hydraulic capacity would bereduced with thicket age. Variation in morphology (i.e., leaf thickness, leaf area) and structure (i.e. leaf angle) related to light capture was observed. Yet, little or no differences were observed in photosynthetic pigments, electron transport rate (ETR) and hydraulic conductivity across sites. Previous research has shown declines in leaf nitrogen content, productivity and leaf litter production across the chronosequence. In contrast, physiology remains consistent despite considerable differences in thicket age and development. Myrica cerifera maintains high photosynthetic and hydraulic efficiency, factors which enable maintenance and expansion of shrub thickets.

173 **Stephen M. Via[1], Julie C. Zinnert[2], Donald R. Young[3]**

Physiological responses of *Morella cerifera* to varying concentrations of explosive soil contamination

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Considerable research has focused on 1,3,5-trinitroperhydro-1,3,5-triazine (RDX) and 2,4,6-trinitrotoluene (TNT) soil contamination effects on plants. Most studies have used individual compounds, despite compound mixtures being more realistic, and study plants have seldom been native species. Composition B (CompB) is the most common munitions mixture used globally, containing both RDX and TNT. For our study physiological responses ofa native coastal shrub, *Morella cerifera,* were quantified relative to soil contaminated with RDX, TNT, and CompB. We hypothesized that CompB would have the greatest impact on plant physiology as both RDX and TNT negatively affect plant growth and function. Adult *M. cerifera* plants were exposed for 7 weeks to soil amended with RDX up to 1500 mg kg^{-1} dry soil, TNT up to 500 mg kg^{-1} dry soil, and CompB up to 750 mg kg^{-1} dry soil. Stomatal conductance, photosynthesis, leaf water potential, and leaf fluorescence values were measured at the end of the experiment. As contaminant concentration increased, significant declines in photosynthesis and leaf fluorescence occurred for all compounds. Overall responses varied between contaminants and impacts of CompB were largely reduced compared to either RDX or TNT. Multivariate analysis of physiological parameters distinguished CompB as clustered between TNT and RDX. Thus, plant responses to real world munitions is more complex than expected. To fully understand the impacts of explosives contamination natural ecosystems, more research of mixed contaminants and native plant species is needed.

174 **Pieter A.P. deHart[1], Lawrence E. Hurd[2], Megan Shearer[2], Joseph Taylor[2]**

Unraveling ecosystem interactions of a top arthropod predator, the praying mantis, using stable isotope analysis

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Arthropod predators such as praying mantids (*Tenodera sinensis*) have recently been shown to exhibit complex feeding relationships in terrestrial ecosystems. Contemporary laboratory studies demonstrate that these top predators may feed not only on herbivorous and carnivorous prey, but can also depend on pollen in the absence of other prey. Given the possibility that mantids exert a unique tri-trophic predation pressure extending down to the primary producer level, the systems in which these organisms reside are ideal models for studying the general properties of ecosystem trophic interactions. To investigate the degree to which these generalist predators may be a controlling influence on biodiversity in multiple habitats, we performed stable isotope analyses on the diet of wild caught mantids in comparison to those raised in the laboratory on known diets at all three trophic levels. We found that not only is there a wide range of $d^{15}N$ (3.2 to 7.2‰) and $d^{13}C$ (-28.4 to -26.2‰) in field caught mantids, but the dietary signatures of laboratory-raised organisms are equally trophically distinct. Mantids consuming herbivores were significantly depleted in ^{15}N and ^{13}C relative to those consuming primarily carnivorous prey. This variation may be useful in pinpointing shifts in the diet of mantids due to gender differences, changing nutritional needs, and seasonal prey availability. Initial interpretations suggest that while field-caught mantids were likely not dependent upon pollen, shifts in climate and prey distribution may push these predators to shift their diet over time, and this change can be detected using stable isotope analyses.

175 **A. Joseph Pollard[1], J. Andrew C. Smith[2]**

Population-level variation in nickel tolerance and hyperaccumulation in *Alyssum serpyllifolium* from the Iberian Peninsula

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Hyperaccumulation, a rare phenomenon occurring in fewer than 600 plant species globally, involves ability to detoxify and sequester high concentrations of metals in leaves. Most hyperaccumulators are endemic to metal-rich soils, especially those derived from serpentine minerals, with high nickel concentrations. However, a few species occur on both low- and high-metal substrates; an example is *Alyssum serpyllifolium* (Brassicaceae) from Spain and Portugal. To compare nickel-tolerance and nickel-accumulation among populations, we collected seeds from three serpentine and three limestone sites in the Iberian Peninsula. Plants were cultivated hydroponically in nickel-amended Hoagland's solution. Nickel tolerance was assessed based on declines in root and shoot mass as concentrations increased, while hyperaccumulation was measured by atomic absorption spectroscopy of leaf extracts. The serpentine populations were more tolerant than the limestone populations; however, there was also significant variability within each category. Hyperaccumulation of nickel is defined as exceeding 1,000 µg Ni per gram dry weight of leaf tissue; however, metal uptake can be unpredictably low or high if the plant is experiencing severe toxicity and death. We propose that a meaningful measure of hyperaccumulation is foliar metal concentration when the plant is growing in a medium that does not cause a significant inhibition of its growth. By that standard, all populations of *A. serpyllifolium* showed ability to hyperaccumulate. When grown in 30 µM nickel solution, the limestone populations accumulated more nickel than the serpentine populations; however, in 300 µM the serpentine populations accumulated more strongly, mostly because of their higher tolerance.

176 **Glenn Marvin, Mattie Lewis**

Effect of temperature, photoperiod, and feeding on the rate of tail regeneration in a semiaquatic Plethodontid salamander (*Desmognathus conanti*)

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Caudal autotomy enhances survival in salamanders, but tail loss can subsequently be costly to the individual. For example, maximal swimming performance is significantly reduced after tail loss in desmognathan salamanders. However, the long-term cost of tail loss depends on the rate of tail regeneration. To examine seasonal variation in the cost of caudal autotomy, we determined the effect of temperature, photoperiod, and feeding on the rate of tail regeneration in *Desmognathus conanti*. We used eight experimental groups (N = 15 for each group) which were equivalent in body size. After acclimation for four weeks at one of two temperatures (either 10°C or 20°C) and one of two photoperiods (either 9.5L:14.5D or 14.5L:9.5D), 60% of the tail length was autotomized for each individual. After autotomy, the eight experimental groups were maintained under different conditions of temperature (either 10°C or 20°C), photoperiod (either 9.5L:14.5D or 14.5L:9.5D), and feeding (either fasting or weekly feeding). The length of the regenerated tail portion was measured once each week (until the group with the fastest regeneration had regenerated 50% of the lost tail length) to determine the rate of tail regeneration for each individual. Three-way analysis of variance revealed that temperature had a large, significant effect ($F = 378$, $P < 0.001$) and feeding had a small but yet statistically significant effect ($F = 6$, $P < 0.05$) on tail regeneration rate. Our results indicate that the cost of caudal autotomy differs among seasons (and microhabitats) based on variation in temperature and food availability.

177 **Dane Kuppinger[1], Peter White[2]**

Experimental tests of *P. tomentosa*'s germination requirements and the seed's ability to survive fire

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Restoring fire regimes has helped many fire-dependent ecosystems, but has also resulted in the invasion of exotic species. *Paulownia tomentosa tomentosa* (Princess tree), an Asian species, has invaded following fire in the southern Appalachians but frequently has a very low invasion rate in the first growing season following the fire. The invasion pattern suggests that micro-site characteristics may significantly impact germination and it is unclear whether *P. tomentosa*'s seeds survive the fire. To study this we conducted two experiments; the first measured the effect of light, litter, and seed position within the soil profile upon germination. The second measured how seed position within the soil profile affects the impact of fire upon germination. Bare soil germination was significantly higher under 50% shade than in full sun ($p < .001$), significantly lower ($p < .001$) when litter was present than when it was absent, and significantly lower for buried seeds than those on the soil surface ($p < .001$). There was a significant interaction was between ground cover and light ($p < .001$). In the second experiment, buried seeds experienced lower temperatures than seeds on the soil surface and there was a significant negative relationship between germination and the temperature seeds experienced ($p < .05$). Mortality was ~100% when temperatures exceeded 100°C. Seeds may survive fire, but only low intensity fires or when buried. These experiments suggest that the delay in invasion may be due to the time needed for surviving buried seeds to become exposed and for additional seeds to disperse into the area.

178 **James Rayburn**

The interaction effects of natural oil and oil dispersants with delivery system on embryos of *Palaemonetes pugio*

Jacksonville State University, Jacksonville, AL

Grass shrimp (*Palaemonetes pugio)* are an important species from an ecological perspective because they serve as a link for energy transfer between trophic levels in the coastal food web. As part of the overall effort in determining the effects of hydrocarbon on estuarine environments in the Gulf of Mexico, this project investigated the effects of oil and oil dispersant toxicity to grass shrimp embryos. The question investigated was to determine if there are synergistic effects between the natural oil and dispersants. The grass shrimp were collected and identified to species (*Palaemonetes pugio*). Ten females and 15 males were kept in glass aquaria (approximately 35 liters) at 20 ppt sea water (made with artificial sea salts). Grass shrimp were maintained in standard laboratory conditions, 12 hr light dark, ~27 degrees C. The grass shrimp were feed high protein fish food. Gravid females were removed and ages of embryos were determined. Embryos were collected at tissue cap stage. Embryos were placed in individual 24 well plates with 2 mls of test solution. Twenty-four wells (one plate) were used for controls and for each test concentration. Embryos were observed daily for mortality. Embryos were exposed to a concentration series of oil, oil dispersants and mixtures of the two to determine the LC50 using probit analysis. Toxic unit analysis was performed to quantify the interactions. This study further validates the use of grass shrimp embryos in assessing the impact of chemicals and mixtures in estuarine environments.

179 **Matthew S. Swain[1], Derick B. Poindexter[2], Ray S. Williams[1]**

Abiotic effects on biological control of the invasive weed *Persicaria perfoliata* and surrounding vegetative community composition

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Mile-a-minute weed (MAM), *Persicaria perfoliata* (L.) H. Gross (Polygonaceae), is an annual vine from Asia that has invaded the eastern US, where it can form dense monocultures and outcompete other vegetation. *P. perfoliata* was discovered in several disturbed habitats in Alleghany County, North Carolina in 2010, and the Asian

weevil *Rhinoncomimus latipes* Korotyaev (Coleoptera: Curculionidae) was released in May 2011 as part of a classical biological control program. The weevil and plant community were monitored for two full growing seasons in 2011 and 2012 in two release and two control transects to determine what effect insect control had on MAM and ascertain what if any changes occurred in the extant plant community. In 2012 light intensity and temperature were analyzed to determine if they had an effect on the plant community and the performance of the weevil. A freeze in April 2012 resulted in the mortality of much of the MAM in lower elevation transects. During the freeze event, low temperatures were significantly higher in Release Transect 2 and those MAM plants were not killed. In this transect, high light plots had significantly more MAM cover and higher densities of weevils than low light plots. In lower elevation transects, weevils were observed concentrating on surviving MAM and to preferentially feed on high light plants. Overall plant diversity was significantly higher in 2012, and native taxa contributed significantly more to this increase than exotic taxa. Native plant taxa also had significantly higher cover in 2012 in all treatments.

180 **Jonathan Cooley[1], Joseph Poston[1], Jillian V. Goodwin[2]**

Interactions between red-eared sliders (*Trachemys scripta elegans*) and yellow-bellied sliders (*T. s. scripta*)

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The red-eared slider (*Trachemys scripta elegans*) is popular in the pet trade. Pet owners occasionally release unwanted turtles in the wild, with potential impacts on wild, nativeturtle populations. Many studies have examined the impacts of red-eared sliders on other species. Interactionsbetween red-eared sliders and other subspecies of *T. scripta* have not been examined as carefully. We report the results of a study to compare the condition of turtles from these two subspecies in an area where theyco-occur. The Catawba College campus hosts a population of yellow-belliedsliders (*T. s. scripta*). Sometime between 2000 and 2007, one or more red-eared sliders became established on thecampus. To better understand the interactions between these two subspecies, infall 2012, we trapped sliders and scored the color patterns on their plastronand on their head and neck to gauge their taxonomic identity (*T.s. scripta*, *T.s. elegans*, or intergrades between the two subspecies). We also measured the body size and weight of turtles to calculate an index ofcondition. We compare the condition of turtles based on their taxonomicidentity. Also, we compare the frequencies of phenotypic traits for turtlesfrom 2012 with those captured in a separate bout of trapping from 2007.

181 **Madeleine M. Kern[1], Jacquelyn C. Guzy[1], Jeffrey E. Lovich[2], J. Whitfield Gibbons[3], Michael E. Dorcas[1]**

Factors causing deviation from optimal egg size theory in the diamondback terrapin (*Malaclemys terrapin*)

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When investing energy in reproduction, organisms face tradeoffs between what number and size of offspring will optimize fitness. Optimal egg size (OES) theory predicts that a relatively constant OES should be selected, while any increase in resources allocated to reproduction should increase clutch size. Variations on this theory predict that egg size should be optimized, but not necessarily constant across a population, as optimality is contingent on maternal phenotypes and recent environmental conditions. We examined the relationships among body size variables (pelvic aperture width, caudal gap height, and plastron length), maternal body condition, clutch size, and egg width of diamondback terrapins from separate populations in Kiawah Island and Edisto Island, SC. We found that terrapins do not fit traditional OES theory. Both populations exhibited greater variation in egg size among clutches than within (ANCOVA; Kiawah: $F = 26.845$, $df = 25$, $p < 0.001$; Edisto: $F = 12.14609$, $df = 20$, $p < 0.001$), suggesting an absence of optimization. We found that egg size appeared to be constrained in Kiawah terrapins but not in the Edisto population and that maternal body condition explained over half the variation in mean egg width in Kiawah terrapins ($F_{2,16} = 8.489$, $p < 0.001$, $R^2 = 0.514$) but not in terrapins from Edisto Island ($F_{2,19} = 2.694$, $p = 0.093$, $R^2 = 0.221$). This study

demonstrates how factors ignored by traditional OES theory which result in deviation from the inflexible model's definition of optimization can contribute to a more complete understanding of optimizing reproductive output.

182 **Amy J. Nesius, John H. Niedzwiecki**

Optimizing microsatellites for use in the population genetics of spotted salamanders, *Ambystoma maculatum*

Department of Biology, Belmont University, Nashville, TN

Recent amphibian decline has led researchers to study population parameters of amphibians to help provide a better understanding of possible reasons behind the decline. One way to examine population genetics is to look at DNA microsatellites. Microsatellites are high variation genetic markers that can convey information about many population parameters. In this study two microsatellites where developed using samples from two populations of the salamander, *Ambystoma maculatum*. The process was carried out by DNA isolation and quantification, PCR, and gel electrophoresis. The goal of this project was to develop a precise procedure of analyzing these genetic markers, and to assure reliability for a project that may be split over several researchers and several years. Statistical tests were carried out to determine effect of researcher on DNA concentration and sample purity and to determine effect of concentration and purity on PCR success. While there was significant differences in sample concentration and purity between researchers, It was found that, within the parameters of our method, neither DNA concentration nor sample purity determined the outcome of the sample.. This technique can now be utilized in future research that addresses specific questions population genetics and can hopefully contribute to our understanding of amphibian decline.

183 **Carlos D. Camp[1], John B. Jensen[2]**

Life in a thermal ecotone: salamander activity patterns within twilight zones of caves

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Twilight zones of caves represent thermal ecotones, creating a moderately variable buffer between highly variable surface temperatures and stable temperatures deep within caves. We seasonally monitored salamander activity within the twilight zones of five caves in northwestern Georgia from 2000 to 2012. Average cave temperatures taken in the twilight zones were strongly related to elevation, high caves being warmer than low caves. Out of 3616 total salamander sightings, 47% were Cave Salamanders, *Eurycea lucifuga*, and 43% were Northern Slimy Salamanders, *Plethodon glutinosus*. Average numbers of *E. lucifuga* were directly related to elevation, with greater numbers associated with cold, low-elevation caves. Numbers of *P. glutinosus* were not related to elevation. Seasonal patterns of *E. lucifuga* were strongly correlated for the easternmost caves, with activity highest in spring. *Plethodon glutinosus* was most abundant in all caves during summer. Numbers of *E. lucifuga* in the easternmost caves were positively related to surface temperatures during spring, the peak season for surface foraging. Numbers of both species were negatively related to twilight-zone temperatures during summer, the season showing the greatest temperature variation within the twilight zones. We concluded from these results that the activities of both species are strongly dependent on the thermal environment. The two species differ, however, in their respective responses. We hypothesize that *E. lucifuga* prefers relatively low temperatures, which can only be accessed in caves. If true, this would explain this species' strong dependence on karst regions.

184 **Abby L. Sinclair, Thomas K. Pauley**

Preliminary data on amphibian use of road-rut pools in West Virginia

Department of Biology, Marshall University, Huntington, WV

Amphibians are sensitive to environmental changes and are declining globally. Their declines could signal detrimental changes in their habitats. Knowledge of how these environmental disturbances affect amphibians may be used to help prevent the declines of other wildlife. Understanding habitat selection and success will provide better information for conserving amphibian habitats. Some species of amphibians are known to use road-rut pools as breeding and foraging sites. The objectives of this

study were to ascertain what species use road-rut pools and what environmental conditions regulate the activities of these species. Environmental data such as water temperature, water depth and lengths of road-rut pools were collected to determine if species select pools based on these conditions. It is expected that optimal environmental conditions will differ among amphibians because each species has unique life history traits and habitat preferences. Inferences as to why certain species of amphibians are present in road-rut pools can be made by verifying the life cycle stages. Study sites were located in Beech Fork State Park in Wayne County and Chief Cornstalk Wildlife Management Area in Mason County. The road-rut pools were surrounded by drift fences with pitfall traps. Each site was sampled weekly. Several road-rut pools, as well as the two main sites, were also sampled periodically by dip-netting. Understanding relationships between amphibians and anthropogenic habitats is imperative for the successful conservation of amphibian populations.

185 **Diane R. Nelson[1], Eugenie Clark[2]**

Behavior of *Trichonotus elegans* (family Trichonotidae) and its cohabitation with the garden eel, *Gorgasia maculata* (family Congridae)

[1] East Tennessee State University; [2] Mote Marine Laboratory

The behavior of the protogynous hermaphroditic sand-diver, *Trichonotus elegans*, was studied off the central west coast of the volcanic island of Sangeang, Indonesia, where their territories overlapped with colonies of the garden eel, *Gorgasia maculata*. Each sexually mature *Trichonotus* male mated almost every morning with the 2 to 5 females in his harem shortly after sunrise. Males with adjacent harems often skirmished at their territorial boundaries, raising their filamentous dorsal fins and chasing each other. Mating took place on the sand, with the male pressing his quivering body on the female as she laid eggs on top of the sand. Once the male left, she buried the eggs into the sand with her mouth. After mating, *Trichonotus* left the sand area and formed swarms that fed on plankton, whereas *Gorgasia* fed on plankton only within reach of its permanent burrow. No competition between *Trichonotus* and *Gorgasia* was observed. When potential predators or divers approached the fishes' territory, *Trichonotus* dove into the nearest sand, whereas *Gorgasia* retreated into their burrows, easily recognized by the presence of the burrow entrance. At sunset, *Trichonotus* males with their harems dove into the sand in their territories where they remained until dawn. We collected *Trichonotus* eggs by scooping sand from the mating areas and placing the sample in containers with sea water. The pelagic larvae hatched out at approximately sunset.

186 **Charles Battaglia, John Carr**

A herpetofaunal comparison of a regenerating versus an established bottomland hardwood forest in Northeastern Louisiana, USA

Department of Biology, University of Louisiana at Monroe, Monroe, LA

CANCELLED

187 **Gavin R. Lawson[1], Eran S. Kilpatrick[2]**

Hybridization among the subspecies of Eastern Newts (*Notophthalmus viridescens*) in South Carolina

[1] Department of Biology, Bridgewater College, Bridgewater, VA; [2] Division of Mathematics and Science, University of South Carolina Salkahatchie, Walterboro, SC

The eastern newt, *Notophthalmus viridescens* (Caudata: Salamandridae) is widely distributed in North America and is subdivided into four subspecies on the basis of morphological and life history characters (Petranka 1998). Perhaps due to their distinctiveness, relatively little work has been done on hybridization in this group. In the most recent and extensive study to date, Gabor and Nice (2004) analyzed allozyme variation among the four subspecies throughout the species range. Analyses divided the sampled populations into northern and southern groups rather than along taxonomic lines suggesting introgressive hybridization had occurred. Furthermore, genetic variation indicated a pattern of restricted gene flow with isolation-by-distance among northern populations whereas southern populations appeared to be isolated and undergoing genetic drift. To evaluate whether these patterns are also observed at a more local geographic scale, we sequenced 530 bp of the NADH dehydrogenase (ND2) and the flanking $tRNA^{Met}$ genes for 111 specimens from 13 populations in South Carolina. Analysis by maximum parsimony, maximum likelihood and statistical parsimony analysis recovered three distinct haplotype

groups suggesting historically-restricted gene flow and population isolation. The boundaries of these groups are similar to those observed in *Eurycea bislineata*, *Ambystoma maculatum* and *A. tigrinum* and may represent refugial populations established during the last glacial maximum. Furthermore, two haplotypes were recovered in more than one subspecies and each haplotype group includes individuals from more than one subspecies suggesting introgressive hybridization may have occurred. Lastly, there is evidence of limited exchange between these haplotype groups that may represent recent dispersal following glacial retreat.

188 **David A. Beamer**

Head shape evolution in an adaptive radiation of salamanders

Department of Mathematics & Sciences, Nash Community College, Rocky Mount, NC

Microhabitat partitioning amongst *Desmognathus* species involves a size component, with very large species being aquatic and small species being terrestrial. However the mid-sized species range from aquatic to terrestrial and some species demonstrate microhabitat shifts in different portions of their range or when they are found sympatrically with congeners. I investigated head shape with size independent geometric morphometric techniques. A MANOVA of head shape variables found highly significant differences between populations occupying different microhabitats. Discriminant analysis was able to correctly classify microhabitat based on the head shape variables 64% of the time. These results suggest that head shape is correlated with microhabitat. Since lineages do not represent independent data points, I used independent contrasts to control for phylogeny and found a significant correlation between three head shape variables and microhabitat.

189 **Daniel Gaillard, Brian Kreiser, Carl Qualls, Joshua Ennen**

Population genetics of the gopher tortoise, *Gopherus polyphemus*.

Department of Biological Sciences, The University of Southern Mississippi, Hattiesburg, MS

The gopher tortoise has undergone a dramatic decline in numbers over the past century due to rapid loss, degradation and fragmentation of its native habitat. Genetic drift can lead to a decrease in heterozygosity, loss of alleles and potentially lead to inbreeding depression. In this study, we sampled tortoises from sites across a broad geographic area of the tortoises' natural range in order to ascertain population genetic structure and genetic diversity. Information on population genetic structure and diversity can help management agencies identify what populations are more similar genetically, which can help preserve adaptive potential, and to help identify at risk populations. We genotyped 933 individuals at 20 microsatellite loci from 47 sites across the southeastern United States. The analyses we performed show support for two values of K (number of populations); 1) for two populations, showing a split at the Tombigbee and Mobile Rivers (TMR) and 2) for five populations, one population west of the TMR and four populations east of the TMR. Our results also show that populations west of the TMR have undergone a genetic bottleneck and that central populations have higher levels of genetic diversity than populations along the periphery.

190 **Brian Williamson, Jayme Waldron, Thomas K. Pauley**

The effect of habitat diversity on home range area of the eastern box turtle

Department of Biology, Marshall University, Huntington, WV

Currently, many turtle species throughout the world are declining, including the Eastern Box Turtle. This decline is due, in part, to habitat loss and fragmentation. In order to successfully conserve Eastern Box Turtles it is necessary to have more information concerning their ecology, including an understanding of factors that may affect the size of a turtle's home range. We hypothesized that home range area of the Eastern Box Turtle decreases with increasing habitat diversity. To test this hypothesis, we tracked 10 box turtles at Hungry Beech Nature Preserve in Roane County, West Virginia, from May until October 2012. We estimated home range area using adaptive LoCoH. We determined habitat diversity of each home range based on observations made during each capture. We will compare habitat diversity results with home range area to determine if there is any correlation between the variables. The results of this project will increase our understanding of Eastern Box Turtle home range behavior, which will aid efforts to manage declining poplulations.

191 **Kevin Messenger, Yong Wang**

Determining areas of high biodiversity and habitats of concern for the herpetofauna of China

Department of Biological and Environmental Sciences, Alabama A & M University, Normal, AL

We examined the distribution of reptiles and amphibians in China and used Geographic Information Systems (GIS) to produce maps that would show where the highest areas of diversity were among the individual taxonomic groups. We want to determine which areas of the country should be the highest in priority to conservation needs from threats. In addition to general species, we also focused on regions with high endemism and imperiled species. Endemism and species richness are highly relevant to the prioritization of conservation efforts. We redefined current distribution maps using ecological models such as elevational maximum and minimums based on available knowledge of species in order to create more representative range maps, which in turn, helped accurately identify biological "hotspots." We examined the effect of elevation, temperature, rainfall, landcover, and human density on herpetological diversity. Having these data will provide an excellent baseline for future studies to look at how climate change might be affecting species diversity. The ultimate goal of this project is to be able to manage land and habitat the most efficiently, to be able to pinpoint regions that are under the most pressure from development or indirect human activities and to prioritize these regions in regards to conservation.

Poster Abstracts

P1 **Cynthia L. Blankenship, J. Christopher Havran**

Preliminary analyses of fruit and seed variation of *Planchonella sandwicensis* across the Hawaiian Islands

Department of Biological Sciences, Campbell University, Buies Creek, NC

Planchonella sandwicensis is an incredibly variable species endemic to the Hawaiian Islands. It has been suggested that there are ecological correlations involved in the variation of the fruits and seeds of *P. sandwicensis*. To investigate ecological variations within the species, specimens of *P. sandwicensis* were sampled in the field across the islands of Hawaii, Oahu, Molokai, Maui, and Kauai. Attributes of the fruits and seeds of the specimens were measured. Fruit horizontal and vertical diameter was measured. Seeds were extracted from each seed-bearing fruit and were measured for length and width. Ecological data from each collection site was obtained and correlations between specimen characteristics and ecological parameters were investigated. We showed that fruit shape is positively correlated to the amount of rainfall at each site ($p = 0.0044$). Seed number was not found to be a factor in fruit size or seed size ($p = 0.1$). Also, seed shape and size was not found to be significantly correlated with ecological data ($p > 0.05$). In conclusion, ecological parameters may be responsible for some, but not all, of the variation in the fruits and seeds of *P. sandwicensis*; however, limitations such as immature fruits, small sample size, difficulty in gathering random samplings, and time of year may have influenced the outcome of these findings.

P2 **Zhi Lin[1], Kunsiri Chaw Grubbs[2]**

The allelopathic effects of Chinese privet (*Ligustrum sinense* Lour.) foliage extracts on seed germinations

[1] Department of Chemistry, Physics & Geology, Winthrop University, Rock Hill, SC; [2] Department of Biology, Winthrop University, Rock Hill, SC

Allelopathic compounds possibly play an important role on plant growth and development. Chinese privet (*Ligustrum sinense* Lour.) is a highly invasive species found in the Southern United States and is extremely well established in parts of this region. The hypothesis of this study was that seed germination and plant growth are inhibited with higher concentrations of the Chinese privet leaf extracts. The purposes of this study were to: 1) conduct a Tetrazolium Chloride test to examine the viability of Chinese privet seeds; 2) examine the impact of allelopathic compounds of Chinese

privet leaf extracts on seed germination and growth. The researchers applied Chinese privet leaf extracts to sunflower, mungbean, oat, and wheat seeds at 0%, 1%, 5%, and 10% levels, respectively. Conditions were constant for all experiments, 25-27 ° C with a grow light. The results show that Chinese privet seeds have a relative high viability (92.6%). All four species of the crop plants are susceptible to the alleopathic compounds from the leaf extract; however, there is no statistically significant difference between the control and the experimental groups in the percent of seed germination. The inhibitions of root and shoot growths of the seedlings were observed. All treatments applied with Chinese privet leaf extract showed decreased growth levels. Additionally, the rate of abnormal seedlings increased when the concentrations of the leaf extract increased. The findings from this study indicate that allelopathic compounds from Chinese privet leaves can inhibit the growth of other plants that grow nearby.

P3 **Christine Hassell, Nancy Buschhaus**

The effect of habitat type on bat activity and species richness monitored via acoustic survey at Reelfoot Lake in Northwest Tennessee

Department of Biological Sciences, University of Tennessee at Martin, Martin, TN

Bats capture insects while flying in the dark using a sophisticated system of echolocation. Presently, bat species diversity is declining in the Eastern United States due to a deadly fungal disease known as White Nose Syndrome (WNS). Therefore, documenting any fluctuations in bat species diversity is essential. Bats often congregate near large bodies of water due to high levels of aquatic insect emergence. The focus of our study was to determine the most effective sampling sites for bats near Reelfoot Lake in Northwest Tennessee. We used hand-held bat detectors to document bat ultrasonic calls at four different sampling sites that varied in the amount of open water foraging area at Reelfoot Lake June - August 2012. We found that the four sites varied in the amount of bat activity observed Summer 2012. We concluded that sampling site at Reelfoot Lake did influence the efficacy of recording bat activity and species richness.

P4 **Morgan Harris, Lynn Siefferman**

The effects of interspecific competition on personality and assortative mating in Eastern Bluebirds (*Sialia sialis*)

Department of Biology, Appalachian State University, Boone, NC

Predictable personality (or consistent and predictable behavioral responses of individuals) in animals is thought to influence monogamous relationships by better allowing mates to coordinate territory defense and parental care behaviors. Aggressive territorial defense behavior is often an important and ecologically relevant measure of animal personality. However, recent invasions can increase interspecific competition for limited breeding resources and may interfere with otherwise adaptive personality traits. Eastern bluebirds (*Sialia sialis*) are secondary cavity nesting birds that have been shown to exhibit personality (or repeatable aggressive behaviors toward simulated territorial intrusions). Tree swallows (*Tachycineta bicolor*) have recently expanded their breeding range southward and have been breeding near our field site in the mountains of NC for < 30yrs and compete with bluebirds for nesting sites. In 2012, we examined the effects of interspecific competition on 1) consistency of aggressive behavior within individual bluebirds, 2) the degree to which bluebird pairs exhibit similar aggressive behavior (assortative mating), and 3) the relationship between assortative mating and fitness. We found that, in locations with little or no interspecific competition, bluebirds showed consistent aggressive behaviors, bluebirds tended to pair assortatively for personality, and pairs that behaved most similarly achieved the highest reproductive success. In locations with high levels of competition with tree swallows, however, none of these relationships persisted. Our research demonstrates that interspecific competition can disrupt otherwise consistent and predictable behavioral traits in individuals and this disruption may reduce pair compatibility and reproductive success.

P5 **Betty L Haughn[1], Lisa Kelly[1], Wm. Bruce Ezell[1], Lee Phillips[1], Stephen Macko[2]**

The trophic ecology of invasive fire ants in natural ecosystems of North Carolina

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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.

P6 **Brooke Terilli, Timothy O. Menzel**

A comparison of frog assemblage patterns within a recently restored wetland to assemblage patterns at similar locations within the same drainage system

Department of Natural Sciences, Piedmont College, Demorest, GA

Frog call surveys were conducted within a recently restored wetland, as well as within similar areas within the same drainage, to determine whether species habitat relationships were consistent between restored wetlands and reference sites. A Mantel test was used to determine if there was a non-random relationship between frog species and habitat characteristics. MRPP was used to determine if there are non-random relationships between frog species and group membership, and between environmental variables and group membership, where groups are reference or restored sites. The Mantel test yielded an observed Z-score of 20.59 and an expected Z of 18.68 (p=0.0012), showing a non-random relationship between frog assemblage and the measured environmental variables. The MRPP test involving frog species and group membership showed an observed delta of 0.5180 and an expected delta of 0.4938 (p = 0.6375), while the MRPP test involving environmental variables and group membership yielded an observed delta of 0.6713 and an expected delta of 0.6433 (p = 0.6321).The MRPP tests indicate no difference between restored and reference sites for frogs or measured environmental variables. From these results, we can conclude that restoration efforts are providing frog habitat consistent with naturally occurring wetlands in the area.

P7 **Sandra L. Westergaard[1], Joseph B. Vaughan[2], J. Christopher Havran[1]**

Inter-island variation in leaf shape of *Planchonella sandwicensis* (Sapotaceae) an endemic Hawaiian tree

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Planchonella sandwicensis is a hypervariable Hawaiian endemic species. Previous authors have suggested the variation may be correlated to geography. In previous studies variation in size of leaves, but not shape, was studied across the archipelago. In the current study, standardized methods were used to quantify leaf shape of *P. sandwicensis* across its entire range. Five fully exposed leaves were collected and scanned from 39 trees across the islands of Kauai, Oahu, Molokai, Maui, and Hawaii. Leaf Analyser software was used to quantify the mean leaf shape for each individual. Principal Component (PC) analysis was used to detect the shape variation in co-ordinate models of the collected leaves. Size was analyzed separately from shape by using Procrustes fitting to scale the leaf models to equal size. Three PCs were calculated which correlated to width (PC1), symmetry (PC2), and apex and base

angles (PC3). PC1 indicates that the leaf margin of specimens from Kauai are distinguishable from the other island populations. PC2 indicates specimens from Hawaii are less symmetrical than the other island populations. PC3 does not show any significant difference between island populations. PC1 on Kauai may be due to variation in just one tree. PC2 in Hawaii indicates a possible geographic correlation in the species. There is a small difference in the leaf shape of *P. sandwicensis* across the archipelago.

P8 **Jamie Dennis, Timothy O. Menzel**

The relative importance of environmental factors and dispersal distance on the occurrence of *Oxydendrum arboreum* saplings

Department of Natural Sciences, Piedmont College, Demorest, GA

Sourwood trees (*Oxydendrum arboreum)* are known pioneer species that have been found across a wide range of habitats. Little research however has been done to determine what factors affect patterns of seedling establishment. We investigated the importance of varying environmental factors and dispersal distance on sapling distribution. The locations of mature trees were recorded across a 100 meter by 100 meter area. Within a 50 meter by 50 meter plot located in the center of that area, measurements were taken at 25 arbitrary locations, and at each sapling. These measurements included: canopy openness, slope, aspect, and distance from the nearest mature *O. arboreum*. The relationship between sapling occurrence and environmental variables was assessed using a Multiple-Response Permutation Procedure (MRPP). Non-metric multi-dimensional scaling (NMS) was used to determine the set of arbitrary sites having suitable conditions for seedling establishment (those occupying the same ordination space as sapling locations). The distances between the suitable arbitrary sites and mature trees were compared to the distances between saplings and mature trees. Our observed delta from the MRPP was 24.0451 and the expected delta was 25.0025 ($p = 0.0224$), indicating a non random relationship. The mean distances from saplings and suitable arbitrary locations to the nearest mature trees, 5.948 meters and 9.072 meters respectively, were significantly different ($p = 0.0125$). Based on these results we have concluded that seedling establishment is associated with our measured variables, but that establishment is limited to locations closer to mature sourwood trees.

P9 **John B. Farmer, Timothy O. Menzel**

The relationship between ant species co-occurrence patterns and the nature of their interactions

Department of Natural Sciences, Piedmont College, Demorest, GA

The purpose of this project was to investigate the relationship between ant species co-occurrence patterns and the behaviors of individual ants while co-occurring. Sixteen bait stations were video-taped for an hour each and the presence/absence and time on bait station were recorded for each species. Temporal overlap and characteristics of physical interactions were recorded for each species pair. Similarity indexes were generated for each pair based on occurrence on baits (S1) and temporal overlap on baits (S2). Physical interactions were evaluated for their intensity and duration. Chi square was used to evaluate the relative frequencies of high and low intensity interactions by species pairs (indicated by one or both ants leaving the station immediately following the interaction). Analysis of variance was used to evaluate the effect of species-paired on interaction duration. Of the five pairs used in Chi square, only one had a significantly different distribution of high and low intensity interactions ($df = 2$, $Chi^2 = 6.636$, $p = 0.0362$). There was a significant effect of species-paired on duration ($df = 2$, $F = 25.45$, $p < 0.001$). The pair with the highest S2 value and the largest gap between S1 and S2 values was also the pair having a different from expected interaction distribution (more high intensity interactions than expected) and the shortest mean interaction duration ($p = 0.001$, in comparison with the pair having the second shortest mean duration). This suggests a relationship between co-occurrence patterns and the nature of interactions between ant species.

P10 **Shauna L. Gearhart, Morgan G. Lange, Madeline McMillan, Charles Palmer, Braden Stocks, Kate Lyn Sheehan, Ron J. Johnson, Megan Phillips**

Pond Depth Influence on Freshwater Benthic Communities

School of Agricultural, Forest, and Environmental Sciences, Clemson University, Clemson, SC

Seasonal and long-term temporal shifts in lake levels has the potential to influence the composition of natural communities of organisms that live in the sediment. Changes in water body morphology, temperature, and dissolved molecules (oxygen, PO_4, NO_3) ultimately shape the distribution and composition of benthic communities. Here, we compare the benthic community, water quality of the water column and porewater in an experimental pond system in a variety of flood to draught conditions using multivariate general linearized models. Our findings suggest that deeper depths support a similar benthic community when oxygen concentrations are above 4.0, but shallow benthic communities are more species rich when oxygen drops below the level of hypoxia. When drought conditions promote increased hypoxia in lakes, benthic communities at moderate water depths are likely to emigrate into the sediment under peripheral/shallow water where water mixing and dissolved oxygen concentrations are likely to be more variable.

P11 **Andrew S. Begrowicz, Charlton Brownell, Kayla B. Frady, Kate Lyn Sheehan, Ron J. Johnson**

Influence of Avian Guano on Primary Productivity in Shallow Freshwater Ponds

School of Agricultural, Forest, and Environmental Sciences, Clemson University, Clemson, SC

Large colonies of waterbirds are suggested to cause a natural form of local eutrophication in freshwater ecosystems. We experimentally treated small ponds with seabird guano to test for changes in abundance and size of primary producers in the sediment (rooted vegetation) and water column (phytoplankton). A strong response was initially seen in phytoplankton abundance, but this association was lost after successive treatments. We believe this was a product of upper-trophic level population response as primary producer resources became more abundant. Rooted vegetation abundance did not differ in fertilized treatment from unfertilized treatments; however, growth rates appear faster in fertilized ponds. Based on our assessments, waterbird colonies could support increased primary production where they persist.

P12 **Andrew S. Begrowicz, Charlton Brownell, Kate Lyn Sheehan, Ron J. Johnson**

The role of vegetation in structuring aquatic communities

School of Agricultural, Forest, and Environmental Sciences, Clemson University, Clemson, SC

Terrestrial habitats are defined by the plant communities that dominate the landscape and ultimately determine the animals they will support. In aquatic environments, this relationship is not as strong. We assessed two ponds with varying degrees of vegetation to determine the strength of the relationship between vegetation abundance and composition on aquatic community structure. Extremely dense emergent vegetation exhibited limited benthic community components and lower species richness in the water column. Additionally, high vegetation density was associated with decreased dissolved oxygen, temperature, and primary productivity of the water column. Moderate to low emergent vegetation and low to high floating vegetation had similarly high species richness in the water column, but moderate richness and abundance of organisms in the sediment. High benthic community abundance and richness were associated with low vegetation cover. Fishes were commonly found in the low to moderate vegetation coverage. While vegetation can provide refuge, structure, and detritus to aquatic communities, it appears that freshwater systems with highly dense vegetation may suffer from lower diversity and organisms abundance with decreased water quality.

P13 **Kristin Emery, Gwendolyn Casebeer, H. David Clarke, Jennifer Rhode Ward**

Genetic variation in the rare, clonal shrub *Spiraea virginiana* Britton (Virginia Spiraea) and implications for its conservation in Western North Carolina

Biology Department, University of North Carolina Asheville, Asheville, NC

Spiraea virginiana (Virginia spiraea), Rosaceae, is a clonal, perennial shrub that inhabits disturbed riparian zones. It is federally threatened throughout its range in the Appalachian plateau and endangered within North Carolina, largely due to small population size, low levels of sexual reproduction, and reduced gene flow among populations. In addition, *S. virginiana* depends on scouring from seasonal flooding to create optimal conditions for dispersal and to reduce competition. Modification of stream flow and construction of impoundments have resulted in less exchange among populations and increased vegetative cover within *S. virginiana* habitat. Previous research has focused on the genetic variation of *S. virginiana* populations in Ohio, Kentucky, and Tennessee. However, limited information is available for imperiled North Carolina populations despite evidence of reduced reproductive success. This study examined genetic relationships within and among eight populations of *S. virginiana* in stream corridors throughout western North Carolina. Leaf tissue DNA was extracted using a modified CTAB method and Qiagen DNeasy kits. Samples were amplified via PCR at four microsatellite regions, PCR products were sequenced, and data were used to determine degrees of relatedness and levels of inbreeding in populations. Prior work using SDS-PAGE length variants detected heterozygous loci, and sequencing results confirmed these patterns. A better understanding of the genetic structure of *S. virginiana* populations may enable conservation practitioners to enhance in situ genetic variation, thus improving the adaptive potential of this rare species.

P14 **Marlon H. Romo, Christopher B. Manis, G. John Lugthart**

Investigation of a turtle community in a Northwest Georgia lake and wetland prior to restoration

Department of Natural Sciences, Dalton State College, Dalton, GA

A study of a Northwest Georgia lake and adjoining wetland was undertaken from June 11 to June 22, 2012 in order to characterize the turtle community prior to a pending restoration of the area. A total of 164 turtles were captured representing four families and six species. *Trachemys scripta* was the most abundant Emydid and species observed (34%). Other Emydids, including *Pseudemys concinna* (16%) and *Chrysemys picta* (9%) were less common. Representatives of families Kinosternidae, Chelydridae, and Trionychidae were represented by one species each, with *Sternotherus odoratus* (26%), *Chelydra serpentina* (15%), and *Apalone spinifera* (1%) being collected, respectively. The Smith and Wilson's Index of Equitability value (.328) and the Shannon-Weiner diversity index value (1.54) indicated that heterogeneity and evenness were lacking due to numerical dominance of *T. scripta* and *S. odoratus*. All but two of the species had sex ratios of approximately 1:1. Female *S. odoratus* outnumbered males (1.49♀:1♂) and male *C. serpentina* significantly outnumbered females (3.8♂:1♀). Proximate studies indicate the turtle community of the northwest Georgia site is similar to other regional assemblages. Sexual size dimorphisms were noted in two of the Emydid species, with females reaching significantly larger sizes in all body measurements relative to males. Mature male *C. serpentina* were significantly larger than females in regards to carapace length.

P15 **Kristen Oliver, Mellissa Hughes, Jeffery Beasley, Erynn DeLancy, Rachel Reid, Jennifer S. Borgo**

Herpetofaunal composition at Kalmia Gardens of Coker College

Department of Science and Mathematics, Coker College, Hartsville, SC

The purpose of our research was to complete a survey of herpetofaunal diversity within Kalmia Gardens in Hartsville, South Carolina. Our survey began in May of 2010, and involved the weekly collection of herpetofaunal individuals using drift-fence, pitfall, and coverboard techniques. The drift-fence devices used consisted of standard construction fencing, were x-shaped, and had been established in two land plots located on an uphill region and within the swamp area of the Gardens. The drift-fence in the uphill land plot was formed by the intersection of a 7.7m arm and a 7.1 m arm,

while the drift fence in the swamp area was formed by the intersection of a 7.5 m arm and a 6.4 m arm. Twelve buckets outlined each of the drift-fence devices and served as pitfall traps. Seven coverboards, approximately 0.8 m x 1.6 m pieces of tin, were located throughout each plot surrounding the drift fences. Drift-fence buckets were opened weekly on Mondays and checked daily Tuesday through Friday, while coverboards were checked bi-weekly. Individuals collected by all methods were identified to the species level. Seventy-three individuals have been captured in drift-fence buckets and 23 underneath coverboards. The majority (55/96) of these individuals were collected within the uphill plot and represented four snake species, four lizard species, three toad species, two frog species, two salamander species, and one turtle. Data collection is on-going and we will be evaluating the impact of invasive plant removal on herpetofaunal diversity starting in Fall 2013.

P16 **Fatumata Sesay, Stephen Matike-Tita, Steven Riera, Mark Meagley, Kirsten Edwards, Katherine Heying, Chelsea Reinert, Cassandra Lumpkin, Michelle Cawthorn**

The effect of distance and season on the giving up density (GUD) of oldfield mice, *Peromyscus polionotus*

Department of Biology, Georgia Southern University, Statesboro, GA

Animals must balance the risks and rewards of foraging. Foraging is required for survival and reproduction, but while foraging animals are at risk from predation, and are not investing time in other activities (i.e., finding mates) that are also necessary for survival and reproduction. One way to examine the trade-offs that animals are making is by measuring giving up density (GUD). Foraging trays were used to determine the effect of distance (near and far) and season (fall and spring) on GUD of Oldfield mice, *Peromyscus polionotus*. A specific mixture of millet seeds and sand were placed in foraging trays. Four trays were then placed at each burrow (n=12) at two different distances (near and far) overnight, and the difference in the amount of seeds that were placed in the trays and that remained in the tray was calculated. Our results indicated that this species of mice foraged longer in trays near their burrow versus those that were further away. Season did not affect this pattern. However, there was a difference in the overall GUD between seasons. The GUD was lower during the fall than that of the spring. This difference is probably due to a difference in vegetative cover between the seasons.

P17 **Shawna Wade, Michelle Cawthorn**

Do right-pawed dogs have right-handed owners and vice versa?

Department of Biology, Georgia Southern University, Statesboro, GA

The interaction between humans and their canine companions has become a common interest in the world of animal behavior in recent years. Specifically, scientists wonder if canines can observe their owner's behaviors and possibly mimic them in some way. We compared hand dominance and paw dominance between humans and their canine companions to look for evidence of such mimicry. In a series of three tests, adult dogs (> 2 years old) were tested for paw dominance. We observed which paw dogs used first to 1. choose a treat, 2. remove a piece of tape from their nose, and 3. retrieve a toy. In all three tests, dogs used the paw that matched their owner's dominant hand two out of three times. Based on these preliminary data, we suggest that canine companion animals may be mimicking certain behaviors of their owners. Future studies should examine the relationship between brain-hemisphere dominance and paw dominance in dogs and relate this back to "handedness" of owners.

P18 **Sarah Farmer, Jonathan L. Horton, H. David Clarke, Jennifer Rhode Ward**

Native plant community response to different methods of removal of exotic invasives

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Exotic plant invasions disrupt native ecosystems and reduce the richness, abundance, and health of native plant communities. Curtailing exotic plant invasions and removing them from invaded sites can be difficult and costly, yet may be critical for conservation and restoration efforts. Our study sites were established in 2008, on two forested areas on the campus of University of North Carolina, Asheville. Sampling was conducted in the understory, shrub layer and overstory before the plots were

treated for exotic invasive removal either mechanically (by digging and pulling), chemically (foliar application of herbicide), or a combination of mechanical and chemical treatments. Sampling and treatments were repeated annually. All three treatments reduced exotic cover, and community responses to treatment are being investigated. Understory data from 2008-2010 was compiled and analyzed with PC-ORD using non-metric multidimensional scaling (NMMS), which revealed that the understory plant communities on the two study sites are distinct from each other. Further analysis will employ NMMS to determine if the shrub and canopy layers are also unique between the two sites. Next, the native and exotic plants of each site will be analyzed separately to determine if any clusters of species are responding similarly to particular treatments, or if any exotic invasive species are drivers of the plant community response. Identifying exotic species that have the most impact on the overall plant communities and targeting them for removal will help maximize scarce resources and get the most out of restoration projects.

P19 **Kaitlyn Schaaf[1], Rita Malia Fincher[1], Tara Joy Massad[2], Alex Gilman[3]**

Bottom-up control of herbivores in tropical forest restoration

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Tropical reforestation is a developing field as practitioners and ecologists work to formulate ecologically sound methods to restore degraded lands. This project explores how bottom-up plant-insect interactions influence tree growth and survival during reforestation in a diverse lowland tropical moist forest. The reforestation experiment involves replicated plots that differ in planted species richness and tree species identity, using all native plants planted in polyculture. By carefully measuring herbivory, sapling growth, and sapling defenses, we aim to determine the importance of bottom-up control of herbivores in reforestation and how these factors will ultimately affect sapling growth and survival. Preliminary results after 2.5 years of plot development indicate that herbivory was affected by saponins both at the plot and species level—individuals with more saponins and individuals in plots with higher overall saponins suffered less herbivory. We expect treatment effects will become more apparent over time as planted individuals mature and pasture grasses and common herbs are reduced as the canopy closes. In the long-term, we will evaluate the effect of initial restoration strategies (planting diversity and unassisted regeneration) on forest recovery.

P20 **Carmony Adler[1], Andrew S Begrowicz[2], Melissa Chromik[1], Kate Lyn Sheehan[2], Claire Stuyck[2], Ron J. Johnson[2]**

Birding on campus: using citizen science as an introduction to avian research

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Citizen science is a data collection tool that is gaining widespread popularity in many scientific fields. We used the birdwatching citizen science program Project Feeder Watch as a basis for additional observations of avian species that forage on and around bird feeders on the campus of Clemson University. In addition to the basic bird counts and qualitative environmental variables assesed, we altered the placement and content of bird feeders, and recorded birds within 20m of the feeders. Observations occurred four times each week on the same days and at the same times. We observed a measurable increase in avian activity in association with temporal phenomena (sunrise) and a strong preference for sunflower seeds over a corn and millet mixture. Shifts in the composition of species utilizing the feeders and surrounding area were observed as migration season started. This project has stemmed strong interest from other programs and appears to be a useful way to increase the experience and confidence of student birders.

P21 **Cakey Worthington, Corinne McCullough, Robert Spalding, Christopher J. Paradise**

Effects of surrounding land use patterns and floral diversity on insect pollinator abundance and biodiversity

Davidson College Biology Department, Davidson, NC

Insect pollinators are responsible for pollinating approximately 87 percent of the world's flowering plant species. Recent declines in bee populations have raised

concerns about pollinator biodiversity and function. Habitat fragmentation causes biodiversity declines globally, yet isolated preserves are used to protect biodiversity. We wanted to determine the impact of land cover patterns and floral diversity on the biodiversity of insect pollinators in isolated parks. We measured pollinator communities in parks in Mecklenburg County near Davidson, NC. We used regular timed transect walks to quantify pollinators, repeating walks 13 times during the field season. All specimens were identified to the species and each site was analyzed for species richness, abundance, and diversity. Land use patterns within 0.5 km and 1.0 km of each site were quantified. We predicted that robust communities of pollinators, as determined by higher biodiversity and abundance of common species, would be found in sites with more natural areas, less degraded land and a more heterogeneous composition of land cover. We found that abundance of some species was strongly related to percentages of particular land cover categories at particular distances from sites, such as the positive relationship between *Apis mellifera* abundance and percentage of forest surrounding a site. Separation of insect communities was evident in ordination analysis and those differences often correlated with land cover patterns around sites. Pollinator diversity was positively related to floral diversity and density. Landscape context and floral resources affect species richness and abundance of pollinators, and should be considered during pollinator conservation efforts.

P22 **Alexander J. Worm, Melissa Bobowski, Thomas Risch**

Perch-site characteristics in relation to prey and vegetation cover densities of overwintering Red-tailed Hawks (*Buteo jamaicensis*) and American Kestrels (*Falco sparverius*)

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Red-tailed Hawks (*Buteo jamaicensis*) and American Kestrels (*Falco* sparverius) are sit-and-wait predators that rely on perch-sites to forage efficiently. Overwintering Red-tailed Hawks and American Kestrels use available perches (i.e., utility poles and wires, trees, fences, gates, etc.) to hunt for prey items in the agricultural fields in Northeast Arkansas. Observations were made from December 2011 to the present on three representative cover types: short rice stubble, soybean stubble, and fallow areas including roadsides in order to determine which perch-sites were used by Red-tailed Hawks and American Kestrels the most. Prey density and vegetation cover were also estimated in each cover type. Utility pole crossbeams at a height of 7.5 meters are the main perch-site used by Red-tailed Hawks, demonstrating the use of man-made structures as perch-sites. These perches were generally in or near short rice stubble fields, which were found to have the lowest amount of vegetation cover, and low prey density. Conversely, American Kestrels most used utility wires at a height of 4.5 meters from the ground, over fallow roadsides as perch-sites, representing an area with high prey density and vegetation cover. Although there have been documented cases of inter-specific competition between these two species, Red-tailed Hawks and American Kestrels may limit direct interaction via differential uses of perch-sites.

P23 **Alexi Dart-Padover, David Brown, Jennifer Koslow**

Population trends of the federally endangered running buffalo clover (*Trifolium stoloniferum*) in the Blue Grass Army Depot, KY from 2003-2012

Department of Biological Sciences, Eastern Kentucky University, KY

Running buffalo clover (*Trifolium stoloniferum*) is an endangered species with the highest density of extant populations at the Blue Grass Army Depot (BGAD) near Richmond, KY. It was discovered at BGAD in 1992 and surveyed every one or two years from 2003 to present. *T. stoloniferum* has occurred in 166 patches since 1992, however only 55 of these patches still persist today. Its peak abundance was recorded in 2006 with 9404 rooted crowns counted in 86 patches. Four years later (2010) the individuals had dropped to a quarter of that number with 2367 rooted crowns in only 52 patches. The latest survey, conducted in summer 2012, has seen a moderate increase to 3685 rooted crowns in 55 patches. Flower production also varied highly among years and was not strongly correlated with trends for rooted crowns. It is unclear what causes the *T. stoloniferum* population to fluctuate from year to year. Previous research suggests that *T. stoloniferum* depends on ground-level habitat disturbance such as grazing, trampling, and flood scouring, and these processes have undoubtedly changed at BGAD over the past two decades. Based on our own observations and other

research, we suspect competition from plants such as coralberry (*Symphoricarpos orbiculatus*) and the invasive Japanese stiltgrass (*Microstegium vimineum*) threatens recovery. Recently we have initiated controlled landscape scale experiments to investigate potential management strategies, including combinations of grazing, herbicide application and mowing.

P24 **Kelsey J. Cooper, E. Natasha Vanderhoff**

Preliminary survey of brown pelicans *Pelecanus occidentalis* in Jacksonville, Florida

Department of Biology and Marine Science, Jacksonville University, Jacksonville, FL

Although the Brown Pelican *Pelecanus occidentalis* was federally delisted in 2009 by the Fish and Wildlife Service, it remains a Species of Special Concern (SSC) in Florida. The Brown Pelican can be found year-round in North Florida consisting of both resident and migrating individuals, yet to date a formal survey and population trends for this area have not been conducted. We gathered data at three sites in Jacksonville, Florida to investigate seasonal trends in population abundance and demography. We also collected foraging data to discern differences between adults and juveniles foraging near shrimp trawls. The study is ongoing and our data indicates seasonal differences in abundance and site use tied to human food sources.

P25 **Sarah Katherine Springthorpe**

Modeling the population dynamics of *Lasiurus borealis* and their prey in Western North Carolina

Department of Biology, Salem College, Winston-Salem, NC

In Western North Carolina, the thirteen known species of bats are fundamental not only to the health of the ecosystems, but to the health of the local agricultural industry as well. However, with the confirmed spread of White Nose Syndrome (WNS) into Western North Carolina in 2010, there has been a decrease in the abundances of cave bat species, including the little brown bat (*Myotis lucifugus*). Conversely, tree bat species, such as the eastern red bat (*Lasiurus borealis*), have remained unaffected by WNS, but have been affected by habitat losses. Using a 75% annual decline in *M. lucifugus* from WNS, habitat destruction data and diet preferences, three scenarios were used to model how the *L. borealis* population and their insect prey would change over a five year period following the introduction of WNS. One scenario was increasing *L. borealis* population, the second a declining population and the third a stable population. The increasing model showed an 18.1% increase in the population while the declining model showed a 0.9% decrease in the population. These results translated into 8,375-10,020 kg of insects that would no longer be consumed at the end of the five year period, when *M. lucifugus* would be locally extinct. This large increase in unconsumed insects could have significant effects on both agriculture and local ecosystems.

P26 **Andrew Watson, H. David Clarke**

Modeling responses of American Ginseng (*Panax quinquefolius* l.) populations to different levels of simulated harvest

Department of Biology, University of North Carolina-Asheville, Asheville, NC

Wild-harvested American ginseng (*Panax quinquefolius* L.) is traded internationally for its medicinal properties, and North Carolina is one of the United States' leading exporters of wild American ginseng. Harvest is regulated by state, and states must demonstrate that harvest is not detrimental to ginseng's long-term viability, so to determine if North Carolina regulations adequately protect ginseng, the demographic characteristics of 5 local populations were examined. Annual censuses were conducted for 2 years, tracking each plant individually and recording leaf number and the presence of flowers. In the second year, data on fruit production of each plant were collected, and seed production was estimated using a published value of average seeds per fruit. A population matrix model was constructed for each population using these data, and growth rate, stable size distribution, and the elasticity of growth rate to transition probabilities were calculated. Three of the five populations were declining in the absence of any harvest, so we projected time to extinction for these populations. We also projected the effects of increasing harvest rates (up to 100% of legally harvestable individuals) on growth rate of the other two populations. Estimations of growth rate varied substantially (from 0.9 to 1.2),

indicating that even geographically close populations may have very different population dynamics. It is difficult to place much weight in these conclusions due to limited data, but sampling will continue so that in several more years, a more robust data set can be used to provide more reliable conclusions.

P27 **Alaina Wynes, Kunsiri Chaw Grubbs**

The effect of gibberellic acid on Schweinitz's Sunflower, *Helianthus schweinitzii* T. & G. (Asteraceae) seed germination

Department of Biology, Winthrop University, Rock Hill, SC

The US Fish and Wildlife service has listed Schweinitz's sunflower (*Helianthus schweinitzii*)as an endangered species. Native populations are generally found in the Piedmont of the Carolinas. Little is known about the seed propagation of this species. In Fall 2012, seeds from Rock Hill, SC were collected, measured and analyzed. Tetrazolium test was applied to test for seed viability. Seeds were treated with 0, 1, 10, 100 and 1,000 mgL^{-1} giberellic acids. The results indicate that seeds are very small, and colors are somewhat varied. Tetrazolium test showed that the sinking seeds showed more viability than floating seeds so the sinking seeds were used for the entire experiments. The seeds were germinated with 3 different methods: 1) seed germination paper, 2) the roll paper method, and 3) using the soil mixture. All treatments were kept at the same condition of 25°C with dim light. After 12 days, the seeds started to germinate. The seeds that were treated with 100 mgL^{-1} GA had the fastest and highest germination of all methods. The seedlings from GA treatment formed much taller plants compared to the control group of the same age. This approach shows that a small amount of GA provide some benefit to the seed germination of Schweinitz's sunflower. The next step will be to apply a plant tissue culture technique to increase the yield of seed germination.

P28 **Emma York, Timothy O. Menzel**

Micro-scale effects on growth and survival of *ex situ* planted individuals of *Helonias bullata* in a high mountain bog

Department of Natural Sciences, Piedmont College, Demorest, GA

The objective of this study is to gain a better understanding of the micro-scale environmental effects on growth and survival of an *ex situ* population of *Helonias bullata*. In the early spring of 2011, 40 *Helonias bullata* were planted in eleven groups of three to five plants in a mountain bog (Rabun County, GA). The summed leaf area of each patch (n=11) was measured at the time of planting and re-measured in the summer and fall of 2012. In early fall of 2012 we measured the final leaf area, biotic factors (including canopy openness, bare ground, herbaceous vegetation, and others), and abiotic factors (soil saturation and soil pH and soil element concentrations). Growth (change in leaf area) was treated as the dependent variable in our analysis, while all other variables were treated as independent. Variables that were not normally distributed were natural log transformed. Principle Components Analysis was conducted separately for soil elemental concentrations and biotic factors to reduce those two larger sets of variables to smaller sets of independent variables. The resulting factors were used in two backwards multiple regressions (one for each set). The importance of soil pH and saturation were investigated separately using simple linear regressions. Neither biotic factors ($p=0.277$, $R^2=0.125$), soil elements ($p=0.111$, $R^2=0.250$), nor soil pH ($p=0.902$, $R^2=0.002$) were good indicators of growth. There was a positive relationship between soil saturation and growth ($p=0.039$, $R^2=0.391$).

P29 **Mark A. Schlueter, Nathaniel A. Wall**

The effect of human settlements on carnivore abundance and diversity

Georgia Gwinnett College, Lawrenceville, GA

The following study surveys mammalian carnivore diversity in Georgia's piedmont forests. Human settlements and man-made structures have impacted wildlife abundance and diversity. The purpose of this study is to assess mammalian carnivore species diversity and abundances in forests located in urban, sub-urban, and rural sites. How successful are urban and suburban parks in providing useful habitats for carnivores? The project utilized DLC Covert II digital infra-red trail cameras, placed1 km apart. Once a camera was strapped to the trunk of a suitable tree, a scent lure was placed approximately 1 m from the camera, in the center of the field of view.

Lures were created by dipping sticks in bobcat urine and placing them upright in the ground. Cameras were left out for a minimum of one week at each study site. A variety of species were seen on the cameras including: whitetail deer, opossum, squirrel, rabbit, armadillo, grey and red fox, raccoon, coyote, and bobcat. The suburban sites had the greatest concentration of mammalian carnivores. For example, coyotes appear on film twice in urban forest sites, 32 times in suburban forest sites, and not at all in rural forest sites. Foxes, opossums and raccoons were most abundant in suburban forest sites, while rural forest sites had the second highest abundances of opossums and raccoons. Bobcats, however, were only filmed in rural forest sites.Foxes appear on film twice in urban forest sites, 5 times in suburban forest sites, and not at all in rural forest sites. Results suggest that large protected areas of forest, for instance state parks, in suburban areas are best for protecting carnivore populations and increasing carnivore diversity.

P30 **William Futch[1], Jeffery Duguay[2], Kim Marie Tolson[1]**

Seed selection by mourning doves (*Zenaida macroura*) in Northeastern Louisiana

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The mourning dove (*Zenaida macroura*) is the most widely distributed game bird in North America. Mourning doves are among the ten most abundant bird species on this continent with the autumn dove population reaching as high as 475 million birds. During this study, two types of seeds, sunflower (*Helianthus annuus*) and brown-top millet (*Urochloa ramosa*) were planted in a total of 6 plots on Floy McElroy WMA in northeast Louisiana. Point-count surveys were conducted throughout the month of September 2012 and parts of October 2012. Observers were positioned in pop-up blinds so as to view an entire plot and counted the number of birds that landed in each experimental plot. A managed hunt was conducted on Floy McElroy WMA on September 15-16, 2012. The breast meat on all harvested birds was removed and returned to the hunter. The crop and gizzard was removed on 52 birds. The crops were dissected and the contents were removed to determine composition of ingested seeds. The preliminary results of this two year study revealed that 50% (26/52) contained millet, 5% (3/52) contained sunflower, and 2% (1/52) contained both sunflower and millet. Gizzards were first x-rayed for the presence or absence of lead shot, and then dissected to confirm x-ray results. Seed selection data along with shot analysis data will be used by private land-owners and government agencies to develop a habitat management plan for the mourning dove in Louisiana.

P31 **Corinne McCullough, Cakey Worthington, Christopher J. Paradise**

Using digital macrophotography to measure biodiversity, identify insects and enhance outreach and education

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Digital macrophotography holds potential as a valuable tool for observational studies and experiments in entomology and ecology. With advances in digital technology, high-resolution images can be acquired with rapid speed to capture fast-moving insects as they land for short periods of time. Macrophotography serves as an accurate and flexible method of observing and identifying insects with little disturbance. Using the sharp resolution from advanced macrophotography lenses in the field, verification of sight identifications can be obtained and the images serve as a record of species presence. We tested the robustness and efficiency of collecting species presence data via camera in an insect pollinator biodiversity study. In a study conducted on factors affecting insect pollinator communities, digital macrophotography was introduced into a traditional transect-based method of observation. Six sites were chosen to conduct thirty-minute observation walks along a 100-meter transect. Rather than rely solely on sight identification, pollinators from three hymenopteran families and all butterflies were recorded digitally. Images were then organized into a virtual collection that can also be placed in an online database that will offer information about pollinator conservation to the public and be used as a teaching tool in an entomology course and a workshop for local K-12 educators. Creating a digital collection promotes accuracy of identification, minimizes mortality due to collecting specimens (important for rare species), facilitates researchers' familiarity with the insects (especially undergraduates learning identification), and allows outreach to the local community.

P32 **Victoria Underwood[1], Elizabeth G. Dobbins[1], Kevin J. Morse[2]**

The persistent effects of abandoned mine drainage on water chemistry and benthic macroinvertebrates in Black Creek, a tributary of the Black Warrior River in Western Jefferson County, AL

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Abandoned mine drainage (AMD) is a persistent problem in the Black Warrior watershed in Western Jefferson County, AL. Black Creek, a tributary of Five Mile Creek in the Locust Fork of the Black Warrior River, contains a point source upwelling from an abandoned mine with a constant discharge of 53,000 cm^3/sec. This project evaluated the persistence of AMD on water chemistry and its effects on the downstream biological health of the Creek. We sampled the AMD for water chemistry (pH, conductivity, total dissolved solids, salinity, total iron and ferrous iron) and four sites in Black Creek (upstream and10 m, 500 m, and 1,500 m downstream) for water chemistry and benthic macroinvertebrates. We collected macroinvertebrates using EPA rapid bioassessment protocols and identified them to genus. The pH of Black Creek was significantly depressed by the AMD ($p < 0.01$). Total and Ferrous iron, conductivity, salinity, and solids were significantly elevated in the AMD and immediately downstream ($p < 0.01$). Total and ferrous iron and pH recovered downstream from the AMD site as a function of distance, reaching upstream control values by 1,500 m downstream. Levels of conductivity, salinity, and TDS increased significantly at the AMD site ($p < 0.01$) and remained elevated through 1,500 m downstream. The AMD altered the macroinvertebrate community structure to one dominated by pollution-tolerant organisms, increasing % chironomids and decreasing % EPT. Despite the persistent AMD effects on conductivity and solids, the macroinvertebrate populations and indices recovered to upstream values by 1500 m downstream.

P33 **Robyn Harmon, Lindsay Guild, Elizabeth G. Dobbins, Kristin A. Bakkegard**

The effects of rock vane remediation on sediment load and fine silt deposition in Shades Creek, Homewood, AL.

Department of Biological and Environmental Sciences, Samford University, Birmingham, AL

Shades Creek suffers from excess sedimentation that depresses water quality, harms fish and bottom dwellers, and impairs the overall health of the creek. In November 2010, ten rock vanes were installed in a 330 m section of creek to focus water energy midstream, reduce bank erosion and decrease sediment deposition downstream. We hypothesized that the sites within the rock vane area would have greater sediment deposition and more fine sediment than downstream. We analyzed sediment deposition using ceramic tiles and sediment particle size with scoop samples in four sites: upstream and downstream controls (outside rock vanes) and upstream and downstream affected (between rock vanes). The upstream affected sites had significantly greater mean inorganic sediment mass than downstream control sites ($p < 0.01$) indicating that the rock vanes decreased sediment deposition downstream. The downstream affected sites had significantly more silt and clay than the downstream control ($p < 0.01$) suggesting that the rock vanes trap fine silt. Increased silt and clay negatively affect fish and macroinvertebrates and increase turbidity. There was twice as much sediment deposition in 2012 as 2011 at every site except the downstream control, which was not significantly different. We believe that recent construction a mile upstream caused the increase in sediment in the creek. Despite the increased sediment load, there was a decrease in sediment deposition downstream from the rock vanes indicating that they are highly effective in sediment control.

P34 **Robert Hopkins II, Oliver Hewitt-Fisher, Holly Huntley, Erin Sherman**

Newly discovered population of Eastern Sand Darter (*Ammocrypta pellucida*) in Raccoon Creek (Ohio River basin) in South-central Ohio

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The Eastern Sand Darter (*Ammocrypta pellucida*) has a broad, sporadic distribution in eastern North America. Once common, the species has experienced a sharp decline

in its range in the last 50 years – primarily due to habitat destruction. The species now persists only in isolated localities which contain the clean, sandy substrate required. In this paper, we report the discovery of a new population of Eastern Sand Darter in Raccoon Creek (Ohio River basin) in south-central Ohio in Fall 2011. To better assess the status of this population, we conducted collection surveys in Fall 2011 and Fall 2012. In 2011 we collected only two individuals. In 2012 we collected 17 individuals. To better understand reach-level distribution patterns and habitat selection, microhabitat analyses were completed in 2012 using a quadrat sampling technique. As previously reported, the species occupied areas with ~80% sand cover, low flow, and limited coarse substrate. Based on these data, we estimated that ~5% of the reach area could potentially be utilized by Eastern Sand Darter. The detection of this species is encouraging and suggests notable improvement in stream habitat in a watershed historically plagued with acid mine drainage and agricultural pollution. However, the potential available habitat and distribution of the darter in Raccoon Creek will likely remain limited due to the naturally low gradient and restricted mesohabitat complexity in the stream. Thus, any extant populations should be vigorously protected.

P35 **Charles B. Shutt, Pieter A. P. deHart**

An evaluation of multiple lure techniques to attract wild canines for biological research

Department of Biology, Virginia Military Institute, Lexington, VA

Attracting wild mammals in a predictable fashion for scientific research is known to be an extremely challenging task for biologists. The techniques used are very region-and species-specific, and have made applying those strategies to new areas a difficult endeavor. Of particular difficulty has been attracting Coyotes (*Canis latrans*) and Red foxes (*Vulpes vulpes*) in Virginia. The goal of this study was to determine the most effective lure for attracting coyotes and red fox to a given location in Rockbridge County, VA. To address this, during May and June 2012 we measured the success of different audio, olfactory and visual lures in coordination with trail camera images captured. A total of 861 images were captured during the study, 28 of which were canines. The type of attractant proved to have a substantial effect on the number of canine images with the olfactory lure attracting the highest number of target species. Additionally, specific camera location had a considerable effect on the number of both canine and total images captured. Using an olfactory attractant and taking into account location will assist in more efficiently collecting hair samples for wild canine research in this region. Future studies should focus on evaluating the most effective of many olfactory attractants available. Additionally, given the limited range of this study and possible seasonality of canine behavior, further studies should be expanded to include a broader temporal scale.

P36 **Kathryn Rogers, Jana Eggleston, Sarah Crawford, Robert K. Rose**

Variations of a small mammal community in a changing landscape in southeastern Virginia

Department of Biological Sciences, Old Dominion University, Norfolk, VA

In 2005, an ongoing monitoring program of the small mammal community began on a successional old field, wetland site owned by The Nature Conservancy. We hypothesized the spatial distribution of the herbivorous small mammal community and populations would be related to that of vegetation. Our study site consisted of an 8 x 8 grid, at12.5m intervals, and had two modified Fitch traps per station. We trapped for three days each month, averaging 4600 trap nights per year. After determining the spatial densities for the small mammal community and populations, we used ArcGIS to map and conduct cluster analyses of 2006 LiDAR and 2012 vegetation ground survey data, with respect to the small mammal community and population densities. With the progression of succession, this site experienced a general and parallel decline of all old field species, both for vegetation and the small mammal community.

P37 **Anna L. Peters, Jared L. DeForest**

The effect of acid rain on *Acer rubrum* flower and seed production in unglaciated hardwood forests

Department of Environmental and Plant Biology, Ohio University, Athens, OH

Anthropogenic acid precipitation has significantly altered soil chemistry in the Ohio River Valley, due to an abundance of coal-fired power plants. Notably, acid rain has the ability to acidify soils and decrease soil calcium (Ca) and the availability of soil phosphorus (P), while increasing the availability of nitrogen (N). At the same time, Ohio forests' understories are becoming increasingly dominated by *Acer rubrum*. Could acid rain contribute to an increase in *A. rubrum* dominance? Forest plots with elevated P and Ca were established in Southeastern Ohio in 2009 by adding P and/or Ca to forest plots in a randomized complete block design, with treatments of elevated P, elevated Ca, elevated P + Ca, and ambient conditions. In the spring of 2012, *Acer rubrum* flowers and seeds were collected in litter traps from within all 36 experimental plots. *Acer rubrum* flower and seed production were compared between treatment types. All treatments were found to produce from 167% to 346% more flowers than the control plots, although this difference was not statistically significant. However, the elevated P, Ca and P+Ca treatments produced a mean of 48%, 19% and 20% of the seeds/flower mass than produced by the control, respectively. The *A. rubrum* growing in ambient, acidic soil are producing significantly more seeds per flower mass than those growing on soil with elevated Ca levels. Perhaps acid rain is increasing *A. rubrum* fecundity, which could be contributing to this species' observed increase in abundance.

P38 **William Wollman[1], David Vandermast[2]**

Effect of *Castor canadensis* herbivory on invasive plant species richness and abundance

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Beavers (*Castor canadensis*) play in important role in shaping the composition and structure of an ecosystem. Beavers are ecosystem engineers that play an important role in creating and modifying the habitat that they live in. However, there is little data that examines the preferred tree species of beavers or the relationship between beaver herbivory and invasive species presence. Given the abundance of invasive species in riparian forests of eastern North America, it is important to understand beaver tree selectivity and assess the correlation between beaver activity and invasive species cover. Our research surveyed invasive plant species richness and cover in $100m^2$ areas around beaver-damaged 'focal' trees along the Haw River North Carolina. Beaver damage data were collected by recording whether the tree was dead or alive and estimating the percent of the damaged stem that had been fed on by beavers. Our results indicate that there is a significant negative correlation between beaver damage and the number of invasive species; however the reduction in invasive species richness was not due to greater cover of any individual invasive species. It may instead be due to increased cover of one or more native species. Additionally, our research showed that average cover of Japanese honeysuckle (*Lonicera japonica*) and Silverberry (*Elaeagnus umbellata*) were significantly greater when the focal tree had damage exceeding 60% percent of the stem area. Our results indicate that beaver herbivory on riparian trees can affect invasive species richness and cover, at least temporarily.

P39 **Lyndsay L. Rankin, Anne C. Axel**

Assessing ecological integrity of grazed and ungrazed tropical dry forests through soundscape analysis

Department of Biological Sciences, Marshall University, Huntington, WV

Human activities are responsible for the majority of worldwide habitat degradation. Livestock grazing is often cited as an environmentally destructive practice. Grazed habitats may be disturbed but still suitable to support wildlife communities. Responsible grazing may even provide favorable habitat to some species. This study uses soundscape analysis to characterize the ecological integrity of grazed forests. Automated recording devices were placed across grazed tropical dry forests of southern Madagascar. Sensors were placed in each of the three grazing categories (ungrazed, moderately grazed, and heavily grazed) and two forest types (gallery and dry deciduous). The resulting spectrograms were analyzed to calculate a normalized difference soundscape index (NDSI) for each site. This is an indicator of biological composition to human disturbance. In the dry deciduous forest, NDSI values were fairly uniform across all grazing levels. In the gallery forest, lower NDSI values were recorded in the ungrazed areas than in the moderately and heavily grazed areas.

These results indicate that ungrazed habitats may not be ecologically superior to openly grazed habitats. Wildlife and habitat surveys will be completed to strengthen the soundscape analysis results. Acoustic habitat assessment has the potential to be applied to numerous systems including habitats sensitive to human presence, physically impenetrable regions, and restoration sites. Analysis at the species level can determine presence or abundance of cryptic and nocturnal species. Soundscape analysis is a promising new method with applications for large scale ecological monitoring.

P40 **Brenden Dodd[1], Brenton Campbell[1], Michael Chung[1], Jorge Magana[1], Seth Stennis[1], Melissa You[1], Ben Thornton[1], Henri D. Grissino-Mayer[2] Developing a site-wide reference tree-ring chronology on the biology trail system of Southern Adventist University: how the past informs the future of our forests**

[1] Department of Biology and Allied Health, Southern Adventist University, Collegedale, TN; [2]Department of Geography, University of Tennessee, Knoxville, TN

The widths of growth rings in conifers have been shown to indicate historical fires, past temperature patterns, and especially rainfall. Using Haglof increment borers, we extracted ca. 200 core samples from conifers across the biology trail system of Southern Adventist University in Collegedale, Tennessee. Tree species, dbh, and elevation were recorded for each tree sampled on standard forms to assist in the dating of the tree rings. To assign absolute calendar years to each ring, we will scan the cores and their rings using WinDendro software at very high resolution to accurately measure the ring widths to 0.001 mm accuracy. These raw ring widths will then be processed through COFECHA software to assist in dating each and every tree ring on all core samples with annual precision. Once all rings are crossdated, the ring series from each core and each tree will be processed using ARSTAN software to develop a site-wide reference master tree-ring chronology that retains both high-frequency, year-to-year trends, as well as low-frequency, interdecadal trends. We will use the indices from this dimensionless chronology to compare with regional climate records from eastern Tennessee to evaluate the influence of past climate on tree growth so that we can evaluate future trends in tree growth given pervasive changes in climate expected that are believed to be primarily driven by anthropogenic changes during the 20th and 21st centuries. In other words, by first evaluating the past, we should gain a sense of the health and vigor of our future forests.

P41 **Jonathan Cooley, Jay Bolin**

All taxa biological inventory of Catawba College Preserve and adjacent lands

Department of Biology, Catawba College, Salisbury, NC

The Catawba College Ecological Preserve and the adjacent Horizons Unlimited NatureStudy area is approximately 68 hectares and is located inthe central piedmont of North Carolina (Rowan County). The study area iscomposed of a floodplain and bordering slopes. The floodplain drains towards Grants Creek, which is seasonallyinundated and includes several manmade ponds and ditches. The southern half ofthe preserve was farmland as recently as 1995, and is proceeding throughsecondary succession. The mature forested slopes on the east and west sides ofthe property are classified as piedmont mixed mesic hardwood forest underlainby Pacolet and Poindexter soil types. The slopes have been designated by the NorthCarolina Natural Heritage Program as a significant Natural HeritageArea. Current and previous Catawba College students and facultyhave conducted surveys and assembled lists of various taxa, but these listshave not been compiled and made accessible online, a goal of this study. Aninventory of the mollusks, grasshoppers and crickets, dragonflies anddamselflies, butterflies, moths, vascular plants, amphibians, birds, fishes, mammals, and reptiles of the Catawba College preserve and adjacent study areawas conducted with the aim of updating existing databases andnomenclature.

P42 **E. Natasha Vanderhoff, Nigel Campbell, John Enz**

Preliminary survey of orb-weaving spiders in an oak hammock forest in Northeast Florida

Department of Biology and Marine Science, Jacksonville University, Jacksonville, FL

We conducted a preliminary survey of orb-weaving spiders in the Theodore Roosevelt Area of the Timucaun Ecological and Historic Preserve located in Jacksonville,

Florida. We visually surveyed either side of a half kilometer section of trail. For all webs encountered we identified spiders, took web measurements and calculated percent cover. The three most encountered spiders were the Orchard Spider *Leucauge venusta*, Spiny Crab spider *Gasteracantha cancriformis*, and Spined Micrathena *Micrathena gracilis*. *Gasteracantha* webs were the largest and the highest, followed by *Micrathena* and *Leucauge*. Whereas *Leucauge* webs were generally flat with a catchment web underneath, *Micrathena* and *Gasteracantha* webs were more vertical. *Micrathena* webs were located in more open environments as compared to *Leucauge* and *Gasteracantha*. Our results are preliminary and future studies will address the relationship between habitat, spider pattern/coloration, web construction and prey capture.

P43 **Ashley Galway[1], Joshua Campbell[1], James Martin[2]**

Pollinating insect communities in semi-natural grasslands managed for conservation benefits and biomass production

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Pollinating insects in various ecosystems have shown declines in abundances and species richness. Biofuel crops (e.g. corn) have expanded in recent years due to ethanol demand. Some crops, such as corn, used for biofuels have been shown to be detrimental to pollinating communities. We tested alternative biofuel crops: 1) Big Bluestem-*Andropogon geradii*, 2) Little Bluestem-Schizachyrium *scoparium*, 3) Indian Grass-*Sorghastrum nutans*, and 4) Bermuda Grass-*Cynodon dactylonto* determine whether these crops could be used as surrogates for corn without disrupting pollinating insect communities. Our twelve 25 ha experimental plots located near Starkville Mississippi included, 1) native grass mixture without cattle, 2) native grass mixture with cattle, 3) Indian grass with cattle, and 4) Bermuda grass with cattle. Bermuda grass plots contained the lowest abundances and species richness of pollinating insects. Various insect groups showed higher abundances and species richness within plots containing native grasses. Cattle grazing did not influence most pollinating insect abundances. Overall, our data supports the notion that native grasses rather than non-native grasses (e.g. Bermuda grass) may allow for continued biofuel production without disrupting pollinating communities.

P44 **M.H. Schaus, V.R. Townsend, J.J. Illinik**

Food choice of the neotropical harvestman *Erginulus clavotibialis* (Opiliones: Laniatores: Cosmetidae)

Department of Biology, Virginia Wesleyan College, Norfolk, VA

Relatively little is known about the food habits of Neotropical harvestmen. We conducted a food choice experiment (fresh fruit vs. live invertebrate prey) using *Erginulus clavotibialis* (Pickard-Cambridge 1905), a locally abundant species of cosmetid harvestman in Belize. *E. clavotibialis* showed a strong preference for fruit, as 72% of individuals ate it first and 67% spent the most time in the fruit-containing portion of the experimental chamber. Five *E. clavotibialis* (13%) consumed 1-4 termites, confirming this species' ability to capture and consume live invertebrate prey. Adult males located food more quickly than nymphs. Harvestmen feeding on fruit were also significantly more active than non-feeding individuals or those preying upon termites first. Opportunistic frugivory may be important to *E. clavotibialis* during times when fruit is available (e.g., wet season). We hypothesize that this species most likely exhibits a generalist diet in the field.

P45 **Jamal H. Hunter[1], Michael D. Toews[2]**

Will *Podisus maculiventris* control *Megacopta cribraria* populations?

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Megacopta cribraria, an invasive insect pest discovered at Atlanta in 2009, is now found in seven southeastern states and continues to expand its range in North America. This insect primarily feeds on legumes such as kudzu and soybean. Although it does not kill its host, *M. cribraria* is a severe economic pest of soybean production. Due to its recent arrival in the New World, there is currently very little information available on native natural enemies that may be able to suppress *M.*

cribraria populations. We investigated the potential for a native generalist predator, *Podisus maculiventris* (commonly known as the spined soldier bug), to feed on *M. cribraria* adults or nymphs in the laboratory. Experiments were conducted by placing a single *P. maculiventris* male or female (3 to 5 day old adult) in a 0.95-liter plastic container provisioned with different densities of *M. cribraria* nymphs or adults. Experimental treatments were organized in a completely randomized design with five replications per treatment and response variables were analyzed using analysis of variance for qualitative variables and trend analysis for quantitative variables. Results show that prey consumption by *P. maculiventris* increased linearly with increasing *M. cribraria* density. There were no differences in survival or the number of prey consumed between male or female predators. Similarly, prey consumption by *P. maculiventris* did not vary between life stages of the pest.

P46 **Robert Wayne Van Devender[1], Amy S. Van Devender[2]**

Land snails of North Carolina. Part 3. Flat snails with simple lips (Gastrodonta, Haplotrema, Mesomphix, Paravitrera, Ventridens, and Vitrinizonites).

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Distribution, abundance, and ecology of the land snails of North Carolina remain poorly known because very few people can reliably collect and identify these animals. This problem is particularly evident in several common and conspicuous genera formerly included in Family Zonitidae. Genera are easily distinguished; but most genera are represented by more than one species in many parts of the state. Differences between species are real but subtle and difficult to verbalize. We address this problem by providing the current classification and high quality photographs of all species known to occur in North Carolina or within one county of its border with surrounding states. For comparison a few additional similar genera are illustrated. Genera included are *Gastrodonta* (1 species), *Haplotrema* (2 species), *Mesomphix* (9 species), *Paravitrea* (14 species), *Ventridens* (14 species) and *Vitrinizonites* (1 species). These 50 species represent 19% of the state's known fauna.

P47 **Travis Seaborn**

Developing a predictive model of the autecology of the spruce-fir moss spider, *Microhexura montivaga* Crosby and Bishop 1925

Department of Biology, Western Carolina University, Cullowhee, NC

The endemic and endangered spider species *Microhexura montivaga* is the world's smallest member of the Dipluridae, more commonly known as the funnel web tarantulas, ranging in size from 2.5 mm to 5.6 mm (Coyle 1981). Originally collected in 1925 by Crosby and Bishop, in 1995 it was added to the Federal List of Endangered and Threatened Wildlife and Plants by the U.S. Fish and Wildlife Service (Fridell 1994). All of the populations are defined by several shared characteristics. 1.) Populations reside at high elevations (5300-6600 ft.) in spruce-fir forests (Coyle 1981). Spruce-fir forests in this area are dominated by Fraser fir (*Abies fraseri*) (author?) and red spruce (*Picea rubens*) (Spira 2011). 2.) Spiders are only known on rock outcrops and boulders with bryophyte mats generally 1-4 cm. thick that are moderately drained, not dry or soggy. *M. montivaga*'s sensitivity to desiccation also means that it is restricted to north-facing slopes (Coyle 1981). Beyond these general characteristics, little is known about the ecology of the spider. Soil and bedrock data for all sites was gathered thus providing predictive power for continued searching of *M. montivaga* sites. Bedrock for all metapopulations was analyzed using data compiled by United States Geological Society (North Carolina Geology). Soil data was compiled by using the same locations but using previous data from United States Department of Agriculture (The Comparative Soil Survey). Surveys of soil samples were also analyzed to try and better define the community of the spider, with identification lists of species created.

P48 **Nicole Sadecky, Kelli Lighthiser, Raquel Fagundo, Michael Lucero, E. Joseph Nolan, Zachary Loughman**

Crayfishes of the New and Gauley River Basins of West Virginia: Conservation and natural history

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The New and Gauley River basins are among the most dynamic lotic waterways in all of West Virginia. During the summer of 2012, 83 streams, 50 in the New and 33 in the Gauley River basins were sampled for crayfishes to determine both basins current epigean crayfish fauna. Previous surveys in the 1980's determined that invasive *Orconecte virilis* maintained robust population levels in the upper New River system. A major focus of this endeavor was determining the extent of *O. virilis* invasion into the Lower New and Gauley River systems, as well as determining the current status of the native fauna. Site coverage accounted for all stream orders conducive to crayfishes. Ten seine hauls were completed at each site in the best available habitat to collect crayfishes. Physiochemical and biotic data were collected at each site, and all captured crayfishes were retained as vouchers for identification in the laboratory. The native fauna consisted of *Cambarus* (*cf.*) *sciotensis*, *Cambarus carinriostris*, and *Orconectes cristavarius;* all native species population levels were stable. Invasive *O. virilis* were collected from historic locations in Upper New River basin, from three new streasm in the Lower New and were allied mainly with the New River mainstem. In the Gauley River system *Orconectes virilis* were only collected from Summersville Lake, and were not taken from any lotic situations. Siltation proved to be the most limiting anthropogenic source of pollution, and was prevalent in portions of both river systems that experienced elevated extractive industry utilization.

P49 **Nicholas G. Stewart, Mark A. Schlueter**

Identification of a native bee species to serve as the primary pollinator for commercial apple cultivation in North Georgia

Georgia Gwinnett College, Lawrenceville, GA

Honeybees (*Apis mellifera L.)* are the most important insect pollinator for the majority of agriculture crops, excluding cereals. Reliance on a single insect species, the honeybee, for the pollination of over 1/3 of the human food supply can be dangerous. Colony Collapse Disorder (CCD) has diminished stocks of honey-bees in the United States over the past two decades. The decline in the availability of honeybee hives has led to an increased focus on alternatives, including utilizing native bees inherent to every region in the country for pollination. Unfortunately, each crop has specific native bees which serve as its ideal native pollinator. Since 2010, this study has focused on surveying the native bee diversity in four Georgia apple orchards with the central goal of identifying the 'target native pollinators' (TNPs) for Georgia apple production. TNP selections were based upon seasonal abundance, pollination efficiency, consistent year-to-year presence, and conducive morphology. The following taxa have been selected as apple TNPs in North Georgia: *Andrena crataegi, Andrena (Melandrena)* species, and *Xylocopa virginica*. The premature apple blooms in 2011 and 2012 adversely affected the abundance of the original TNP Andrenids, making it apparent that alternative TNPs are necessary during such large climactic swings. Thus, the selection of *Osmia* as an alternative TNP allows native pollination systems to be useful during any season.

P50 **Raquel Fagundo, Michael Lucero, Zachary Loughman**

Results of the first survey of northern West Virginia's centipede fauna

Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV

Centipedes are among the least understood invertebrate faunas occurring in West Virginia. To date, zero publications have been completed by myriapodologists documenting the diversity of centipedes in the state. In an effort to fill this knowledge gap, centipede diversity was surveyed in the northern panhandle (Marshall, Ohio, Brooke and Hancock counties) within the Appalachian Plateau physiographic province of West Virginia. Sites selection was deponent on the presence of moist microhabitats conducive to centipedes. Surveys were completed during the spring and fall months of 2010 through 2012. All animals were vouchered on site and identified in the laboratory. Four orders (Scolopendromorpha, Lithobiomorpha, Geophilomorpha, and Scutigeromorpha) comprising 10+ species were collected in the panhandle. Geophilomorphs dominate the northern panhandle centipede fauna. The most common species, however, was the lithiobiomoprh *Bothropolys multidentatus*. Scolopendromorphsare the least diverse native order, with *Scolopocryptops sexspinosus* the most frequently encountered species. *Scutigera coleoptrata* was the only introduced species encountered, and was allied with anthropogenic habitats.

P51 **Andrea L. Slurff, Victor R. Townsend, Jr.**

Comparative study of the microanatomy of Neotropical sclerosomatid harvestmen (Opiliones, Eupnoi)

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There are relatively few studies of the microanatomy of Neotropical harvestmen belonging to the family Sclerosomatidae. The taxonomy of these harvestmen requires major revision. Most species descriptions are based upon few morphological characters, i.e., relative body size, coloration of the legs, and dorsal pattern. In this study, we investigated interspecific variation in three Neotropical species (*Prionostemma vittatum*, *Metopilio niger*, and *M. ornatipes*). For comparative purposes, we also examined the microanatomy of the temperate harvestman *Leiobunum formosum*. For each species, we examined the dorsal scutum, legs, pedipalps and chelicerae of multiple adults with the aid of a Hitachi S-3400N scanning electron microscope. We observed considerable interspecific variation in the morphology and distribution of denticles on the pedipalps, especially for adult *P. vittatum*. The cuticle of the dorsal scutum and the morphology of the ocularium also exhibited considerable interspecific variation. The dorsal scutum of *L. formosum* possessed tuberculate, rounded protuberances with micropores surrounded by microgranules. The dorsal scutum of *P. vittatum* had a punctuate morphology, with circular, concave depressions surrounded by microtubercles. The dorsal scutum of *M. ornatipes* displayed thickset patterns of rounded and acute laminae. Areas of the dorsal scutum of *M. niger* was similar to the scutum morphologies of both *L. formosum* and *P. vittatum*. In contrast to other studies, we observed multiple clusters of porous protrusions on the dorsal surfaces of the anterior cephalothorax and abdomen. Overall, the microanatomy of *P. vittatum* was more similar to *L. formosum* than to *Metopilio* spp.

P52 **Mary K. Bennett, Victor R. Townsend, Jr.**

Reproductive morphology of three species of Neotropical harvestmen (Opiliones, Laniatores, Gonyleptoidea)

Department of Biology, Virginia Wesleyan College, Norfolk, VA

In harvestmen of the suborder Laniatores, males possess sclerotized penises that exhibit a generally, complex morphology. In contrast, females have flexible, relatively short ovipositors that are generally unarmed. While descriptions of male genitalia are standard in modern taxonomic descriptions for harvestmen, relatively little is known about intraspecific variation in penis morphology. In contrast, descriptions of female genitalia are rarely included in species descriptions and remain unexamined for most species. In this study, we used a Hitachi S-3400N SEM to examine intraspecific variation in the reproductive morphology of *Cynortula granulata* (Cosmetidae), *Rhopalocranaus albilineatus* (Manaosbiidae), and *Santinezia serratotibialis* (Cranaidae). For male genitalia, we compared the distal margin of the ventral plate, the number and morphology of marginal setae, the shape of the glans penis, the morphology of the stylus, and the orientation of the glans penis and stylus. For ovipositors, we examined the number and morphology of setae on the distal tip of the ovipositor as well as the overall surface texture and symmetry. We observed considerable intraspecific as well as interspecific variation for ovipositor morphology, especially with respect to the total number of setae, morphology of distal tip of the setae, and surface texture. For males, we observed relatively little intraspecific variation. The discovery of informative characters is vital for future taxonomic and systematic studies of harvestmen and may lead to remarkable new insights into the function and biological roles of previously overlooked structures, such as the ovipositor.

P53 **Victor R. Townsend, Jr., Megan B. Johnson, Tara White**

Microanatomy of Neotropical Cosmetid harvestmen

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Cosmetid harvestmen are among the most common arthropods occurring in wet tropical forests in Central America. However, their taxonomy is in serious need of major revision. Presently, somatic characters used to identify genera and species include tarsal formula, armature of the dorsal scutum, color patterns, body size, shape of the scutum, and sexually dimorphic structures (chelicerae, leg IV). In this study, we used scanning electron microscopy (SEM) to investigate interspecific

variation in the ocularium, dorsal cuticle, free tergites, genital plate, pedipalps, legs, and chelicerae. We examined multiple adults of each of the following cosmetid species: *Cynorta blasi, C. marginalis*, *Cynortula granulata*, *Erginulus clavotibialis*, *E. subserialis*. *Eupoecilaema magnum*, *Holovonones compressus*, *Paecilaema chiriquiense*, and *Vonones ornata*. For comparative purposes, we used SEM to examine the morphology of several Gonyleptoidean taxa including *Glysterus* sp. (Gonyleptidae), *Phareicranaus calcariferus* (Cranaidae), *Rhopalocranus albilineatus* (Manaosbiidae), *Stygnoplus clavotibialis* (Stygnidae), and *Trinella intermedia* (Agoristenidae). Our investigation revealed several characters that displayed considerable interspecific variation including the number and shape of tubercles on the femur and patella of the pedipalp. distribution, relative size and shape of the granulations on the ocularium and dorsum, and the distribution and shape of macrosetae and tubercles on the legs and dorsum.

P54 **Michael Lucero[1], Raquel Fagundo[1], Stuart Welsh[2], Zachary Loughman[1]**

Distribution and conservation status of four *Orconectes* crayfishes occurring in Virginia's Upper James and Maury River systems

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Understanding patterns of species occurrence at a watershed scale aids conservation and management efforts for native and non-native species. The Orconectid crayfish fauna of Virginia's Upper James and Maury River basins consists of *Orconectes cristavarius*, *Orconectes obscurus*, *Orconectes sp.*, and *Orconectes virilis*. Of these taxa, *O. virilis* is a non-native species, and *O. cristavarius* is questionably native to the James River. Fifty-five stream sites were sampled for crayfish and ecological covariates (including elevation) following the Qualitative Habitat Evaluation Index (QHEI) protocol of the Ohio Environmental Protection Agency. We used logistic regression to model species presence as functions of ecological covariates. Model selection and inference were based on the Akaike Information Criterion. *Orconectes obscurus* and *O. sp.* were associated with higher and lower elevations, respectively. Presence of *O. virilis* and *O. cristavarius* was not associated with specific site covariates, a finding consistent with other studies of non-native species. With these results it is hypothesized that *O. obscurus* and *O sp.* constitute native species for both river basins, and *O. cristavarius* is considered introduced.

P55 **Holland M. Hendrick, Devin L. Carter, C. Brian Odom**

A preliminary attempt at estimating the founding population size of the invasive plataspid *Megacopta cribra*using Randomly Amplified Polymorphic DNA (RAPD) PCR.

Departmento of Biology, Wingate University, Wingate, NC

Megacopta cribraria is a recently invasive hemipteran in the United States, with a native habitat range of India, China, Southeast Asia, and Australia. *M. cribraria* was initially detected on the similarly invasive kudzu plant in Oconee County, GA in 2009. Since the kudzu bug's introduction into the United States, it has spread into North Carolina, South Carolina, Virginia, Tennessee, Mississippi, Florida, and Alabama. The technique of RAPD PCR has been used to detect DNA polymorphisms in an attempt to determine the approximate size of the founding US population of this invasive insect.

P56 **Stephanie Simmons, Monica Henry, S. Luke Shelton, Erika Scocco**

A preliminary approach using an entomopathogen as a biological control agent against *Megacopta cribraria* (Fabricius)

Department of Biology, Wingate University, Wingate NC

The kudzu bug, *Megacopta cribraria*, is an invasive insect in the United States, with a native habitat range of Southeast Asia, India, and Australia. *M. cribraria* was initially detected on the similarly invasive kudzu plant in Oconee County, GA in 2009. Since the introduction of kudzu bugs into the United States, it has spread into North Carolina, South Carolina, Virginia, Tennessee, Mississippi, Florida, and Alabama. While reducing the biomass of kudzu, the insect has also reduced soybean yields. With no known natural enemies in the United States, control of the kudzu bug has been strictly done so with insecticides. The purpose of this study is to determine LD_{50}

levels of adults and nymphs using *Beauveria bassiana* (Balsamo) Vuillemin as a potential biological control agent.

P57 **D. Gonsalves-Jackson, A. Slurff**

***Ercolania manglephila*: a new species of limapontian ascoglossan (=sacoglossan) from the Florida Keys (Opisthobranchia: Ascoglossa: Limapontiidae)**

Biology Department, Virginia Wesleyan College, Norfolk, VA

A new species of ascoglossan, *Ercolania manglephila*, is described from Key Largo, Florida. It was found with its algal food, *Cladophoropsis* sp., and occasionally *Chaetomorpha* sp., either on the roots of the red mangrove, *Rhizophora mangle*, or on the floor of a large mangrove lagoon, with its occurrence varying seasonally with algal abundance. In view of the circumtropical distribution recorded for many *Ercolania* species, *E. manglephila* is compared not only with western Atlantic species, but with all 24 species so far ascribed to the genus. This new species is unique in having a translucent body with bright green digestive diverticula visible within the numerous (up to 25 per side), variably-sized dark green cerata, as well as a vein-like pattern of the digestive diverticula at the base of the rhinophores. It is thus far the second *Ercolania* species described with a Type 2 (lecithotrophic) developmental pattern.

P58 **Kassandra Riley, Anastasia M. Woodard, Travis D. Marsico**

Can they finish together? Development of a standard operating procedure for synchronization of a laboratory colony with two species of cactus-feeding moths (Lepidoptera: Pyralidae)

Department of Biological Sciences, Arkansas State University, State University, AR

Across the coastal Southern United States, *Opuntia* cactus populations have come under attack by the invasive cactus moth, *Cactoblastis cactorum* (Berg). These areas were already home to the native cactus moth, *Melitara prodenialis* (Walker). In order to conduct laboratory studies aimed at understanding why *C. cactorum* is a destructive pest while *M. prodenialis* is not, as well as to develop new control methods for *C. cactorum*, laboratory colonies need to produce readily available larvae and eggsticks of both the invasive *C. cactorum* and the native *M. prodenialis* simultaneously for experiments. Here we describe the procedures developed for reliable use of synthetic diet, colony disease control, and the breeding needs of the separate species in a USDA-approved quarantine insect rearing facility. Along with synchronizing egg production of the two species, the timing of their lifecycles was investigated. *Cactoblastis cactorum* has a shorter lifecycle than that of *M. Prodenialis*, making it difficult to have eggsticks or larvae available for both at the same stage in their development, though the synthetic diet greatly increases the synchronicity of development over rearing on host plants. Procedures involving keeping eggsticks at temperature of around 20 degrees Celsius (instead of the ~30 degrees C used in rearing) for a period of up to 10 days as well as developing a plan to time the life cycles of each to allow for monthly laying of eggsticks from both species would fulfill needs for regular experimentation with these species in the laboratory.

P59 **Michael K. Moore[1], Victor Townsend, Jr.[2]**

Antipredator adaptations of harvestmen from Trinidad, W. I.

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For its size, Trinidad supports a diverse assemblage of Opiliones (i.e., Harvestmen). In coastal crappo-cocorite tropical forest habitats, 5 species are commonly encountered. Initial field observations of behavior and morphology of this species assemblage suggested potential interspecific differences in predator avoidance strategies. We field-tested the behavioral responses of these species in May of 2011 and 2012. We captured individuals in the field by seizing the proximal region of femora IV to simulate grasping by a predator, and the response of each individual was recorded. After 10 seconds a light dorsoventral pressure was applied with forceps to the opisthosoma. Again responses were recorded. Significant differences in behavioral responses were observed between species. The large, heavily-ornamented male *Phareicranaus calcariferus* individuals showed the least overall response to the tests, with most individuals showing no alteration of behavior or

defensive (i.e., enteric) secretions. However, females of this species had the greatest percentage of individuals secrete defensive materials (often ejected forcefully from the ozopore) compared to all other species. In general, species responses escalated when pressure was applied to the opisthoma. For example, while the most common response to initial to leg grasping in *Cynortula undulata* was leg waving, when pressure was applied the most common response was a combination of thanatosis and enteric secretion. A detailed comparison of the responses of each of the 5 species is presented.

P60 **Shana Hensley, Darwin Jorgensen**

Cardiovascular responses to graded exercise in the Atlantic blue crab, *Callinectes sapidus*.

Department of Biology, Roanoke College, Salem, VA

Blue crabs (*Callinectes sapidus)* are known for migrating substantial distances via walking and/or swimming. We are interested in analyzing the physiological characteristics of the cardiovascular system while under the stress of graded exercise. Maximum and minimum pressures of ventricular and pericardial pressures were measured as well as mean infrabranchial pressure over the course of a 2 hour experiment. Animals were prepped for experimentation 24 hours in advance and allowed a minimum of 30 minutes to acclimate to the tank before beginning data collection. While at rest, data was collected for 30 minutes, then the animal walked on a underwater treadmill for 15-30 minutes. Depending on how the animal tolerated the stress, some were allowed 30 minutes to recover and then walked again at the same intensity; after stopping the treadmill, the animal's recovery was monitored for 30 minutes.We expected to see an increase in the difference between maximum and mininum pressures in the ventricle and pericardial space during exercise and a decrease as the animal recovered. We anticipated seeing an increase in mean IB sinus pressure from rest to walking and a decrease in mean IB sinus pressure while recovering.

P61 **Jordan Holman**

Affects of time of day, temperature, and humidity on *Atta cephalotes*

Fairland High School, Proctorville OH

This study examined the daily activity pattern of a leaf cutter ant species, *Atta cephalotes*, at the Piro Research Station in Osa Peninsula, Costa Rica. Leaf cutter ants harvest leafs off of trees in order to use them as a fertilizer for a fungus that they then cultivate and feed off of. I investigated whether *Atta cephalotes* was more active at certain parts of the day; when does their production peak and when is it at its slowest. After locating a suitable leaf cutter ant trail, I set up a video camera and placed a scale bar on the trail. Then I recorded the ants on their trail during the first 10 minutes of every hour from 6:00 am to 4:00 pm. I also record the humidity and temperature on the hour. Videos were then played back and the number of ants carrying vegetation was recorded. The total sample size was 11,495 ants. My results showed that the ants in my sample site were most active from 11:00 am till 2:00 pm and they were least active around dawn and dusk. Correlation statistics of the number ants and temperature and between number of ants and humidity showed that there was a positive correlation between temperature and number of ants (r=0.70) and a negative correlation (r=-0.74) between number of ants and humidity.

P62 **Donald Trisel, Caitlyn Jones-Stealey**

Daily and seasonal weight fluctuations in a honeybee colony (*Apis mellifera*).

Department of Biology, Fairmont State University, Fairmont, WV

During the summer of 2010, we placed a honeybee hive (*Apis mellifera*) on top of an electronic scale on private property near Farmington, WV (GPS: 39.495, -80.300). Weight data was continuously recorded every 10-30 minutes. This hive did not receive sugar water or pollen patties to supplement their resources nor did they receive any type of chemical treatment for mites or other pests. Bees in this hive were successful in filling supers of honey which were harvested each year. Interesting patterns in the life of the honeybee were reflected in the data. After an extended drought during which the hive was losing weight on a daily basis, a long soaking rain was followed by a good goldenrod bloom and the hive gained 33 lbs (14.97 kg) in one week. During the winter when temperatures remained below 40 °F (4.4 °C), there

were no daily fluctuations – just a slow and steady decline in weight as the colony slowly consumed their resources and gave off moisture/CO2 from cellular respiration. During the growing season, there were very distinct patterns of weight loss as the field workers left the hive each day and weight gain as they returned, perhaps with their nectar and pollen loads. Each night during the growing season there was also a steady weight decline, presumably as the nectar was being dried and cured into honey.

P63 **Andrew E. Rosselot, Mary Clare Yerke, Andrew J. Jajack**

Importance of pollen in the establishment of the red mite as a natural enemy in the biological control of scale insects, aphids and other plant pests

Department of Biology, Wittenberg University, Springfield, OH

We report an innovative colorimetric-based technique documenting feeding activity in the mite *Balaustium murorum* using Evans blue stained pollen as a tracer. This technique allowed us to investigate whether feeding mites produce an attractant pheromone that leads other conspecific mites to sites where food, plant pests, is abundant. In this study, mites were placed into Petri plate attraction bioassays and exposed to pollen from tulip (*Tulipa*), daffodil (*Narcissus*), pear (*Pyrus*), maple (*Acer*), viburnum (*Viburnum*) and crabapple (*Malus*) cultivars with the goal of exploring habitat selection. Examining the response to fed mites by free-ranging mites tested pheromone production. All active, mobile stages of this mite (larva, deutonymph, adult) fed on pollen. Pollen feeding was most pronounced in the larva, as evidence by rapid clearance of pollen by feeding in the bioassays. All kinds of pollen were eaten, but larvae and deutonymphs ate daffodil and viburnum pollen preferentially (strong attraction and more rapid clearance), and this shifted to maple and crabapple pollen utilization in the adults. Mites responded to fully fed mites passively, causing neither attraction nor repellent reactions. Our conclusion is that these mites encounter prey and pollen randomly, which corresponds to their rapid, scurrying activity on walkways and walls, and pollen serves as an important alternate food source for larvae early in the spring when plant feeding prey are less abundant. Thus, sites where pollen falls are critical regarding the suitability for release of these mites in a new geographic application in classical biological control programs.

P64 **Terrance J. Smith, Andrew J. Jajack, Andrew E. Rosselot**

Requirement for a dry habitat for proper development and hatching of larvae of the emerald ash borer based on the water relations of eggs

Department of Biology, Wittenberg University, Springfield, OH

The egg of the emerald ash borer, *Agrilus planipennis*, is the primary transmission stage for the spread of this pest by infected lumber, and more significantly it gives rise to larvae that eventually kill the tree by their tunneling action through the wood. The egg is cleidoic and impervious to the environment, making water balance a critical issue. The goal of this study is to determine the attributes of the egg that may permit it to remain hydrated enough to hatch. Water balance characteristics were determined as a function of temperature and relative humidity based on gravimetric analysis with a microbalance. Low water content, low water loss rate, high dehydration tolerance limit, and a layer of water-proofing lipid were the outstanding features of the egg that ensure hatching. Water loss increased with increasing temperature exhibiting a regular Boltzmann fashion (i.e., there is no critical transition temperature), and the activation energy was suppressed. Isolated eggs were not at a disadvantage compared to eggs laid in a cluster. Solvent treatment stripped the eggs of cuticular lipids causing eggs to lose water faster. These enhanced water conservation features of survival imply that eggs depend on a dry microhabitat. This observation matches behaviorally what occurs in adult females that selectively oviposit on dry, sun-exposed sites on trees, requiring eggs to suppress heat-induced water stress. Thus, the key element of survival for the emerald ash borer eggs is a covering of eggshell waxes that is highly resistant to thermal breakdown.

P65 **Tamara Johnstone-Yellin[1], Lisa Shipley[2]**

Using *Grammia nevadensis* to test the effects of resource allocation on growth and birth sex ratios.

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Since it was first proposed, researchers have attempted to look for evidence to support the condition dependent selection hypothesis of sex allocation (Trivers and Willard 1973) in herbivores. Because of difficulties in measuring mother condition, digestion and assimilation efficiencies, resulting data remains equivocal. To remove these complexities of physiology, we tested how resource availability affects sex allocation using *Grammia nevadensis* (Lepidoptera: Arctiidae) as a model species. We used high protein low fiber kale and a low protein, high fiber pelleted diet to explore how these diets affect growth rate, population density and sex ratio. Despite the benefits of using this fast growing species as a model, we found little evidence that forage quality, average number of days to pupation or average number of days to emergence affected population sex ratios. Forage quality did, however, affect growth rates and the average number of days to pupation or emergence. Our results illustrate the difficulties in testing evolutionary hypotheses of sex ratios.

P66 **Fengjie Sun[1], Gustavo Caetano-Anollés[2]**

Phylogenetic studies revealed the ancient history of the structure of ribonuclease P and the early origins of Archaea

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Ribonuclease P characterizes a biologically fundamental macromolecular complex and model system that is universally distributed in life. This ancient endonuclease cleaves precursor tRNA and generally consists of a catalytic RNA subunit (RPR) and one or more proteins (RPPs). The RPR in bacteria is further divided into two functional domains, one is the catalytic (C) domain involved in substrate cleavage and the other is the specificity (S) domain involved in substrate binding. Although it has been proposed that C domain is more ancient than the S domain, which plays an accessory role during the cleavage of precursor tRNA, the evolutionary history of the molecular components of the two structural folding domains remains elusive. We apply an award-winning phylogenetic approach using RNA and protein structural information to reconstruct evolutionary history of RNase P complex. Trees of molecules revealed the tripartite nature of life and the early origin of archaeal RPRs, while trees of substructures showed molecules originated in stem P12 and the accessory catalytic P1-P4 core structure. In conjunction with the census of protein domain structure in hundreds of genomes, this study showed that the RPPs appeared after the rise of metabolic enzymes at the onset of the protein world. These results provide further evidence in support of the existence of a tripartite organismal world that originated by the segregation of archaeal lineages from an ancient community of primordial organisms.

P67 **Kellie C. Fredette[1], Steven M. Guthrie[1], Andrew L. Sheldon[2], Alicia S. Schultheis[1]**

Differing levels of genetic structure in stonefly (*Doroneuria baumanni*) populations within and outside the Great Basin, USA

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Sky islands are montane regions surrounded by valleys with drastically different vegetation and environmental conditions, which can isolate mountain top populations from one another. In the Great Basin sky island system, past studies have identified three genetically distinct clades of the stonefly *D. baumanni*. While there is clear support for the clades, the relationship among them is unclear. In this study, we sought to better resolve the relationships by sampling additional populations from outside the Great Basin and in areas within the Great Basin known to have high levels of genetic structure. The populations outside of the Great Basin are separated by less extreme environments; therefore, we hypothesized that genetic structure among these populations would be lower. We tested our hypothesis using 649 base pairs of the mitochondrial cytochrome b gene, and phylogeographic and population genetic methods. Our results confirmed the pattern of high genetic structure among populations in NW Nevada that are separated by harsh environmental conditions. Populations outside the Great Basin showed levels of genetic differentiation similar to populations within the Great Basin that are separated by higher elevation valleys with more hospitable conditions. More sampling is needed to clarify the relationships

among the Great Basin clades. The degree of genetic structuring among Great Basin sky island populations of *D. baumanni* underscores the importance of sky island systems as sources of evolutionarily distinct genetic lineages.

P68 **Kimberly G. Arnaldi[1], Allyson M. Fenwick[1], Andrew L. Sheldon[2], Alicia S. Schultheis[1]**

Phylogeography and population differentiation of the stonefly *Hesperoperla pacifica* across mountain ranges in the Great Basin, USA

[1] Department of Biology, Stetson University, DeLand, FL; [2] Professor Emeritus, Department of Biology, University of Montana, Missoula, MT

Isolated montane populations of stoneflies have been found to have high levels of genetic structure within the Great Basin. This diversification occurred during the Pleistocene and may have been affected by climatic oscillations. With this in mind we looked at contemporary genetic structure of the stonefly *Hesperoperla pacifica* because this species has a wide range and relatively broad habitat requirements. We expect it to have less genetic structure than montane species with stricter habitat requirements. We estimated genetic differentiation among and within several populations of *H. pacifica* by using over 850 bp of the mitochondrial gene cytochrome b. F_{ST} estimates and phylogeography suggest that *H. pacifica* populations are less structured than the previously studied stonefly *Doroneuria baumanni,* which has three distinct haplogroups. These results confirm the benefits of a comparative approach to understanding the phylogeography of the Great Basin.

P69 **Nathaniel T. Akers, Thomas W. Cannon, Tamara L. Walker**

A genetically distinct population of three-lined salamanders, *Eurycea guttolineata*, in the Florida Parishes of Louisiana

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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 this 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.

P70 **LaShonda M. Caine, Chantia M. Stewart, David A. Beamer**

The impact of the Apalachicola River as a phylogeographic barrier in *Pseudotriton ruber*

Department of Mathematics & Sciences, Nash Community College, Rocky Mount, NC

The red salamander (*Pseudotriton ruber;* family Plethodontidae) has four currently recognized subspecies: the northern red salamander, *P. r. ruber;* the Blue Ridge Red Salamander, *P. r. nitidus;* the Blackchin Red Salamander, *P. r. schencki;* and, the southern red salamander, *P. r. vioscai.* A range wide survey of *Pseudotriton ruber* revealed a pattern of genetic homogeneity. However, populations of *P. r. vioscai* from west of the Apalachicola River are highly differentiated genetically from adjacent populations to the east. This sharp genetic break suggests that western populations of *vioscai* might represent a separate species. In order to test whether these two lineages might represent two separate species, we amplified, purified, and sequenced eight nuclear genes for populations within the contact zone. Here we present the results of our speciation analyses.

P71 **Jessica M. Avila[1], LaShonda M. Caine[1], David A. Beamer[1], Sean P. Graham[2] Diversification of seepage salamanders across a complex geologic landscape**

[1] Department of Mathematics and Sciences, Nash Community College, Rocky Mount, NC; [2]Department of Biology, The Pennsylvania State University, University Park, PA

The seepage salamander, *Desmognathus aeneus*, occupiesmany distinct physiographic regions and several independent river drainagebasins. Within this range, seepage salamander populations tend to belocalized and most are apparently

disjunct. The disjunct nature of thesepopulations coupled with a complex geological and ecological history of theregion occupied by these salamanders provides conditions which are conducive tolineage diversification. During the course of a range wide surveyof seepage salamander, we visited nearly every historical site from which thisspecies has been reported; in addition we discovered many previously unknownpopulations. Here we report the first phylogeographic survey of theseminute salamanders. A Bayesian phylogenetic reconstruction of bothmitochondrial DNA and eight nuclear genes reveals the presence of several wellsupported, distinct evolutionary lineages. The presence of multiplelineages within seepage salamanders has important conservationimplications. The results of this survey provide a strong case for theimportance of molecular systematic techniques in revealing the biodiversity ofthe southeastern United States.

P72 **Brenten L. Bottoms, Jessica M. Avila, David A. Beamer**

Morphological homoplasy within mountain dusky salamanders (Desmognathus)

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Mountain dusky salamanders (*Desmognathus*)are medium sized lungless salamanders distributed across the AppalachianMountains. Historically, there has been debate about how many species ofmountain duskies occupy this region, currently there are six recognizedspecies: *ochrophaeus*, *orestes*, *carolinensis*, *apalachicolae*,*ocoee*, and *abditus*. These six species have been recognized, inpart, based upon molecular data. However, to date there has not been acomprehensive range wide molecular phylogeny for *Desmognathus*.. Here wepresent a range wide molecular phylogeny that reveals the relationships of thesix recognized *Desmognathus*, as well as several apparently unnamedlineages. To understand the morphological variation within these lineages wehave photographed and measured specimens from various localities in thesouthern Appalachians. In the 1960's Martof and Rose collected over 4,000 *Desmognathus*from 21 localities and made twelve different measurements for each specimen. Toleverage their large morphological data set, we collected a series of thirtysalamanders from the same localities. We made measurements of snout to ventlength, vent to tail length, head length, and head width to supplement theirexisting data. For each of these localities we sequenced ~1100 bp fragment ofmtDNA ND2 gene. Our measurements, within the context of our molecularphylogeny, reveal considerable levels of morphological homoplasy withinmountain dusky lineages.

P73 **Andrew Hart, Emily Gillespie**

Preliminary phylogenetic investigation of *Ledum* (Labrador Tea, Ericaceae)

Department of Biological Sciences, Marshall University, Huntington, WV

The genus formerly known as *Ledum* (=*Rhododendron* subg. *Rhododendron* Section *Rhododendron* Subsect. *Ledum*) is comprised of several species of small shrubs distributed across northern North America. These species are lepidote rhododendrons, recognized by the presence of scales on the abaxial leaf surface. Older treatments recognized up to eight species of *Ledum*, whereas the Flora of North America recently recognized three species (within *Rhododendron*) based upon overlapping morphological variation among some of these species. The current study seeks to use molecular data to 1) determine the phylogenetic placement of Subsect. *Ledum* within *Rhododendron* and to evaluate species boundaries among the three FNA-recognized species (*R. groenlandicum*, *R. columbianum* and *R. tomentosum*). Taxon sampling includes all species of *Ledum* as well as representatives of the non-lepidote *Rhododendron* subgenera as outgroups. Here, we report preliminary phylogenetic placement of *Ledum* based upon multiple molecular markers and Maximum Parsimony, Maximum Likelihood and Bayesian analyses. We discuss the evolutionary implications within the lepidote rhododendrons and the apparent species boundaries within *Ledum*.

P74 **Richard Carter[1], Jordan C. Jones[2]**

Distribution, dispersal and ecology of *Sphenoclea zeylanica* (Sphenocleaceae) in North America

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Native to the Eastern Hemisphere, *Sphenoclea zeylanica* (gooseweed) is an aquatic

plant that occurs along margins of lakes and ponds, streambanks, and disturbed wetlands. It is a major pest of rice *(Oryza sativa)* and is now distributed widely in both Hemispheres in tropical, subtropical, and warm temperate regions. Data obtained from more than 300 voucher specimens from more than 30 herbaria indicate gooseweed has been in the United States since the mid-1800s. The earliest records of gooseweed in the United States are from Louisiana, where it was most likely introduced as a contaminant of rice seed. Its distribution is linked strongly with rice agriculture, and we document the distribution and dispersal of *Sphenoclea zeylanica* in the United States over the past 150 years, from Louisiana westward into southeastern Texas, northward through eastern Arkansas and into southeastern Missouri, and sporadically eastward into Florida, Georgia and the Carolinas. Finally, descriptive data on its habitat and diagnostic characteristics are presented to facilitate identification of gooseweed in floristic inventories of wetlands.

P75 **Wendy B. Zomlefer, David E. Giannasi, Sabrina Y.S. Sewell**

Vascular plant flora of the lower Ogeechee River: Savannah-Ogeechee Canal Nature Center, Chatham County, Georgia

Department of Plant Biology, University of Georgia, Athens, GA

The Ogeechee River originates in the lower Georgia Piedmont and flows southeast for ca. 402 km (250 miles) to the Atlantic Ocean, ca. 26 km (16 mi) south of Savannah. The lower portion of the river, a floristically critical area within the Southern Coastal Plain ecoregion, comprises many high priority habitats designated by the Georgia Department of Natural Resources. Threats to these areas include encroaching development and drainage of adjacent wetlands. The focus of this study is a vascular plant survey of two adjacent parkland parcels (143.4 ha; 354.4 acres) along the lower Ogeechee River corridor in Chatham County: the Savannah-Ogeechee Canal Nature Center and the Ogeechee River Nature Preserve. The site has historic significance as the terminus of a 26.6 km (16.5 mi) long canal completed in 1831, which connected the river to the port of Savannah. Vegetation types at the preserve include floodplain hardwood forests, freshwater tidal marshes, and subxeric pine-oak hardwoods. Nine collecting trips conducted in 2012 yielded 448 specimens representing 375 species of vascular plants. Twelve percent of the non-cultivated flora is non-native, and no state/federally ranked rare plant species occur within the study area. This plant survey serves as field verification for crucial coastal areas recently mapped by DNR biologists and will be integrated into nature programs at the Savannah-Ogeechee Canal Nature Center. A set of the professionally prepared vouchered specimens comprises the foundation of a new DNR coastal reference collection for use in research and outreach activities.

P76 **Donald Trisel, Kassen Lloyd, Justin Hilliard, Josh VanOsdol**

Vascular plant survey of the Crawford Tree Farm, Marion County, WV.

Department of Biology, Fairmont State University, Fairmont, WV

In 2012 a new project was initiated to document the vascular flora of the Crawford Tree Farm in Marion County, West Virginia (GPS: 39.50587, -80.06695). The property has been in the Crawford family since at least the Civil War, specifically managed to conserve soil resources since 1950, and enrolled as a tree farm since 1963. The property included a total of 378 acres, 315 of which were woodlands. Forest types included some oak-hickory dry ridges and some cove hardwood stands. There were cooperative projects by the Crawford family and the US Forest Service under way to manage *Ailanthus altissima*, Tree of Heaven, and *Celastrus orbiculatus*, Oriental Bittersweet. The goal of our survey was to document the diversity that can be present when our forests are properly managed. Bi-weekly collecting trips were conducted throughout the 2012 growing season from March 13th to September 30th. Over 300 vouchers were collected from at least 264 different specimens. The collections documented 67 families. To date, 103 different genera have been identified. As a result of this survey, we are anticipating several new county records that have not been documented in the Checklist and Atlas of the Vascular Flora of West Virginia by Harmon, Ford-Werntz, and Grafton (2006).

P77 **Caroline L. Matchett, Kevin M. Gribbins, Jay A. Yoder, Matthew H. Collier**

A comparative study on the morphometry of epiphytic, terrestrial, and aquatic North American orchid seeds in relation to their water balance properties

Department of Biology, Wittenberg University, Springfield, OH

In this study, we examined the relationship between seed ultrastructure and the seed water conservation strategies employed by seven terrestrial (*Cleistes bifaria*, *Isotria medeoloides*, *Liparis elata*, *L. hawaiensis*, *Platanthera holochila*, *P. integrilabia*, and *P. leucophaea*), two epiphytic (*Encyclia tampensis* and *Epidendrum nocturnum*), and one aquatic (*Habenaria repens*) North American orchid species. Examination of seed microstructure (N = 12 seeds/species) was determined by light (LM) and scanning electron microscopy (SEM), and included measures of seed and embryo dimension (length, width, and volume), and the fine structure and dimension of testa cells (length, width, and area). Overall, the orchid taxa examined in this study produced seeds that exhibit microstructural characteristics consistent with their water balance profiles. For example, terrestrial orchid seeds had the smallest mean length/width ratio, the greatest seed volume, the largest number of testa cells, and embryos with the highest mean area, all suggesting that they were the least truncated and largest group of seeds examined. These data correlate with the fact that terrestrial orchid seeds tend to lose water at a slow rate, a water balance characteristic that can partly be attributed to the small surface area to volume ratio present in these "larger" seeds. Similar relationships between seed/embryo morphometry and water conservation strategy were also seen in the epiphytic and aquatic taxa examined in this study. We are hopeful that these results not only present valuable information for the conservation of these orchid taxa, but also provide morphometric data that may prove useful for taxonomic/phylogenetic purposes.

P78 **T. Wayne Barger, Brian D. Holt**

An overview of the vascular flora of the Old Cahawba Forever Wild Tract (Dallas County, AL)

AL-DCNR, Natural Heritage Section, Montgomery, AL

The Old Cahawba Forever Wild Tract (OCFWT) is a 1,216 ha property that was acquired by the State of Alabama Forever Wild Program in August 2009. The OCFWT is characterized by black-belt prairie pockets, upland dry/calcareous forest, loblolly plantations, and bottomland/floodplain forest. The property lies 14 km southwest of Selma, AL and is bordered to the northeast by the Cahaba River. The site is managed by the Alabama Department of Conservation and Natural Resources with an emphasis on recreational use and habitat management. An intensive floristic study of this area was conducted from January 2010 through May 2013. A total of 653 taxa (651 species) from 393 genera and 134 families were collected with 262 taxa being county records. Asteraceae was the most collected family with 72 species. Poaceae, Fabaceae, and Cyperaceae were the next largest families with 57, 56, and 29 species, respectively. Quercus was the largest genus represented with 12 taxa. One hundred and eighteen non-native species were collected during the surveys. Plant collections were deposited at the Alabama Natural Heritage Section Herbarium (ALNHS), with duplicates deposited at the Anniston Museum of Natural History Herbarium (AMAL) and Auburn University Herbarium (AUA).

P79 **Tanner M. Morris, JohnRyan A. Polascik, David R. Brown**

Developing a vegetation-based index of biotic integrity for assessing the ecological condition of wetlands in Kentucky.

Department of Biological Sciences, Eastern Kentucky University, Richmond, KY

To enforce the Clean Water Act, a number of ecological assessment techniques have been developed to quantify the ecological quality of streams and wetlands across the United States. However, Kentucky is currently lacking in this area and has no state-wide means to assess the ecological quality of its wetlands. Ohio has a state-wide applicable vegetation-based index of biotic integrity (VIBI) for assessing wetlands that has undergone multiple testing iterations and years of refinement. Due to the geographic and vegetative similarities between Ohio and Kentucky, Ohio's VIBI was used as a model for the development of a state-wide applicable vegetation-based IBI for Kentucky (KY VIBI). The Ohio VIBI metrics were tested for performance in riverine wetlands in two of Kentucky's watersheds, the Green River and Upper Cumberland River. Using a stratified random selection approach, a total of 39 sites were

intensively sampled between the two watersheds over the growing seasons of 2011 and 2012. Preliminary analysis suggests certain metrics (e.g. the number of seedless vascular plants, number of hydrophytes, percent invasive graminoids) from the Ohio VIBI are not performing in a way that correctly reflects wetland condition in these two watersheds. Our next step is to make slight modifications to the existing metrics from the Ohio VIBI in order to properly reflect wetland condition in these two watersheds. These modified metrics will then be validated against an independent method of calculating disturbance (Landscape Development Index or LDI) using correlation analysis and will become candidate metrics for the final KY VIBI model.

P80 **Krystal T. Payne[1], Ross A. McCauley[2], J. Christopher Havran[1]**

A preliminary phylogeny of the endemic Hawaiian genus *Nototrichium* (Amaranthaceae)

[1] Department of Biological Sciences, Campbell University, Buies Creek, NC; [2]Department of Biology, Fort Lewis College, Durango, CO

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*.

P81 **Christopher R. Burkhart, Kari M. Harris, Travis D. Marsico**

Improvement of digital herbarium specimens through image stitching

Department of Biological Sciences, Arkansas State University, State University, AR

Herbaria are currently finding their niche in the technological age. Curators and assistants are producing digital copies of specimens by taking high resolution photographs. Recent technological advancement has allowed for the establishment of virtual databases accessible via the internet, thus linking geographically separated collections into consolidated specimen resources. Currently, there are limitations to image quality and magnification abilities from images taken with digital cameras of entire herbarium sheets. In an effort to alleviate these problems, we have created an improved imaging process. The procedure consists of utilizing higher magnification photo segments in photo stitching software to create a whole specimen reproduction. These stitched images are then able to undergo relatively strenuous digital magnification. Using a Nikon D3200 digital camera and an AF-S DX Zoom-NIKKOR 18-55mm lens, we took photographs that are approximately one ninth the size of actual herbarium specimen. Images were aligned in a specific sequence via an alpha numeric designation on x and y axes. Specimen photo segments were then prepared for stitching and stitched by utilizing FIJI photo editor (LOCI, Madison, WI). The image stitching protocol described provides a magnification through the lower range typical of a stereo microscope. These new digital specimens will allow for examination of minute morphological structures that would otherwise be unobservable through digital herbaria. As stitched image specimens are made available through online databases, they will serve as a new global tool to preserve natural history more efficiently and share information to relevant end-users more effectively.

P82 **Dustin Spivey, Thomas Ford**

Using community-level physiological profiles to measure the impact of mining on microbial communities in West Virginia streams

Biology Dept., Concord University, Athens, WV

The objective of this study was to determine the effects of acid and alkaline mine drainage resulting from coal mining have on microbial communities in streams of southern West Virginia. Microbial communities were analyzed by inoculating BIOLOG Eco (bacteria) microplates and FF (filamentous fungi) microplates and measuring the absorbance. BIOLOG microplates contain different commonly occurring carbon sources along with a tetrazolium dye. As the carbon source is utilized the dye is released and produces a purple/red color. A microplate reader was used to measure absorbance at a wavelength of 590nm for the Eco microplates and 540nm for the FF microplates. The plates were read every 24 hours for 7 days. Alkalinity, pH, conductivity and heavy metal concentrations were analyzed at each site. Average well color development (AWCD) for the bacterial communities was higher for the control sites than for the acid and alkaline mine drainage affected sites. The FF microplates showed no difference in AWCD between the control sites and the acid and alkaline min drainage affected sites. The community metabolic diversity (CMD) was also higher for the control sites in the Eco microplates but demonstrated no difference in the FF microplates. Principal components analysis revealed that the bacterial and fungal communities from the acid mine drainage, alkaline mine drainage, and reference streams utilized different suites of carbon sources. The results from this study indicate that acid and alkaline mine drainage has a negative effect on microbial communities in freshwater streams. Impacted microbial communities can lead to impaired ecosystems.

P83 **Hillary Shupe, Thomas Ford**

Functional diversity of microbial communities in streams impaired and unimpaired by fecal coliform contamination

Biology Dept., Concord University, Athens, WV

We assessed the functional diversity of microbial communities in fecal coliform impaired and unimpaired streams in southern West Virginia. Functional diversity was determined by constructing community-level physiological profiles (CLPPs). Fecal coliform contamination was assessed in three impaired and three unimpaired streams using the standard membrane filtration as well as the Micrology Laboratory's Coliscan Easy-gel technique. CLPP's were constructed using BIOLOG Eco (bacteria) and FF (fungi) 96-well microplates, containing 31 and 95 different carbon sources, respectively. Inoculated microplates were incubated at room temperature for 9 days. Metabolic activity was determined by measuring the absorbance of each well at 595nm (Eco-Plate) or 540nm (FF Plate) with a microplate reader every 24 hours. For the bacterial communities, the average well color development (AWCD) and community metabolic diversity (CMD) were higher for impaired streams than the unimpaired streams. Filamentous fungi communities, with the exception of one of the three sites, showed higher AWCD and CMD values for impaired streams when compared to the unimpaired streams. The higher AWCD and CMD values for the impaired streams could be associated with to high fecal coliform contamination levels due to high concentrations of nitrogen and phosphorous resulting from human and livestock waste. The higher the functional diversity of the microbial communities the greater the number of carbon sources broken down within the stream. The impaired streams may possess enriched amounts of nitrogen and phosphorous, resulting in higher microbial functional diversity and metabolic activity. Therefore, the impaired streams may experience a higher rate of litter decomposition.

P84 **Kimberly J. Bolyard, Joelle E. Bennett**

Habitat use and swimming behavior of longnose dace (*Rhinichthys cataractae*) from a mercury contaminated river

Department of Biology, Bridgewater College, Bridgewater, VA

Mercury in the environment has the potential to negatively affect the behavior of aquatic organisms through impacts on the nervous system and other physiological functions. We investigated the habitat use and swimming performance of longnose dace (*Rhinichthys cataractae*) from a river with mercury contamination and from a non-contaminated river in the Shenandoah Valley. Laboratory studies showed that dace from the non-mercury river spent significantly more time in areas containing

large sticks than in areas with pine brush, pallet wood, or nothing. Dace from the mercury contaminated river did not spend significantly more time in any particular section of the test pool. In a second test, dace from the mercury contaminated river spent more time swimming in a current over a five minute test period than did dace from the uncontaminated river but the difference was not significant. Finally, tested fish from the uncontaminated river were significantly longer than fish from the mercury contaminated river though they were not significantly heavier. As a result of spending less time in cover and possibly more time swimming in a current, longnose dace in mercury contaminated rivers may experience higher risk of predation than dace in uncontaminated rivers.

P85 **Tricia Rea, Elizabeth G. Dobbins, Kristin A. Bakkegard, Christopher Graben**

The influence of rock vane remediation on local macroinvertebrate community structure in Shades Creek, Jefferson County, AL

Department of Biological and Environmental Sciences, Samford University, Birmingham, AL

Shades Creek, the largest tributary of the Cahaba River, is locally impacted by erosion as it passes through Shades Valley in Homewood, AL. In November 2010, ten rock vanes were installed in a 330 m section of creek to reduce erosion and trap sediment. We predicted that there would be supplemental benefits including improving water quality and habitat downstream. Macroinvertebrates are reliable indicators of water quality. Using EPA rapid bioassessment protocols, we sampled macroinvertebrates 100 m upstream of the rock vanes, between the rock vanes (treatment area), and 100 m downstream of the rock vanes. In 2012, we found there were more of the sensitive Ephemeroptera, Plecoptera, and Tricoptera (EPT) taxa, the highest % EPT and the lowest % chironomids downstream of the vanes. The treatment area had the lowest % EPT and the highest % chironomids, but the greatest number of total taxa. The recovery downstream of the vanes is impressive as the creek suffered decreased total water quality upstream of the vanes in 2012, reflected in a 22% increase in chironomids as compared to 2010, and because macroinvertebrate community structure and water quality were initially drastically perturbed by rock vane installation. In the treatment area, total taxa, EPT taxa and family biotic indices have improved to pre-installation (2010) values. These results suggest a local benefit to macroinvertebrate communities downstream from the installed vanes and that treatment areas may be recolonized within a few years.

P86 **Victoria Templeton, Vance Pounders, Jennifer Greenwood**

Effects of light availability and temperature on northwest Tennessee stream diatom community structure

Department of Biological Sciences, University of Tennessee at Martin, Martin, TN

Light availability and temperature are important factors influencing diatom communities. In streams, shading by riparian vegetation can limit the amount of light reaching diatoms during the growing season, when water temperatures are warmer, but shading is reduced during winter and early spring when water temperatures are colder. Our objective was to evaluate how the differential effects of light availability and temperature potentially contribute to changes in diatom community structure. Diatoms were grown for 3 weeks in October 2012 on unglazed ceramic tiles in a 2nd order stream from a primarily agricultural land use area at UT Martin. Tiles continued to develop for 3 weeks in mesocosms (85x40x15cm plastic containers) that were half-covered with shadecloth and contained either chilled (10°C) or heated (22°C) water. Diatom communities were evaluated from permanent slides. A total of forty-five diatom species was identified. Non-metric multidimensional scaling analysis indicated that diatom communities overall differ mostly due to temperature, although light also appeared to have an influence. The species with the highest relative abundance showed mixed responses to mesocosm conditions, potentially explaining community differences. *Luticola mutica* and *Geissleria decussis* were more abundant in warmer temperatures but not affected by light. *Amphora submontana* and *Navicula radiosa* var. *tenella* preferred higher light levels, but were ambivalent to temperature. *Diadesmis confervacea* preferred higher light regardless of temperature and *Encyonema minuta* did not appear to be affected by light or temperature. This mesocosm study was performed on diatoms colonized during the autumn and will be repeated for winter, spring and summer communities.

P87 **John Enz, Ashley Briddell, Danielle D'Amato, Vincent Domena, Alissa Gilmer**

Herpetological survey of Turtle Pond, NASJAX, Jacksonville, Florida with a comparison of turtle trapping methods

Department of Biology & Marine Science, Jacksonville University, Jacksonville, FL

Stormwater management is an issue for many parts of the country, especially in urban areas like Jacksonville, Florida. However, recent interest has increased in terms of these stormwater containment areas (ponds) serving as valid wildlife areas. As part of their environmental management, Naval Air Station Jacksonville (NASJAX) monitors their storm water areas for wildlife. As with most vernal ponds of this nature, high sediment runoff can cause these ponds to fill-in over time with unwanted sediment and may require periodic dredging in order to allow for proper water flow and flooding prevention. One such pond is known to NASJAX as Turtle Pond and it has been impacted by excess sediment runoff. The purpose of this study was to characterize the herpetofauna population, particularly turtles, before the pond is dredged. Turtles were sampled 2-3 times per week using different sampling methods over a seven week period in the fall of 2012. Visual surveys were conducted for other herpetofauna (lizards, snakes, and frogs) each time the turtle traps were checked. Evening frog call night surveys were also conducted during the study period. Results are now being analyzed and will include species lists, abundances, as well as a comparison of the trapping effectiveness of 3 different turtle trapping methods.

P88 **Julia Love, Marielle Kromis, Daniel Rhiner, Marjan Mirkheshti, Joseph M. Dirnberger**

Diet and feeding habits of the eastern mosquitofish *Gambusia holbrooki* foraging among macrophytes

Department of Biology and Physics, Kennesaw State University, Kennesaw, GA

Diet and feeding habits of the eastern mosquitofish *Gambusia holbrooki* were examined in a small beaver-created wetland in Lake Acworth (Cobb county, Georgia). Gut analysis was used to examine mosquitofish diet over the course of two seasons, fall and winter. In the fall, mosquitofish were collected at dawn, midday, evening, dusk, and night. Individuals were found nearshore among macrophytes, and not in areas of open water. Based on gut analysis, mosquitofish fed between midday and at dusk and not during the night. The frequencies of the prey individuals by taxon in the gut were similar to species found near or on macrophtyes (within ~5 cm of the macrophyte) compared to those found away from macrophytes (>5 cm). Over seasons, diet shifted. In the fall, dipteran larva and pupae were a predominant component of the diet. In the winter samples, littoral species of cladocerans were most common in their diet, and prey size was positively correlated with mosquitofish body length. Prey size was significantly smaller in winter. This shift in diet appears to be due to both change in prey availability and change in feeding location (near to versus away from plant surfaces).

P89 **Jonathan Howlette, Troy Mutchler, William Ensign**

A comparison of trophic relationships between urbanized and non-urbanized streams based on natural abundances of stable isotopes

Department of Biology, Kennesaw State University, Kennesaw, GA

Urbanization can impact stream ecosystems by altering the hydrological regime, reducing the extent of canopy cover, and modifying stream temperature and nutrient profiles. These changes can elicit shifts in the quality and quantity of carbon sources at the base of stream food webs that have the potential to alter energy flow and trophic relationships within the system. For instance, urbanization tends to reduce allochthonous inputs of detritus and promote autochthonous production by periphytic and filamentous algae, favoring grazing consumers relative to detritivores. To detect the effects of urbanization on food web structure, food webs were reconstructed from natural abundance stable isotope composition of organisms collected from an urbanized stream and a non-urbanized stream. $\delta^{15}N$ and $\delta^{13}C$ values of organisms collected indicated that periphyton and detrital plant matter were primary carbon sources at the base of the food web. Consumer relationships were also similar between the sites with *Fundulus*, *Hypentelium*, and *Lepomis* occupying the highest trophic level and trichopterans, decapods, and gastropods in intermediate trophic levels. $\delta^{15}N$ differed markedly (4-8‰) between the two sites for all organisms.

Elevated $\delta^{15}N$ values from the urbanized stream are strong evidence of a difference in N sources that is consistent with wastewater inputs from within the local watershed.

P90 **Holly J. Allen[1], Lori Tolley-Jordan[2]**

The influence of substrate heterogeneity on benthic macroinvertebrate diversity in Choccolocco Creek, Alabama

[1] Department of Math and Natural Sciences, Jackson State Community College, Jackson, TN; [2] Department of Biology, Jacksonville State University, Jacksonville, AL

Streams in Alabama maintain some of the highest levels of freshwater diversity in North America. Yet degradation of water quality and has resulted in diversity losses in many of these streams. As many invertebrates occur in benthic habitats, we predicted that increased substrate homogenization would correlate to decreased invertebrate diversity within Choccolocco Creek, a main tributary of the Coosa River in northeast Alabama. Macroinvertebrates and substrate measurements were collected quarterly from April 2011 to April 2012 in benthic habitats of five reaches in an 80 km segment of the mainstem of the creek. Macroinvertebrates, identified to genus, were included in diversity indices (Hilsenhoff Biodiversity Index, Shannon-Wiener Index and Simpsons Index) for each sample site x date (n = 25). Measures of substrate heterogeneity including moss/macrophytes cover, particle embeddedness, and particle size were also recorded for each sample site x date (n = 25). A single variable of substrate heterogeneity was generated from a linear combination the three substrate variables using principal component analysis (PCA). Results showed that all sites and dates exhibited similar, low levels of substrate heterogeneity and moderate levels of diversity. The lack of variation in diversity and substrate heterogeneity among sample dates and sites resulted in a non-significant relationship between substrate heterogeneity and benthic macroinvertebrate diversity. Although no conclusive results were obtained in this study, other systems with greater overall variation in substrate heterogeneity and diversity may result in stronger relationship with benthic diversity.

P91 **Stephen C. Landers[1], Kewei Yu[1], Martin Sorensen[2]**

Analysis of continental shelf meiofauna in the Northern Gulf of Mexico: Effects of the Deepwater Horizon oil spill investigated during a long term community study (2007-present).

[1] Troy University; [2] Natural History Museum of Denmark

Meiofauna from the Gulf continental shelf will be used to study the environmental impact of the Deepwater Horizon oil spill on the ocean floor. The project unites experts from Troy University and the University of Copenhagen and continues the meiofauna surveys that have been conducted since 2007. Data from 2010-2011 have been collected, and currently we are working on sediment samples collected in October and November 2012. This data from the past 5 years represent the only long term meiofauna data set available in the Gulf of Mexico. Sediment cores will be collected from multiple locations across the northern GOM, in conjunction with NOAA. Samples are collected for 1) Meiofauna counting and identification, 2) Hydrocarbon/Corexit analysis, 3)Granulometry and heavy metal analysis, and 4) Identification of specific animals (copepods, nematodes and minor phyla) that may best show the presence or absence of an environmental effect due to contamination. Additionally, CTD data will be collected by NOAA at each sample site. Statistical analysis of data, photography of select specimens, and GIS mapping will coincide with the meiofauna ID. The project addresses GoMRI theme 3, (Environmental effects of the petroleum/dispersant on the sea floor...) through a study of benthic animals in relation to their pollution exposure and the characteristics of their microscopic ecosystem. This research was made possible by a grant from BP/The Gulf of Mexico Research Initiative.

P92 **Carol B. Starkey, Katherine E. Forester, Brian L. Antonsen**

Subthreshold toxic effects of the herbicide Atrazine on learning and behavior in *Procambarus clarkii*

Department of Biology, Marshall University, Huntington, WV

Atrazine is among the most heavily applied pesticides worldwide, and there is evidence to suggest that environmental levels may be unsafe. The European Union banned its use in 2004, while the US EPA Maximum Contaminant Level (MCL) for Atrazine is 3 ug/L. It's classified as a possible human carcinogen by the EPA, is a

suggested endocrine disruptor, and concentrations < MCL have been shown to damage chromosomes. Currently, there are little data on Atrazine's sublethal effects. Fortunately, toxicological research has evolved past dependency on mortality measures to incorporate sophisticated and more sensitive behavioral studies that can elucidate the effects of sublethal exposure to toxins. For example, behavioral tests have recently been used to test toxicity in worms, fish, crayfish, and rats. This research proposes to use such parameters to determine subthreshold (below the level at which harm is immediately detected) Atrazine toxicity in *Procambarus clarkii* (red swamp crayfish), a bioindicator and keystone species. It is hypothesized that this will result in deficits, including impaired learning, lethargy, and retarded muscle movements. Crayfish will be placed in an aquatic T-maze, a classic method to test cognitive ability, with a food reward in a side arm. Time needed for each animal to locate the food over repeated trials will be recorded, as well as time spent in each arm. Impairments in behavior and learning will be an early indicator of chemical toxicity. Such behavioral sensitivity may be useful in predicting chronic toxicity and the ecological repercussions of Atrazine at frequently detected environmental concentrations.

P93 **Kyle A. Hriczo, Melba Horton, Robert Fuller**

Assessment of cyanobacteria and diatom occurrence in five tributaries of Lake Lanier: An ongoing study

Department of Biology, University of North Georgia, Dahlonega, GA

Cyanobacteria and diatoms both hold great ecological importance on a global scale. Diatoms are responsible for processing some twenty percent of the carbon cycle. Diatoms are also important indicator species for water and air quality. Cyanobacterial blooms often produce toxic substances that can cause harm to interacting organisms. This study focuses primarily on the diversity and abundance of cyanobacteria and diatoms in five tributaries of Lake Sydney Lanier in North Georgia. Lake Lanier provides water for nearly four million people and is home to a diverse range of species. Its condition is maintained by monitoring and detecting pollutants that could compromise water quality. Samples collected from tributaries are concentrated and examined using a Sedgewick-Rafter counting chamber under a light microscope. Organisms are classified based on morphology using available taxonomic keys. In order to assess the ecological state of tributaries of the lake, diversity of cyanobacteria and diatoms will be calculated using the Shannon Index. Regression analysis will then be conducted between species diversity and some physico-chemical parameters of the water collected by the University of North Georgia water lab, including biological oxygen demand, chemical oxygen demand, turbidity, salinity, total suspended solids, hardness, temperature, and total nitrogen.

P94 **Jose Orlay Castano, Mark Andrew Schlueter**

A comparison of aquatic macroinvertebrates in streams across the Americas: Georgia, Costa Rica, and Buenaventura-Colombia

Georgia Gwinnett College, Lawrenceville, GA

Macroinvertebrates are good indicators of water quality because they are directly affected by all toxins and stresses in the water column. Macroinvertebrates are aquatic insects that vary in size, color, habitat, and food requirements. Biological monitoring using macroinvertebrates can be more reliable than chemical monitoring, since chemicals move rapidly through a system, while macroinvertebrates remain in a small area of a stream for long periods of time. Biological monitoring involves collecting, identifying and counting macroinvertebrates to assess water and habitat quality. Biological indexes characterize healthy or impacted streams by calculating macroinvertebrate abundance and diversity (sensitive and tolerant species). This study measured the water quality of 26 streams and rivers in North, Central, and South America based on a biological index using macroinvertebrates (Georgia Adopt-A-Stream). Caddisflies (Trichoptera) and mayflies (Ephemeroptera) were abundant in all three countries. Caddisflies in Colombia were much larger than US species. Fishflies (Megalopera) were present at lower numbers. Sensitive macroinvertebrate species, indicators of excellent water quality, such as stoneflies (Plecoptera) and riffle beetles (Coleoptera), were present in all three countries. White shrimp were found in Central and South America, while in the US this niche is occupied by crawfish. The diversity of macroinvertebrates correlated to chemical factors (e.g. dissolved oxygen). Since the same groups of macroinvertebrates were found in all three countries, broad

comparable water quality assessments using macroinvertebrates can be constructed for water quality assessment across the Americas.

P95 **Katherine B. Murray, Gregory P. Lewis, Abbie T. Motes**

Variation in diversity of woody riparian vegetation and canopy cover among urban and rural streams in the South Carolina Piedmont

Department of Biology, Furman University, Greenville, SC

Although an increasing number of studies have examined effects of urban land cover on stream ecosystems, few have compared the diversity of riparian plants or quantified canopy cover along streams in urban and rural landscapes. For example, riparian zones in urban areas might have more exotic (ornamental) plant species and lower canopy cover than streams in mostly forested watersheds. We measured woody plant diversity and canopy cover along first to third order streams draining 1-7 km^2 watersheds in the Piedmont and Blue Ridge provinces of South Carolina. Streams were categorized as commercial, residential, rural (mostly mixed forest and pasture), or forested based on the dominant land cover within each stream's watershed (n=5 streams per category). Along a 100 m reach at each stream, we collected data at 10 m intervals. At each point, the closest canopy tree and woody shrub or understory tree within a 5-meter radius on either bank was recorded. The trunk diameter of each canopy tree also was measured. A spherical densiometer was used to estimate percent canopy cover over the stream channel at each point. Contrary to our expectations, we found no statistically significant differences among the four land cover categories in percent canopy cover, tree diameter or total basal area, percent exotic species, or species diversity. However, canopy cover was more variable over commercial streams (62-92%) than over other streams, especially forested streams (90-93%). Further research is being done to compare the widths of tree-covered riparian zones along streams in urban and rural watersheds.

P96 **Dylan R. Malpass, Sandra L. Cooke**

The effects of UV-B on *Diaphanosoma brachyurum* survival and egg production in Mountain Lake, Virginia

High Point University, High Point, NC

Stratospheric ozone depletion has increased levels of ultraviolet-B (UV-B) radiation reaching earth's surface. Evidence suggests UV-B may substantially affect aquatic ecosystems, and concerted efforts are underway to address this issue. Zooplankton in temperate regions are exposed to natural and potentially harmful doses of UV-B. The goal of this study is to investigate the effects of UV-B on *Diaphanosoma brachyurum* survival and egg production, along with other zooplankton species, in Mountain Lake (ML), Virginia. Planktonic organisms have adapted through behavioral, tolerance and repair mechanisms to cope with the physiological stresses of UV-B. To date, little data exists to evaluate the UV-tolerance of Diaphanosoma. A Chilean lake study suggests a Diaphanosoma species to be particularly sensitive to UV-B, however, another study suggests otherwise. ML is a naturally formed, freshwater lake subject to frequent UV- and hydrological disturbances. Furthermore, ML is a clear lake with unique hydrology, exposing Diaphanosoma to intensities of UV-B that we may expect to impose harm. This summer I will conduct microcosm experiments at ML Biological Station in an attempt to manipulate UV-B, to be quantified with a PUV-500 spectroradiometer. *Diaphanosoma brachyurum* populations within ML may be highly sensitive to environmental UV-B exposure. Preliminary data on the vertical distribution of Diaphanosoma and the attenuation of UV-B at ML has been gathered. Results of this investigation will add to the discipline of ML ecology and to the understanding of the UV-tolerance of Diaphanosoma available in literature.

P97 **Tessa N. Stephens, Tom A. Blanchard**

The impact of a stream restoration project on condition factor and food habits of Bluegill Sunfish (*Lepomis macrochirus*)

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The effects of the channelization of rivers and streams are known to include altered flow patterns, a reduction in microhabitats, and reduced food availability. Although many stream restoration projects have been implemented, relatively little is known of the impacts of restoration on aquatic organisms. In 2010, The Tennessee Department of Environment and Conservation completed a restoration project on Crooked Creek,

a tributary of the South Fork Obion River, in Carroll County, Tennessee. The project added approximately 3000 m to the length of the stream. The goal of our project was to compare condition factor and food habits of Bluegill Sunfish (*Lepomis macrochirus*) in the restored section of Crooked Creek to those of Bluegill from Guins Creek, a nearby channelized stream. Bluegill were collected from both sites during September and October, 2012. For each individual, condition factor was calculated and a stomach fullness value was assigned. Stomach contents were identified to the lowest possible taxonomic group. Although there was no significant difference (t = 1.95, p = 0.057) in condition factor, the mean value was higher for Bluegill from Crooked Creek. There was no difference in mean stomach fullness values (t = 0.077, p = 0.938), but 30% of the stomachs from Guins Creek were empty whereas only 14.3% of stomachs from Crooked Creek had no food present. The diet compositions were similar, but Bluegill from Crooked Creek consumed more chironomids and copepods, and Bluegill from Guins Creek consumed more coleopterans and hymenopterans.

P98 **Richard Watkins[1], Mark Meade[1], Chester Figiel Jr[2], Gregory Scull[2]**

Baseline screening of Amphibians on the Mountain Longleaf NWR for *Batrachochytrium dendrobatidis*.

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The Mountain Longleaf National Wildlife Refuge is located in Calhoun County in northeastern Alabama. Limited information exists regarding the forest dwelling amphibians associated with the Refuge's seeps, bogs, and creeks. It has been suggested that the Refuge may provide refugia for rare or highly specialized salamanders. Because the springs and seeps can serve as hotspots for amphibians in the surrounding forest, the concern for disease is an issue. The chytrid fungus, *Batrachochytrium dendrobatidis*, has been identified as a major contributor in the decline of amphibians worldwide. An intensive effort was begun to survey for chytrid fungus on the Refuge. Up to 20 captured animals were processed and released at the point of capture. All individuals were visually inspected for characteristic signs of Bd infection and swabbed 15-20 times across the ventral surface, mouthparts, and toe webbing. Water samples were also taken on site. Water samples were filtered on site and filters stored in individual microfuge tubes. All equipment was disinfected with a 10% NaClO solution to avoid site contamination. Quantitative PCR was used to detect the presence of the fungus. To date, no sample has demonstrated the presence of the fungus. It is reasonable to assume that these pristine headwaters, lacking the elements of pollution and other anthropogenic factors, would be inundated by the fungus. An alternative explanation is that samples were collected at a time when seasonal conditions were not favorable to Bd proliferation. Nonetheless, due its unique habitats, continued monitoring is ongoing at the Refuge and surrounding sites.

P99 **Erika Jansen, Brent Anderson, Min-Ken Liao**

Bacteriological assessment of Reedy River Falls Park and its surrounding watershed

Department of Biology, Furman University, Greenville, SC

The Department of Health and Environmental Control in South Carolina has consistently detected elevated levels of coliforms in the stream running through the Reedy River Falls Park in downtown Greenville, SC. In this study, we examined the levels of additional fecal indicator bacteria in the Reedy River basin, particularly the Falls Park area and its immediate watershed, and we attempted to identify the source of fecal contamination. To further investigate the said public health risk, we determined the levels of two other indicator bacteria recommended by Environmental Protection Agency (EPA): *Escherichia coli* and *Enterococcus* spp. Given Reedy River Falls Park's location and the presence of animal, including human, activities, we hypothesized that Falls Park was a "point source" introducing fecal pollutants to the Reedy River downstream of the park. Eleven sampling sites along the Reedy River (five upstream and five downstream of Falls Park, plus park itself) were identified and levels of total coliforms, *E. coli,* and *Enterococcus* spp. in water samples collected from these locations were determined using the IDEXX systems. Our results suggested that levels of all indicator bacteria consistently exceeded the EPA standards throughout the entire watershed. Therefore, the Falls Park is not a point source of pollution. To track the source of fecal pollution, we used PCR to amplify the total *Bacteroides* 16S rDNA in water samples and attempted to detect the presence of

Bacteroides 16S rDNA of ruminant, canine, and human origins in the total *Bacteroides* 16S rDNA pool.

P100 **Manuel Bernal Mejia, William R. Bolus, Tonya A. Carver, Margaret J. Kovach**

An analysis of differentially expressed genes in the context of cochlear malfunction in Charcot-Marie Tooth Syndrome

Department of Biological and Environmental Sciences, University of Tennessee at Chattanooga, TN

Charcot-Marie Tooth Syndrome is characterized by improper nerve conduction in peripheral nerves affecting both motor and sensorineural functions of the PNS. CMT1E represents a genetic variant of the disease distinguished by a deafness component attributed to a point mutation within the Peripheral Myelin Protein-22. *PMP22* is abundantly expressed within neural tissue where it plays a structural role in nerve myelination. However, in non-neural tissue, where it has been implicated in cell proliferation, there is a significant reduction in *PMP22* levels. These tissue-specific expression patterns hint at a dual function of the PMP22 protein in normal hearing, that is supported by evidence of neural and cochlear impairment in CMT1E patients. We hypothesize that a genetic defect in *PMP22* causes abnormal regulation and expression of genes central to proper tissue development, that in turn leads to the neuropathic phenotype and cochlear malfunction of CMT1E. Thus, to better understand the molecular nature of CMT1E, we aim to identify and characterize genes that are differentially expressed relative to functional levels of the PMP22 protein.Through Differential Display, 754 gene-transcripts were identified as differentially expressed in the TrJ mouse model for CMT. Thus far, 109 genes have been confirmed as expressed genes, sequenced and characterized according to function. Ontological classification revealed altered expression of genes involved in nucleotide-metabolism, cell-communication and cell-growth. Approximately 52% of these genes cross-reference to the Human Cochlear EST database and represent potential candidate genes of the deafness phenotype. Promising candidates were further evaluated for temporal expression patterns using quantitative reverse-transcription PCR.

P101 **Emma Cosette Hall, Tonya A. Carver, Margaret J. Kovach**

A continued effort to understand the role of peripheral myelin protein 22 (PMP22) and other genes of interest in the development of sensorineural deafness

Department of Biological and Environmental Sciences, University of Tennessee at Chattanooga, TN

Charcot-Marie-Tooth disease (CMT) is a hereditary progressive neuropathy affecting the peripheral nervous system. A duplication of the *PMP22* gene accounts for the majority of CMT cases; however a point mutation in *PMP22* causes the rare genetic variant CMT1E, marked by sensorineural deafness. With respect to the deafness phenotype, PMP22 contributes to the formation of myelin sheaths and nerve conduction of the peripheral auditory nerve. Additionally, *PMP22* is expressed in non-neural tissues of the cochlea, leading to the hypothesis that PMP22 serves a dual function in normal hearing. This hypothesis aligns with audiological findings indicating both neural and cochlear components to hearing loss in CMT1E patients.This study aims to understand the potential role of PMP22 in cochlear development using the Trembler-J mouse model for CMT. Cochlea samples were taken from control (WT) and experimental (TrJ) mice throughout embryonic (E9.5-E17.5) and postnatal (D1-D42) development. Cochlear structures were examined for PMP22-associated changes, and characterized by immunofluorescence for temporal and spatial localization of the Pmp22 protein alongside two proteins considered potential targets of the normal hearing process: Insulin growth factor binding protein-4 (Igfbp4) and Synaptogyrin-1 (Syngr-1). Igfbp4 is reported to affect cochlear size and number of hair cells, while Syngr-1 is implicated in neural plasticity of rat auditory systems. Preliminary results confirm Igfbp4 localization to the hair cells, with a more pronounced signal in TrJ tissue. Differences in Pmp22 and Syngr-1 staining between WT and TrJ samples were noted at developmental time-points D1 and D14, and may indicate critical junctures in cochlear development.

P102 **Lauryn N. Luderman, Fang-Ju Lin**

Gene expression in Parkinson's Disease

Department of Biology, Coastal Carolina University, Conway, SC

Parkinson's Disease is a neurodegenerative disorder affecting movement through degeneration of dopaminergic neurons. Although proteins involved in hereditary Parkinson have been linked to the Parkin pathway, the cause of sporadic Parkinson is still unknown. Like other studies involving neurodegeneration, Drosophila melanogaster was used as a genetic model in determining affected genes. Parkinson-like symptoms, mainly locomotor impairment, can be induced in flies by treatment of rotenone. Flies were tested 7 and 14 days after initial treatment with rotenone at varying concentrations (0 µM-50 µM). In order to test locomotor impairment among flies, a negative-geotaxis climbing assay was utilized; percentage of flies that recover from being knocked to the bottom of a vial indicate the causal effects of rotenone on motor function. All treatments resulted in a decreased percentage of fly recovery between day 7 and day 14, including the control. However, after 14 days following initial treatment, the percentage of flies subject to 37.5 µM rotenone that recover from the negative-geotaxis climbing assay is significantly lower than all other concentrations and contained the largest difference in fly recovery percentage. Based on data from the negative-geotaxis climbing assay, flies subject to an intermediate dose of rotenone exhibit the greatest amount of Parkinson-like symptoms in the form of motor function loss. We are currently studying gene expression involving RNA analysis of flies treated with rotenone to determine the genetic pathway affected upon development of Parkinson-like symptoms.

P103 **Claudia Ortuno[1], Abigail Smith[1], Fang Ju Lin[2]**

Learning and memory in *Drosophila*: The effects of caffeine and taurine

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Our previous data indicated that caffeine and taurine, two chemicals in popular energy drinks, have effects on the activity and sleep levels in fruit fly *Drosophila*. While taurine decreased locomotor activity, caffeine increased locomotor activity levels. Interestingly, the combination of the two showed more fragmented sleep than that of caffeine alone. Long-term consumption of energy drinks in humans may result in sleep deprivation, and impact on learning and memory. In *Drosophila*, several successful assessments of memory tests such as smell, courtship and mating behaviors have been developed and well documented. In our experiment, we chose to observe the courtship behaviors with, or without, treatment of caffeine, taurine, or both. By placing a virgin male with a trained female, and then pairing the same male with another virgin female, we can gather information not only on the courtship behavior but also on how long the memory is retained. In comparison of the control flies with those affected by caffeine and taurine, we will be able to deduce how much of the courtship process is affected by these chemicals. Although only semi-quantitatively, measurements such as Courtship Index (CI) and analysis of video of the courtship process enable us to mathematically calculate the effect that caffeine and taurine have on the learning and memory of *Drosophila* flies.

P104 **Vanessa Yanes, Jennifer De Barboza, Michael Erwin**

Haplotype diversity analysis of Black Crappie, *Pomoxis nigromaculatus* (Family Centrarchidae), in Lake Sydney Lanier, Georgia.

School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA

Molecular markers have been used to analyze the genetic structure of many pelagic fish populations. In this study haplotype diversity will be examined for the nuclear rhodopsin gene (RHO) and the mitochondrial cytochrome c oxidase I gene (COI) of *Pomoxis nigromaculatus,* Black Crappie, in Lake Sydney Lanier, Georgia. This species is a popular freshwater sport fish in the southeastern United States, and data released by the U.S. Department of the Interior shows that *P. nigromaculatus* is the third most targeted freshwater fish in Georgia. This fishery has been sustainable due to the species' fecundity, monitoring by wildlife management, and enforced bag limits by the state. Data on the genetic structure of this population may provide a useful tool for wildlife managers to more effectively manage this species. Mitochondrial DNA (mtDNA) and nuclear DNA (nuDNA) sequence data were collected for the purpose of

developing an initial genetic baseline for black crappie inhabiting Lake Sydney Lanier, Georgia.

P105 **Ben J. Przygoda, Stephanie R. Songer**

Effects of alcohol on the larval morphology of *Drosophila melanogaster*

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We are using *Drosophila melanogaster* as a model organism for the influence of alcohol on post-embryonic development. Upon hatching, eggs from alcohol dehydrogenase-negative (Adh-) mutants and wild-type controls were fed yeast paste made with either a non-lethal amount of ethanol or with water, until late in the third instar. Imaginal discs (except genital discs) were harvested and processed for immunocytochemistry with monoclonal antibodies against a range of gene products, including the segmentation genes *engrailed/invected* and *even-skipped*, and the homeotic gene *Ultrabithorax*. All discs appeared to have their expected morphologies. No consistent differences in immunostaining were noted between Adh- mutants or wild-types, with or without alcohol exposure. Continued investigation may address different ethanol concentrations, time(s) of ethanol delivery, and the application of other alcohols, as well as other aspects of larval anatomy.

P106 **Tyler dos Santos, Ben Thornton**

Effects of atrazine on general esterase activity in sexed *Drosophila melanogaster.*

Department of Biology and Allied Health, Southern Adventist University, Collegedale, TN

Atrazine is the most commonly used herbicide in the world and is a ubiquitous contaminate of fresh water ecosystems. Its effects on non-target species are not fully understood. Sexed *Drosophila melanogaster* were exposedfor 48 h in vials laced with 100 ppm atrazine after which general esterase activity (GE) was quantified using 1mM para-nitrophenyl acetate as a substrate and read at 405 nm for 60 reading at five second intervals (40 °C). Our results showed no significant differences in GE activity between control and exposed groups. We did observe sex-dependent GE activity with male *D. melanogaster* exhibiting significantly higher activity than the females in both control and exposed groups. The significances of these differences are unclear but could affect other biochemical pathways involving esterases.

P107 **Theodora Barkoulas, Renee J. Chosed**

Demystifying the epigenetic roles of *BRE1* and *RAD6* in a yeast model for Parkinson's disease

Department of Biology, Furman University, Greenville, SC

Parkinson's disease is one of the most common neurodegenerative disorders among the elderly population. The hallmark of Parkinson's disease (PD) is the formation of protein inclusions, consisting of predominantly alpha synuclein, which aggregates in the cytoplasm of neuronal cells. However, it is still unclear whether the presence of inclusions cause cell death or if the presence of inclusions impairs the function of the ubiquitin proteasome system. Moreover, epigenetic mechanisms such as histone modifications and their role in modulating the expression of genes related to Parkinson's disease is a field that has not been widely explored in current PD research. The purpose of this research was to determine how the deletion of *BRE1* and *RAD6* genes in yeast impacts the formation of alpha synuclein aggregates. These genes were chosen because of their involvement in gene expression. Specifically, *BRE1* encodes for an E3 ubiquitin ligase that forms a heterodimer with *RAD6* to monoubiquitinate histone H2B-K123, signaling for trimethylation of histone H3K4 and subsequently signals transcription. To understand how these genes regulate the formation of inclusions, *BRE1* and *RAD6* were deleted from the genome in a yeast model for PD. The yeast were then assayed for changes in inclusion formation using growth assays and microscopy. The deletion of both genes resulted in reduced aggregation of alpha synuclein inclusions, which became sequestered to the membrane. Furthermore, the reduction of alpha synuclein has implications, as elucidating the underlying mechanisms of regulators that control alpha synuclein expression can serve as drug targets for multiple neurodegenerative disorders.

P108 **Alice Williams, Renee J. Chosed**

Analyzing the effects of the anticancer drug KP1019 on yeast histone modifications

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KP1019 is a chemotherapeutic ruthenium complex that has shown promise in treating ovarian and colon cancer in animal models. While KP1019 has potential as an anticancer drug in human trials, little is understood about its mechanisms of action. Our research is on elucidating these mechanisms; specifically we are interested in determining if KP1019's effectiveness is related to histone modifications that lead to differential gene expression. Using *Saccharomyces cerevisiae* (budding yeast) as a model, we first determined that at certain concentrations KP1019 has a killing effect on yeast cells. We then incubated our yeast with varying concentrations of KP1019 in solution for two hours and then prepared total protein extracts of the treated yeast. Western blots were performed on the protein extracts with various histone modification specific antibodies including Histone H3K4me3 and Histone H3K4me2. Based on preliminary findings, we have not found any alterations to histone modifications in yeast treated with KP1019 compared to control yeast. We are continuing to screen with different histone modification specific antibodies to determine if KP1019 has any effect on global histone modifications in our yeast model system.

P109 **Elizabeth Koppang, Renee J. Chosed**

Elucidating the effects of *JHD2* on alpha-synuclein inclusions in a yeast model for Parkinson's disease

Department of Biology, Furman University, Greenville, SC

Parkinson's disease (PD) is characterized by the selective loss of dopaminergic neurons, which arise from nuclear inclusion toxicity. A *Saccharomyces cerevisiae* model of Parkinson's disease successfully reproduces several hallmarks of the disease including toxic, concentration-dependent inclusions known as Lewy bodies, which consist mainly of alpha-synuclein. The function of alpha-synuclein is unclear, but evidence suggests alpha-synuclein interacts directly with phospholipid membranes. Numerous components are likely involved in alpha-synuclein inclusion formation including epigenetic gene regulation, specifically histone methylation. The gene of interest in my project is the JmjC domain-containing histone demethylase-2 (Jhd2p), which is a demethylase specific for lysine 4 of histone H3.By deleting, reintroducing, and mutating *JHD2* in yeast strains expressing the alpha-synuclein-green fluorescence protein under a regulatable, galactose-inducible promoter at increasing levels of expression, the effects of this gene in the formation of alpha-synuclein inclusions can be observed by comparing growth using dilution plating, protein levels using Western blotting, and phenotypes using fluorescence microscopy. The yeast display large, cytoplasmic aggregates in the *JHD2* deletion yeast strain. The cytoplasmic aggregates disappear when the *JHD2* gene is reintroduced into the yeast. Lastly, introducing a mutant *JHD2*, which is catalytically inactive, to the deletion strain will likely result in yeast similar in phenotype, protein levels, and growth to the deletion strain. Understanding the genes involved in the formation of these toxic aggregates, including *JHD2*, is the first step in understanding the mechanism behind PD and as a result its eradication.

P110 **Megan Willner, Renee J. Chosed**

Elucidating the role of deubiquitinating enzymes in a yeast model for Parkinson's disease

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Parkinson's disease (PD) is a neurological disorder that affects the motor neurons within the brain, causing tremors, muscle spasms, and loss of coordination. A key feature of this disorder is an accumulation of the protein alpha-synuclein in the neurons, which eventually causes the neurons to be non-functional due to alpha-synuclein aggregation in the cytoplasm. Yeast share approximately 60% sequencing similarity with human DNA, making them an ideal model organism to elucidate neurological disorders. Alpha-synuclein is overexpressed in the experimental PD yeast and is tagged with green-florescent protein for visualization. Research has shown that the protein ubiquitin attaches to the excess alpha-synuclein and signals the cell to send the alpha-synuclein to the proteasome for degradation. In PD, we

hypothesize that the ubiquitin might be removed from alpha-synuclein by deubiquitinating enzymes present in the cell. This would allow an excess of alpha-synuclein to remain in the cell, which may yield large protein inclusions. In our experiments, the genes, *UBP1* and *YUH1*, which encode deubiquitinating enzymes, were deleted from the yeast genome. After growing the yeast in galactose containing media to induce expression of alpha-synuclein, the yeast were examined under a florescent microscope to look for the presence of aggregates of alpha-synuclein. We hypothesize that if the aggregates are not present, this is due to the deletion of the deubiquitinating enzymes, which allows the excess alpha-synuclein to be degraded. After the deletion of both the *YUH1* and *UBP1*, alpha-synuclein inclusions were minimal or only localized at the membrane. These results reveal that a significant factor in the development of PD might be the overproduction of deubiquitinating enzymes, which could potentially aid in characterizing the biological changes that occurs in neurons in patients with PD.

P111 **Christina Curry, Renee J. Chosed**

Modeling the MLL (Mixed-Lineage Leukemia) protein complex in *Saccharomyces cerevisiae*

Department of Biology, Furman University, Greenville, SC

Histone H3 Lysine 4 (H3K4) trimethylation is catalyzed by the methyltransferase MLL in humans, and Set1 in the budding yeast *Saccharomyces cerevisiae*. Both MLL and Set1 are the catalytic methyltransferase subunits of large multi-protein complexes. The non-catalytic accessory proteins of each complex are thought to play a role in regulating the methyltransferase activity of each complex, yet their roles are not well defined. Complicating the research of MLL in mammalian cells is the fact that there are several MLL-like proteins with the same function that are active in these cells. This system is simplified by modeling the MLL protein complex in budding yeast. Budding yeast contain a single protein complex referred to as COMPASS, that is homologous to that of the MLL protein complex in mammalian cells. To elucidate the roles of the accessory proteins in the mammalian MLL complex, we replaced proteins of COMPASS in yeast with those of the mammalian MLL complex. We then assayed for the activity of the protein complex by detecting histone H3K4 methylation by Western blotting. Deletion of the *BRE2* gene of the COMPASS complex lead to the elimination of H3K4me3 in yeast. The *BRE2* human homolog Ash2L of the MLL complex was then transformed into the *bre2*Δ yeast strain. Western blotting of protein extracts from transformed yeast showed that addition of Ash2L did not rescue the H3K4me3 defect seen in the *bre2*Δ yeast This research may lead to a better understanding of the human MLL protein complex and its role in cell regulation and cancer.

P112 **Rashidah Farid, Khairy Soliman, Yong Wang**

Long-term impacts of forest disturbance on amphibian populations genetic diversity

Department of Natural Resources and Environmental Sciences, Alabama A & M University, Normal, AL

In a forest community that has experienced dynamic changes in habitat structure and composition, it is expected that pool breeding amphibian populations' genetic variations could be affected because of reduced individual fitness due to declined success of breeding and survivalship, which might lead to the bottleneck effect over multiply generations. Bottlenecks are long standing reductions in effective population size, which can be determined by measuring genotype frequencies at multiple polymorphic loci at a single point in time based on the excess of heterozygosity over the expected, under mutation-drift equilibrium. We initiated a study at Bankhead National Forest, Alabama to examine how past forest management practices have affected genetic structures of pool-breeding amphibians. Simple sequence repeats (SSR) will be used to distinguish between short-term fluctuation and long-term population trend. Nine vernal pools were selected of different size and disturbance history for tissue collection from targeted species including: *Ambystoma maculatum*, *Notophthalmus viridescens viridescens*, and *Lithobates sphenocephalus utricularius*. Each species was fingerprinted for at least 10 SSR markers using PCR technology; the amplified products were sequenced in both directions. The genetic variations in each population are being quantified by determining the number of alleles per locus and the proportion of polymorphic loci, and will be reported during this presentation.

Ultimately, a better understanding of genetic variations in amphibian populations and how these variations are related to the forest disturbance and amphibian diversity could have significant impacts on the way we manage forest and mitigate amphibian population declines and conservation. Key words: forest management, amphibian, genetic variations, bottleneck, SSR

P113 **Sara Atkinson, Hazel Osunga-Buyu, Kelley Godbout, Elizabeth Morris, Joseph Flaherty**

Bioinformatic analysis of 39 coordinately expressed genes associated with the transition from vegetative growth to asexual development in *Fusarium graminearum*.

Coker College, Hartsville, SC

Many important filamentous fungi propagate and spread via the production of asexual spores (conidia). Conidiation is a defined program of morphological development, which presumably requires the coordinated efforts of many individual genes and signal transduction pathways. In the fungal plant pathogen, *Fusarium graminearum*, the morphological transition from filamentous growth to conidiation is critical for dissemination and infection. In spite of this, very little is known about the genetic regulation of this important developmental process. From genetic screens designed to identify genes regulating specific aspects of morphogenesis in *F. graminearum*, we identified several insertional mutants impaired in asexual development, which variously display a range of loss- and gain-of-function phenotypes. We conducted genome-wide analyses of gene expression using microarrays [Fusarias520715 Affymetrix GeneChip] on the wild type and a loss-of-function mutant strain cultured under conditions either favorable or unfavorable for asexual development. A shared subset of 39 genes exhibited altered expression (>4 f.c.) in both strains under both culture conditions. Analysis of these coordinately expressed candidate genes revealed the presence of several signaling homologs, six orphan genes, as well as three putative gene clusters. We have applied bioinformatics tools to search for shared promoter elements and to further examine the genomic signatures of these genes, providing further insight into their relationships and putative functions. This project was supported in part by grants from the National Science Foundation (MCB 0845324), the National Center for Research Resources (5 P20 RR016461), and the National Institute of General Medical Sciences (8 P20 GM103499) from the National Institutes of Health

P114 **Paula Kamara[1], Tasnuva Enam[2], Myrana Craig[2], James Rowan[2], Holly Boettger-Tong[1]**

Strain differences between C3H/HeNHsd and C57BL/6 mice in single and double alternation operant tasks

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Historically, rats have been used as a model organism for serial-pattern learning research. However, molecular characterization of pathways involved in serial pattern learning are limited using the rat as a model organism, as there are few commercially available genetically altered rats. Mouse models are a potentially robust system in which specific genes, due to their elimination via recombination (knock out), may be analyzed for their role in serial pattern learning. To determine if mice are able to engage in both single and double alternation serial pattern learning, two common strains of mice, the C3H/HeNHSd and the C57BL/6 were used. The mice were placed individually in an operant chamber and trained on a single alternation pattern for twenty consecutive days. All of the mice learned the pattern well above chance levels; however, the percent errors of the C57BL/6 strain were significantly less than those demonstrated by the C3H/HeNHSd mice. When animals were switched to a double alternation pattern for an additional 14 days, there were also marked differences in learning between the two mouse strains. The data clearly indicate that mice are capable of learning both single and double alternation patterns using this operant task. In addition, the operant task is sufficiently robust that strain differences are detectable.

P115 **Ploy Kurdmongkoltham, Mijitaba Hamissou**

Molecular investigation of pokeweed, *Phytolacca americana*, extracts and their effects on prokaryotic and eukaryotic cells

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Pokeweed (*Phytolacca americana*) is a perennial herb native to South America, southeastern United States, and Africa. The family Phytolaccaceae includes several South American trees and some unusual serpentine vines of the tropics. Pokeweed is known to contain several toxins such as lectin. The toxin affects cells by binding to their ribosomes and by preventing protein synthesis. It can also cause red blood cells to clump together and stimulate abnormal cell division. Other toxins found in pokeweed include the alkaloid phytolaccine, the resin phytolaccatoxin, and the saponin phytolaccigenin. Although most highly concentrated in the roots, all parts of the plant are toxic. It is well documented that pokeweed contains an antiviral proteins. Pokeweed may possess potential medicinal and economical values that include fungicidal or bactericidal properties. The objectives of this research are to investigate the total protein map in pokeweed extracts and to investigate some antibacterial and anti-callus properties of pokeweed extracts. Pokeweed plants were collected from different sites and separated into leaves and berries. Aqueous extracts were obtained from the different parts and analyzed for their inhibitory effects on bacterial and callus cells. Preliminary data indicated that pokeweed extracts are rich in proteins and in alkaloids and that the extracts have inhibitory effects on the growth of gram negative and gram positive bacteria and callus cell. Western blot and other molecular analyses confirmed the presence of lectin-like proteins and several organic compounds.

P116 **Caroline Matchett, Kevin Gribbins, Matthew Collier**

Venus flytrap (*Dionaea muscipula*; Droseraceae) digestive glands exhibit properties of both apocrine and merocrine modes of secretion

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The insectivorous Venus flytrap, *Dionaea muscipula*, has long been studied because of its unique method of nutrient procurement. The trapping mechanism is triggered when prey contact one of the three trigger hairs located on the surface of each brightly colored, bilobed leaf. Upon closure, microscopic glands on the leaf surface secrete proteolytic enzymes that digest prey over a 5-12 day period. Although the mechanism of flytrap leaf closure is well documented, the secretory nature of the digestive glands remains poorly understood. This study investigates the ultrastructure of flytrap digestive glands to determine if they exhibit secretory properties commonly associated with animal apocrine/eccrine glands. To examine gland ultrastructure, leaves (N=30), were removed from flytraps immediately after feeding and at days 3, 6, and 9 post-feeding. All samples were cut into 3 equal CS pieces, fixed, and embedded. Tissue blocks were sectioned (90 nm) using an ultramicrotome and prepared for TEM. Gland secretory cells appear to accumulate osmophilic dense materials apically, suggesting apocrine secretion. Though the cell wall is thin around gland cells it is improbable all materials are released in this fashion. Evidence was also seen for merocrine release of gland products via exocytotic vesicles. Thus, we hypothesize that flytrap glands show properties of both apocrine and merocrine secretion, providing a mechanism for the exocytosis of both large vesicular materials and inclusions. Previous studies concentrated only on direct enzyme release via the endomembrane system; thus, the present data for large material release adds new insight to digestion in carnivorous plants.

P117 **Cullen Truett, Darwin Jorgensen**

Does the ventilatory pump play a role in moving hemolymph through the gill circulation in the American Lobster?

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Lobsters conduct gas exchange with sets of gills enclosed in chambers located on either side of the thorax. The gill chambers are each ventilated by the action of muscularly driven flattened structure, the scaphognathite (scaph). A scaph moves cyclically creating a slight negative pressure to pull ventilatory water through its gill chamber and past the gills, which contain small diameter hemolymph channels. Under conditions of higher metabolic demand, the cyclic rate of a scaph increases, generating more suction to pull more ventilatory water though its gill chamber per unit time to provide for increased O_2 uptake. A single ventricle pumps hemolymph through the vascular network, which includes gill circulation. We want to know if the ventilatory pumps assist the ventricle in moving hemolymph through gill circulation. We measured hydrostatic pressure in one of the gill chambers of lobsters concurrently with hemolymph pressure in the ventricle and hemolymph velocity through the main

afferent vessel at the base of one of the gills while the animals were resting and while they walked on a submerged treadmill. Our data indicate that the scaphs may assist the ventricle in moving hemolymph velocity through gill circulation principally through passive dilation of the gill hemolymph channels.

P118 **Zachary M. Slifer, Edward D. Mills**

Developmental changes in vocalizations of juvenile Chinese Blue-breasted Quail (*Coturnix chinensis*)

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While adult Blue-breasted Quail (Coturnix chinensis) produce more than thirty different calls, the range of calls that hatchlings and juveniles produce is much more limited. Short, simple calls can serve to keep chicks and parents together for protection. New calls are added and early calls are modified as juveniles mature into adults. The purpose of this project was to examine the developmental changes that occur in Blue-breasted quail calls as they age from juvenile to adult. Juveniles produce an A-shaped call (1900-4800 Hz) at hatching that continues during the juvenile stage. We examined several variables of the A-call from a group of 18 quail over a period of three weeks: low frequency (Hz), high frequency (Hz), change in frequency (Hz), average power (dB), maximum power (dB), and change in call length (s). While there was no change in the high frequencies produced, several other changes occurred. Both average and maximum power (dB) increased significantly over the course of the study, and call length (sec) increased significantly. In addition, a decrease in low frequency caused a significant increase in the height of the call (Hz). These changes may represent developmental alterations that could be related to syrinx development, brain maturation, improvement through repetition or a combination of these factors.

P119 **Kristen Mills[1], Darla J. Wise[2]**

The effects of bisphenol A on germination in radish (*Raphanus sativus*) seeds

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Bisphenol A (BPA) is a known endocrine disruptor that has been documented to decrease the ability to reproduce, lower sperm counts in animals, and decrease agricultural production of some crops. As information regarding the effect of BPA on agricultural plants is limited, we chose to examine the effect of BPA on germination of radish (*Raphanus sativus*) seeds. Seeds were germinated in eight different water samples containing various concentrations of BPA for 120 hours. During this time, germination was monitored by measuring the total length of the seedling and documenting other observations at regular time intervals. The seeds exposed to the higher levels of BPA demonstrated the greatest impairment in root growth ($p < 0.001$), showing little to no lateral growth and reduced numbers of root hairs, in addition to truncated primary growth. Germination of the seeds grown on thermal receipt paper (known to be coated with BPA) was the most impaired ($p < 0.001$) as compared with the controls. Due to the potential environmental impact of these observations, further investigation is needed to determine if the BPA alone is responsible for the observed impact on germination or other chemical contaminants leached from the thermal paper.

P120 **Julia R. Saling, Leah D. Starkey, Matthew J. Zdilla**

Assessment of zinc nutriture using a novel visual analog scale in conjuction with a zinc taste test

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Zinc is needed for human function and overall health. Inadequate zinc intake is associated with numerous diseases. A non-invasive reliable method of assessing zinc nutriture has not been developed. One potential method of assessing zinc nutriture is the Bryce-Smith zinc taste test (ZTT), an approach which assumes a direct correlation between zinc intake and perception of zinc in water. Limited support exists for the reliability of the ZTT. Studies examining the ZTT have not taken into account latent factors. We administered the ZTT in conjunction with a novel visual analog scale (VAS) in a population of 491 college students. Known latent factors were assessed through a health history questionnaire. The comparison of the ZTT scores (1-4) to VAS scores (0-100) yielded a strong, positive correlation which was statistically significant ($r_s = 0.7903$; *P*-value < 0.0001; CI = 95%). Exclusions were

made to account for known latent factors, yielding a very strong, positive correlation which was statistically significant (r_s = 0.8297; n = 122; P-value < 0.0001; CI = 95%). Comparative assessments between male (n = 107) and female (n = 384) groups did not yield a significant difference (U = 18607; P-value = 0.0529) using ZTT scores. However, VAS scores showed significant difference (U = 16424; P-value = 0.0015) between sexes. Our results indicate using both tests in conjunction has the potential to be a better means of assessing zinc nutriture than either test alone.

P121 **Dale Bartek, Carlos D. Camp**

Temperature preference in two species of Trogloxenic salamanders

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Caves are stable environments relative to the surface in available light and energy as well as temperature. However, the twilight zones represent ecological ecotones that are more stable than the surface but more variable than deep within cave systems. Trogloxogenic species of salamanders often use cool, moist environments of twilight zones as refugia to avoid unfavorable conditions on the surface, particularly during certain seasons of the year. Two important trogloxenic salamander species occupying twilight zones of caves in the Cumberland Plateau are the Cave Salamander (*Eurycea lucifuga*) and the Northern Slimy Salamander (*Plethodon glutinosus*). The populations of each species fluctuate seasonally within twilight zones suggesting that each has a preferred temperature range. In northwestern Georgia, *E. lucifuga* is more prevalent in low-elevation, cold caves and during spring; *P. glutinosus* exhibits no elevational preference and is abundant during summer. We studied temperature preference in these two species and tested the hypothesis that *E. lucifuga* prefers lower temperatures than *P. glutinosus*. We collected a sampleof 15—16 of each species from caves in the Cumberland Plateau of Georgia and determined temperature preference along a thermal gradient that ranged from 10 to 40 C. *Eurycea lucifuga* showed a mean preference of 11.8 C, and *P. glutinosus* had a mean preference of 16.0 C, a significantly higher temperature. The low temperature preference of *E. lucifuga* explains the differences between the two species in both seasonal and elevational distribution within twilight zones of caves.

P122 **Paul V. Cupp, Jr.**

Post hatching brooding behavior in green salamanders, *Aneides aeneus*

Department of Biological Sciences, Eastern Kentucky University, Richmond, KY

In SE KY, female *Aneides aeneus* rear their young in crevices of rock cliffs. Following an egg brooding period of about 73 days, females remain with the hatchlings for 3-7 weeks. Eggs deposited in July hatch in late September. At first, new hatchlings are aggregated on the remaining egg suspension material. Females remain near and in front of hatchlings. After the first week or two, the hatchlings continue to remain close but show some movement. One or two stragglers may move away into small recesses in the crevice. Into week three, hatchlings may begin to move about the crevice and to other adjacent crevices. During three to five weeks after hatching, the young may venture out to other areas. The number of young may dwindle somewhat. In some instances, females left the young and did not return. Hatchlings were observed in brooding crevices for 2-4 weeks after the females left. While only females have been reported to brood hatchlings, in this study, a male was observed in front of a group of hatchlings for three successive weeks. In another instance, one hatchling was found on the tail of a male in a crevice adjacent to a brooding crevice containing a female. Posthatching brooding behavior may play an important role in the survival of hatchling green salamanders.

P123 **Chandler H. Gray[1], Christian R. Oldham[4], Elizabeth B. Underwood[1], George W. Schaaf[3], Jacquelyn C. Guzy[1], Steven J. Price[2], Michael E. Dorcas[1]**

Determining the effect of pond type on painted turtle (*CHRYSEMYS PICTA*) growth rates

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Urbanization of the Charlotte-Metropolitan area in North Carolina, USA, has led to changes in natural habitats, particularly in the loss of wetlands, but it has also resulted in the development of new aquatic habitats. These can take the form of storm water detention ponds, ponds in suburban parks, and ponds on recreational lands such as golf courses. Painted turtles (*Chrysemys picta*) are abundant in many

of these suburban aquatic habitats, perhaps because of a higher rate of growth or higher fecundity than their rural counterparts. We conducted a study to determine whether the growth of painted turtles differed by sex and by the type of pond they inhabited. Ten golf course ponds, five rural ponds, and five urban ponds were trapped for 20 days each year between May and August from 2009 to 2012, with the majority of ponds having many more years of data. Using 132 male and 67 female turtles with known age data, we found that turtles inhabiting golf course ponds grew faster than turtles inhabiting rural or urban ponds (ANCOVA, $F=3.82$, $p=0.023$). Additionally, we found that females grew faster than males in all pond types (ANCOVA, $F=15.73$, $p<0.01$). Regardless of variation in growth rates, each of the three pond types appear to offer suitable habitat for semi-aquatic turtles. Further investigation is warranted to elucidate the mechanisms responsible for higher turtle growth in golf course ponds.

P124 **Lauren E. Carter, Margaret M. Stebbins, Jacquelyn C. Guzy, Kristen K. Cecala, Michael E. Dorcas**

Upland habitat use of Spotted Salamanders (*Ambystoma maculatum)* in Mecklenburg County, NC

Department of Biology, Davidson College, Davidson, NC

Many semi-aquatic organisms depend on both aquatic and terrestrial habitats in order to facilitate completion of their bi-phasic life cycle and maintain viable populations. Although some state and federal wetland regulations have been established to protect wildlife needs, such parameters are often limited to the wetland basins and small terrestrial "buffer zones" that typically extend 30 meters or less from the wetland edge. Understanding the spatial location of semi-aquatic animals within terrestrial habitats surrounding wetlands is critical in determining how much and what type of habitat is necessary to maintain populations. To address this issue, we examined habitat use of spotted salamanders (*Ambystoma maculatum*) by intercepting adults during their seasonal breeding migration. To sample salamanders, we completely encircled a 0.5 ha wetland with a 400 m drift fence with pitfall traps spaced 10 m apart. Our results showed salamander use of surrounding upland areas, demonstrating the importance of preserving this critical habitat. Future research will address questions related to habitat use of recently metamorphosed and mature salamanders leaving the wetland, and the short and long-term effects of various landscape practices, such as clear-cutting.

P125 **Lindsay Wargelin, Kaitlin Massey, Morgan Bowling, Rachel Young, Sarah Bouchard**

Carryover effects of larval density on body composition, growth, and feeding in Gray Treefrogs, *Hyla versicolor*, post-metamorphosis.

Otterbein University, Westerville, OH

Amphibian larval environments can have important effects on individuals post-metamorphosis. We studied the effects of larval density on froglet condition, growth and feeding in Gray Treefrogs, *Hyla versicolor*. Larvae were reared at high, medium and low densities in 410 L mesocosms. Each mesocosm was supplied with the same amount of algal food, such that food availability varied with treatment. Larvae were photographed and measured with image analysis software to determine growth rates. Upon emergence from mesocosms, froglets were weighed and measured. They were either euthanized for percent dry matter and ash determinations or placed in individual aquaria where they were maintained on insects to investigate feeding and growth. Euthanized froglets were dried at 65 °C and then ashed at 500 °C. All feces were collected for two weeks from maintained froglets, and intake was determined by counting insect head capsules in feces. Larvae reared at high densities grew significantly slower and metamorphosed later than those reared at low densities. Froglets emerging from high larval densities were one third the mass of those emerging from low densities. Their bodies were also significantly lower in percent dry matter (11.5 vs. 14.3 %) and percent organic matter (78.3 vs. 83.8 %). High density froglets began producing feces 3.5 days later than low-density froglets (8.1 vs. 4.7 days). However, high-density froglets grew by 58% during the four weeks post-metamorphosis, whereas low-density froglets did not grow appreciably. These results suggest that while low larval food resources initially reduce froglet quality, froglets may maintain the capacity to compensate with accelerated growth post-metamorphosis.

P126 **Chelsea R. Jenney[1], Sarah S. Bouchard[1], Karen M. Warkentin[2]**

Carryover effects of larval digestive plasticity post-metamorphosis in red-eyed treefrogs

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Larval environment has a profound effect on post-metamorphic nutrition in red-eyed treefrogs. Small froglets emerging from high-density larval environments begin feeding sooner and grow at a faster rate than large froglets from low-density environments. Additionally, froglet insect intake does not scale with body size despite large differences in froglet mass. We assessed to what extent these patterns could be attributed to effects of larval plasticity that carry over post-metamorphosis. We hypothesized that larvae from high densities would increase gut length (increasing digestive efficiency) and reduce liver size (reducing metabolic costs) in response to lower per capita food resources. We reared larvae at three densities (5, 25 and 45 individuals per 400 L tank), and euthanized 10 size-matched larvae and 10 froglets from each density. We dissected and weighed the guts, livers, and fat bodies of all individuals. The guts were uncoiled and photographed, and gut length and area were assessed using imaging software. As predicted, guts of high- and medium-density larvae were 23% longer than that of low-density larvae, and livers and fat bodies were significantly smaller. Low-density froglets were three times heavier than high-density froglets. Despite this extreme size difference, gut length did not vary with density, although high- and medium-density guts were lighter and thinner than low-density guts. High- and medium-density froglets also had proportionately smaller livers and fat bodies than low-density froglets. These results confirm carryover effects of larval plasticity post-metamorphosis.

P127 **Colleen Jones, Timothy A. Kreps**

A comparison of the effectiveness of glow sticks and sardines for trapping red spotted newts (*Notophthalmus viridescens*).

Department of Biology, Bridgewater College, Bridgewater, VA

Funnel traps are commonly used to monitor amphibian species' abundance and community composition. Utility of any trapping technique is often dependent on the baits or attractants used. Recently, light baits(i.e. glow sticks) have been recognized as an effective amphibian attractant when using funnel traps. However, theeffectiveness of light baits has yet to be tested against other traditional baits. In this experiment, we comparedglow sticks, sardines (a traditional scent bait) and no bait treatments using red spotted newts (*Notophthalmus viridescens*). In three ponds, we compared newt catch rates in funnel traps baited with glow sticks, sardines or nothing. In wading pools, we then examined newt preference in pair-wise tests of baited funnel traps (glow stick-sardines, sardine-nobait, and no bait-sardine). Results of the field and lab experiments were relatively consistent. The light bait outperformed both sardines and unbaited traps. Surprisingly, the unbaited traps were more attractive to newts than the commonly used sardines.

P128 **Kristen T. Carlisle, James Rayburn**

Preliminary cryopreservation of *Xenopus laevis* embryos

Department of Biology, Jacksonville State University, Jacksoville, AL

The feasibility of cryopreservation of *Xenopus laevis* embryos was investigated. This project evaluated the effects of cold treatment (embryos kept at 4°C) for various times, the direct developmental effects of cryoprotectants, and evaluation of preliminary treatments for freezing and thawing of embryos. Cold treatment is used in cryopreservation to reduce the effects of cryoprotectants. Cryoprotectants are chemicals used to prevent damage due to ice crystal formation within cells. *Xenopuslaevis* embryos were studied using a modified Frog Embryo Teratogenesis Assay-Xenopus (FETAX) protocol. Early *Xenopus laevis* embryos were exposed to cold temperature with two replicates of 20 embryos each; treatments of DMSO, Glatose, PVP and mixtures of them were placed into 4 replicates of 20 embryos each for approximately 15 minutes and either placed in a -80°C freezer for at least 24 hours or rinsed and placed in a 24°C incubator. Solutions were changed every 24 hours for embryos at 24°C. Mortality, malformation, and growth were recorded at 96 hours. Frozen embryos were thawed and rinsed under various conditions. Conditions of the embryos were photographed and recorded. ANOVA analysis with Bonferroni multiple comparison test was used to determine differences. The levels of

cryoprotectants did not cause significant effects. For cold treatment, significant effects were seen at 30 minutes, indicating this time limit should not be exceeded. Freezing of the embryos has indicated a chemical mixture of cryoprotectants with limited cold treatment have the most potential for cryopreservation of the embryos.

P129 **Daniel S. Sollenberger, Joseph H. K. Pechmann**

Seasonal activity patterns in dwarf waterdogs (*Necturus punctatus*): Risk management or resource acquisition

Department of Biology, Western Carolina University, Cullowhee, NC

Aquatic salamanders of the genus *Necturus* exhibit seasonal activity patterns, with observations peaking during mid-winter. Predator avoidance has been suggested as an explanation for cool season activity. Another hypothesis is that increased *Necturus* activity during winter is related to increased prey availability in leaf packs. To observe the response of juvenile waterdogs to conflicting cues, we constructed 3 raceways. Three juvenile *Necturus* were added to one of 2 chambers in each raceway along with live blackworms. After foraging behavior by all *Necturus* was observed, we added either a *Rana* tadpole (non-predator control), an adult *Necturus* (gape-limited conspecific predator), or a crayfish (non-gape-limited predator) to the 1st chamber in each raceway. We removed the barrier detaining the juvenile waterdogs and recorded the distance of each from the treatment every 2 min for 14 min. We also sampled *Necturus* and macroinvertebrates from leaf packs in the South Fork Edisto River near Windsor, SC. Treatment had no effect on waterdog behavior during lab trials. *Necturus* density was positively correlated with macroinvertebrate density and maximum discharge rate during the previous 30 days in partial correlation analyses. Our results suggest juvenile dwarf waterdogs may not be abandoning foraging areas during summer to avoid predators. Instead, increase in discharge rate may act as a cue to stimulate waterdogs to leave their summer refugia and move into leaf packs when prey density is at its peak.

P130 **Rachel L. Lester, James Rayburn**

The developmental effects of oil dispersants on *Xenopus laevis* frog embryos

Department of Biology, Jacksonville State University, Jacksonville, AL

Oil spills have caused the need for the use oil dispersants. Do oil dispersants cause effects on the embryo development of vertebrate organisms? The Frog Embryo Teratogenesis Assay *Xenopus* (FETAX) is a standard assay for answering this question. This assay will determine the levels of dispersant necessary to impact the growth, development, and survival of frog embryos. Both a male and female adult *Xenopus laevis* frog were injected with a human chronic gonadotropin hormone and then placed together to mate and produced fertilized eggs. The embryos were exposed for 96 hours from blastula to free living tadpole to 6 different concentrations of oil dispersant. Each experiment had 4 replicate negative controls and 2 replicates for each concentration with 20 embryos for each 60 mm petri dish. After four days, the embryos were removed from culture and analyzed for growth, abnormalities, and survival. Growth was assessed as the length of the embryos. Data was analyzed with systat to determine LC50, EC50, and growth. Terategenic index was determined by 96hr LC50/ 96hr EC50. LC50 was approximately 0.07% and the EC50 was approximately 0.07%. The results indicate the oil dispersant is not a teratogen but does show some effects on the stunt of growth and abnormalities. These results provide evidence that oil dispersant is potentially affecting aquatic vertebrate.

P131 **Brenna Burkhart[1], David Sever[2], Kevin Gribbins**

An ultrastructural description of spermiogenesis within the testis of the Yellow-Bellied Sea Snake, *Pelamis platurus*

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Little is known about spermatid development during spermiogenesis in snakes, as there is only one complete study in ophidians, which details the spermatid ultrastructure within Cottonmouths. Therefore, the objective of the following research is to expand our knowledge of the ontogenic steps of spermiogenesis in snakes by studying spermatid maturation in *Pelamis platurus* that were collectedin Costa Rica in 2010. The testes were removed, fixed in Trumps, and the tissues were processed for standard electron microscopy. The spermatids of *P. platurus* share many similar ultrastructural characteristics to what has been described for squamates and ophidians during spermiogenesis. Two notable differences between the speramtids of

P. platurus and those of other snakes is a more prominent central lacuna within the nucleus and radiating arrays of the outer longitudinal manchete microtubules. The epinuclear lucent zone is shorter in comparison to other squamates and may be a synapomorphy for snakes. Also, the midpiece is much longer in *P. platurus* and is similar to that reported for all snakes studied to date. Other features of chromatin condensation and morphology of the acrosome complex are similar to what has been observed in the Cottonmouth. Though the spermatids in *P. platurus* appear to be highly conserved, some differences in subcellular details are observed. The importance and purpose for these character differences during spermiogenesis in snakes is still unknown. Presently the number of species investigated is too small to unravel the phylogenetic implications of such key character differences.

P132 **Benjamin Rausch, Kevin Gribbins, Richard Phillips**

The influence of temperature on the regulation of small intestinal enterocytes in Mexican Kingsnakes (*Lampropeltis mexicana*)

Department of Biology, Wittenberg University, Springfield, OH

Previous studies suggest snakes have an ability to regulate the morphological structure of their digestive system, especially the small intestine, to conserve energy between prey captures. As poikilothermic organisms, snakes and their digestive physiology are inherently tied to temperature, as evidenced by postprandial selection of warm microhabitats. Although the influence of temperature on snake behavior is well established, the role of temperature in the regulation of small intestine morphology has not been studied. To asses the impact increased temperature has on the morphological characters in digestive regulation, we used light microscopy to visualize small intestines taken from Mexican kingsnakes at 2, 6, 10 or 14-days postprandial at either 23.3°C or 34.4°C. Morphometric data were collected on the enterocyte height, enterocyte width, and brush border thickness (5 enterocytes per tissue-section,5 tissue-sections per treatment, 1µm thick). Despite a significant interaction between temperature and time, enterocyte height was greater and brush border was thicker in the 34.4°C treatment ($F_{1,3}$≥54.10, p≤0.05). Both enterocyte height and brush border had larger peak values for 34.4°C treatment (T_{45}≥2.11, p≤0.05). However, enterocyte width was found to be greater in the 23.3°C treatment ($F_{1,3}$=24.14, p≤0.05) with a peak width significantly larger (T_{45}=-4.79, p≤0.05) at 23.3°C treatment. Although an increase in temperature amplifies the majority of enterocyte characters, the 23.3°C treatment having had a greater enterocyte width (increasing the absorptive surface area) may counter a decrease in enzymatic function at the lower temperature.

P133 **Lisa Ann Blankinship, Symphony P. Keeton, M. Lauren Bates, Vansh Shah**

Changes in antibiotic resistance profiles of cell phone and hand associated bacteria

Department of Biology, University of North Alabama, Florence, AL

Antibiotic resistance is a world-wide health concern. The World Health Organization has stated that medicine will likely return to a pre-antibiotic state within the next 20 to 40 years. Evidence suggests that cell phones act as vectors for transmitting bacteria from surfaces to persons. Presented here are first and second year bacterial identification and antibiotic resistance profile data collected from general population members in west Tennessee. The purpose of this study was to determine if: 1) bacteria associated with cell phones changed over the study period and 2) if the antibiotic resistance profile of cell phone bacteria changed over the study period. Samples were collected from the hands of participants and from their cell phones. Participants were asked to complete a brief survey regarding their cell phone usage with each sampling event. Samples were cultured, serially diluted to produce pure colonies, identified by the Biolog system, and tested for antibiotic resistance by the Kirby Bauer method.

P134 **Leigh Anne Fortney**

The formation, communication, and control of dental biofilm through the use of specifically targeted antimicrobial peptides (STAMPs)

Department of Biology, Virginia Military Institute, Lexington, VA

Specifically Targeted Antimicrobial Peptides (STAMPs) may be the most efficient and effective mechanism in oral hygiene for the removal of unfavorable biofilms. This efficacy is primarily due to the ability of STAMPs to individually target harmful microbes and eradicate them without causing harm to the native, advantageous

microflora. Through an in-depth review of the recent literature, this research explores and presents the most significant findings in biofilm resistance factors with respect to structure, communication, gene expression and STAMPs defense. In order for STAMPs to be selective for a specific type of harmful bacteria, they must consist of independent targeting regions which are separated by flexible linkers held within a peptide sequence. This research presents several case studies ranging from initial synthesis from a full length *Streptococcus mutans* CSP (non-antimicrobial peptide) with the attachment of a "killing" peptide head named G2 consisting of 16 amino acids (together C16G2), to the secrets behind their extensive success. While the mechanism behind STAMPs functionality is not completely known, it seems that C16G2 was extremely effective and fast acting against *S. mutans* in a multispecies environment. Additionally, C16G2 defended against other related species of *Streptococci*, despite steric hindrance. This research not only traces the development of the C16G2 STAMP from the literature, but also presents possible new types of antimicrobial agents (M8G2, C16-33, M8-33) being developed to encompass additional infectious species found throughout the mammalian tissues.

P135 **Gideon Yeboah, Kelly Taylor, Patricia Koplas, Jennifer Easterwood**

Evaluation of disinfectant efficacy on bacteria-coated otoscope cones

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A nosocomial infection is any infection that is acquired in a clinical setting. According to recent statistics, nosocomial infections claim the lives of about 100,000 Americans annually (Zakaria 2012). Nondisposable otoscope cones are perhaps the easiest vectors for nosocomial infections. The purpose of this experiment is to evaluate the efficacy of three disinfectants commonly used in clinical settings (KennelSol, Chlorhexidine, and Opti-Cide) against six bacterial species (*E. coli, S. aureus, S. epidermidis, P. aeruginosa, E. faecalis,* and *P. mirabilis*). Each cone is soaked in a 300mL nutrient broth containing all six bacterial species; the cones are then placed in the respective disinfectants or distilled water and air-dried. After drying, the cones are swabbed and each sample is incubated in a nutrient broth for 24 hours. A standard plate count will determine the colony forming units (cfu), which will be analyzed using a Kruskal-Wallis test. A previous experiment of the efficacy of these disinfectants indicated that Opti-Cide was significantly better at reducing colony forming units compared to the other disinfectants. However, results from the previous experiment may have been confounded by potential contamination. This experiment improves upon the previous techniques in order to limit issues previously observed.

P136 **Priscilla C. Barger[1], Joseph C. Newton[1], Forrest I. Townsend Jr.[4], Lydia A. Staggs[3], Rebecca L. Wells[2], Elisabeth R. Peterman[2]**

A novel diagnostic assay for the rapid detection of mucormycosis caused by *Apophysomyces* spp. in dolphins

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Mucormycotic infections caused by *Apophysomyces* species have been reported in multiple genera of captive and wild cetaceans. These infections are aggressive and rapidly fatal making early detection and treatment paramount for survival. In cases where eschar lesions are present, mucormycosis can be diagnosed histologically, with definitive diagnosis of *Apophysomyces* requiring culture and species identification. In cases with occult presentation, definitive antemortem diagnosis is impossible. The aim of our research is to develop an accurate and sensitive enzyme-linked immunosorbent assay (ELISA) for the early detection of *Apophysomyces* spp. infections in cetaceans. In this study, archived sera from bottlenose dolphins, rough-toothed dolphins, and a Pantropical spotted dolphin were evaluated to determine sensitivity and specificity of the newly developed ELISA. A total of 132 serum samples from 70 individual dolphins were analyzed. Serum samples representing 12 *Apophysomyces* positive dolphins, 13 dolphins with other fungal diseases, 15 dolphins with non-fungal diseases, and 30 healthy dolphins were evaluated. Results from this study found the assay to have an overall diagnostic sensitivity of 85%. Diagnostic sensitivity increased to 95% in samples taken four or more days following the onset of clinical symptoms. Overall diagnostic specificity was 95%. While additional studies are necessary to validate the ELISA, current results are promising

that this assay will allow for the early detection and long-term monitoring of treatment effectiveness for these deadly infections in dolphins.

P137 **Stephanie Dunn, Annie M. Kaye, Michael K. Moore, Virginia A. Young**

Epizoic cyanobacteria associated with neotropical harvestman (Opiliones, Sclerosomatidae) from Tobago

Department of Biology, Mercer University, Macon, GA

In this study, we describe experiments undertaken to identify microorganisms first observed on external surfaces of sclerosomatid harvestmen (*Prionostemma* sp.) collected in Tobago. In the field, we collected multiple adults that had blue films growing upon the dorsal surfaces of the carapace and abdominal scutum. Examination by light microscopy revealed dense clusters of what appeared to be blue-green algae arranged within small pits that cover the external surfaces of the carapace, abdominal scutum, and coxae. Genomic DNA was extracted from the films of multiple specimens and was subsequently used as a template in PCR to amplify a conserved intergenic spacer region within the phycocyanin locus of Cyanobacteria. The presence of a 700 base pair PCR product in DNA from harvestmen that had the film but not in DNA from harvestmen lacking the film confirmed our hypothesis. Importantly, this finding represents only the third confirmed occurrence of epizoic cyanobacteria on Neotropical harvestmen and the first from outside of Central America.

P138 **Andrew J. Jajack, Andrew E. Rosselot**

Imbalance of beneficial fungi due to fungicide spraying leads to chalkbrood disease in the honey bee

Department of Biology, Wittenberg University, Springfield, OH

Honey bee colonies rely on beneficial fungi, namely *Aspergillus*, *Penicillium*, *Cladosporium*, and *Rhizopus*, to generate a natural defense shield for protection against potential microbial diseases, such as chalkbrood (*Ascosphaera apis*), and to manufacture bee bread, a primary source of food for proper development and growth of bee larvae. Fungicide spraying minimizes the amount of naturally occurring spores in the environment. To explore the relationship between fungicide spraying and bee diseases, bee bread from seven habitats was analyzed for fungicide residues and fungus composition combined with a bee disease diagnosis. Fungicide spraying in adjacent fields bears more weight than fungicide spraying in the field containing the colony since bee's forage for pollen within a 3.5 km flight range. Because of this, an organic orchard had the highest levels and diversity of fungicides, and there were even detectable levels of fungicides from regions that were sprayed before bloom. Fungicide contamination functions to reduce the fungal isolates, particularly targeting *Aspergillus*. Colonies that displayed chalkbrood symptoms contained bee bread with fungicide contamination since a reduction in the amount of beneficial fungi make the colonies more susceptible to infection. Inactive colonies that died from unknown causes had lower levels of detectable fungicides and less drastic depletion of fungal components in bee bread, suggesting that fungicide spraying contributes more to chalkbrood than colony collapse disorder. Low fungi levels produced by concentrations of fungicides applied in the field still allow active colonies to produce viable bee bread at the cost of increased risk of developing chalkbrood.

P139 **Mary Clare Yerke, Andrew E. Rosselot, Andrew J. Jajack**

Mold screening of blue honey from the Sandhills region of North Carolina shows evidence of a linkage between fungicide spraying and chalkbrood

Department of Biology, Wittenberg University, Springfield, OH

Honey made by bees (*Apis mellifera*) from honeydew [forest honey, pine honey, fir honey], rather than floral nectar, has a high mold spore count and dark color from sooty molds that honeydew causes. An unusual blue honey occurs sporadically in the Sandhills that is dominated by pine forests and peach tree orchards sprayed regularly with fungicides. Mold culturing and enumeration on three agar media were conducted on blue and non-blue honeys in a six county comparison to test an area beekeeper's hypothesis that the sooty mold *Nigrospora* may be responsible for the dark color. Nine genera of mitosporic molds were recovered, with beneficial fungi *Aspergillus* and *Penicillium* as primary isolates. Composition of molds in blue honeys and non-blue honeys were alike, except number of fungal isolates in blue honeys was 2 - 3x less. No sooty molds, including *Nigrospora*, were recovered from blue honeys. Colonies sampled

for blue honey had chalkbrood, a lethal disease of bee larvae. We conclude that blue honey cannot be attributed to seasonal timing involving a shift from nectar to honeydew collection by the bees. Pollen analysis suggests that the dark color likely derives from summer titi. Additionally, molds in foraging habitats in the Sandhills used by bees are reduced by fungicides, which make the colony more prone to infection by decreasing beneficial fungi. Blue honey is not a signal of an unhealthy colony, rather it points out specific at-risk regions with heavy fungicide use that could be detrimental to the bees.

P140 **Ben Shapiro, Darwin Jorgensen**

Immune system function in the American Lobster: Response to a double bacterial challenge

Department of Biology, Roanoke College, Salem, VA

The American lobster (Homarus americanus) is able to mount a rapid and effective immune response to acute bacterial exposure. Previous work in our laboratory has shown a decrease in circulating bacteria and hemocytes (the lobster analog to our white blood cells) in experimental lobsters within the first 15 minutes following a single bacterial injection. My experiments are designed to monitor the immune response in lobsters exposed to two bacterial loads administered within 24 hours of each other. Is the immune system response to the second exposure different? I have found that the clearance of bacteria from the hemolymph (blood) following the second bacterial challenge is more rapid than that shown after a single challenge.

P141 **Alyssa McManaway, Darwin Jorgensen**

Immune response to acute bacterial exposure in the American lobster: Do the tissues play a role in clearing bacteria from the hemoylmph?

Department of Biology, Roanoke College, Salem, VA

The immune system of the American lobster, *Homarus americanus,* shows a rapid and effective response to acute bacterial exposure. We have shown previously that hemocytes are mobilized quickly and that bacteria introduced by injection into an animal are cleared from the hemolymph within 30 minutes. It has been suggested that the tissues may play a role in the immune response, assisting the circulating hemocytes in clearing bacteria from the hemolymph. In our experiments, lobsters were acutely exposed by injection to the bacterium *Vibrio campbelli.* Various tissues were removed after 60 minutes and the number of culturable bacteria per gram of tissue was determined. It was found that the hepatopancreas and the antennal glands contained a greater number of culturable bacteria than did any other measured organ. Our data suggest that the hepatopancreas and the antennal glands may play a significant role in the clearance of circulating bacteria in lobsters.

P142 **Nidhi Chigurapati, Mariam McKee, Roa Zaied, N. Robert Estes II**

Antimicrobial activity of crude leaf extracts from native southeastern shrubs: *Callicarpa americana* and *Morella cerifera*

Biology Department, Auburn University Montgomery, Montgomery, AL

As the incidence of bacterial resistance to current antibiotics continues to increase, the need for the development of novel antibacterial agents willcontinue to grow. Many studies have focused on compounds derived fromplants that have a history of traditional medicinal uses. Included amongthese are compounds with properties that inhibit the growth and proliferationof potentially hazardous microbes. *Callicarpa americana* (Beautyberry)and *Morella cerifera* (Wax Myrtle) are shrubs native to the southeastern UnitedStates that have a variety of traditional uses. In this study we sought todetermine the antibacterial properties of crude leaf extracts from these plants. Fresh or dried leaves were extracted with methanol, ethanol, isopropanol,acetone, or water. The crude extracts were then dried under vacuum priorto reconstitution in acetone. The extracts were tested against two gram positiveand two gram negative bacteria using the disc diffusion method. Minimal inhibitoryconcentrations were also determined using broth microdilution assays. Extractsfrom the leaves of both plants showed inhibitory effects on the growth of the grampositive *Staphylococcus aureus* and *Bacillus subtilis*, whereas only extracts from *M.cerifera* leaves inhibited the growth of the gram negative *Proteus vulgaris.* Leafextracts from neither plant had any effect against the gram negative *Escherichiacoli.* Our results suggest that crude leaf extracts from *C. americana* and *M. cerifera*have potential for the development of novel antibacterial compounds.

P143 **William Kelly Jr.[1], Allison Acord[1], Amrita Valluri[2], Kristen Rose[1], Jagan Valluri[1]**

Biofuel production from microalgae by heterotrophic growth

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Algae are a favorable biofuel source because of the potential high oil content and fast generation of the biomass. However, one challenge of this technology is achieving high oil content while maintaining an exponential growth of the organism. One way of optimizing these oil yields is to utilize algae's natural process for storing energy in the form of lipids. When algae are put into a stressful environment, such as nutrient starvation, carbon uptake is used for storing energy rather than reproduction, thus producing more lipids. Heterotrophic growth and lipid production of three microalgae species *Chlorella protothecoides*, *Chlorella sorokiniana*, and *Chlorella vulgaris* in response to glucose or other organic compounds for carbon source were investigated. Our studies showed that the addition of 2% glucose to the medium increased lipid content from 12% to 58.4% in *C. protothecoides*, from 6.3% to 17% in *C. vulgaris* and an increase from8% to 49.2% was observed in *C. sorokiniana*. Under inorganic nitrogen starvation in the medium, *C. vulgaris* produced an increase in crude lipid content from 6.2% up to 47.3%, *C. protothecoides* increased lipids from 12% up to 44%, and from 8% up to 40% in *C. sorokiniana*. Lipid accumulation was significantly faster than the control in nitrogen deficient growth. Yet, this may be a limiting factor in the optimization of overall oil yield due to the lack of cell reproduction. Overall biomass yield frequently decreases under environmentally stressed conditions.

P144 **Jeff Illinik, Victor R. Townsend, Jr., Philip Rock**

SEM Imaging of *Neurospora crassa* mutants

Department of Biology, Virginia Wesleyan College, Norfolk, VA

The growth and development of fungal mycelia are complex processes that are still rather poorly understood. We have been using scanning electron microscopy to compare morphological and biochemical mutants of the model fungus, *Neurospora crassa*. The high resolution of scanning electron microscopy is useful for identifying structuralchanges in fungal hyphae associated with specific mutations, which are not readily apparent in the light microscope. An initial analysis has revealed changes in the ultrastructure of the crosswalls in microtubule motor protein (dynein and kinesin) mutants and may further elucidate the roles played by these proteins in hyphal growth.

P145 **Erin Byrd[1], Chris Smith[2], Natalia Goh[2], Erik Hill[1], Sharon Mason[2], Michelle Thomas[2]**

Presence of quinolone resistance in swine enteric flora

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Commercial hog farms utilize antibiotics in their livestock for three main uses: prophylaxis, growth promotion, or therapeutics. Recurrent sub-therapeutic doses of antibiotics can promote antibiotic resistance, which may lead to overgrowth of resistant enteric flora. Fluoroquinolone antibiotics (FQ) are second-line antibiotics that should only be used when an infection cannot be cleared up using first-line antibiotics. FQ use in livestock has already been banned in several countries due to the potential risk of zoonosis caused by FQ resistant bacteria. However, in the United States, fluoroquinolones are utilized for prescription only treatment in commercial farming. We seek to determine if Gram negative bacteria resistant to FQ can be cultured from the fecal material of hogs previously treated with intravenous antibiotics at label dosing. Fecal samples were collected from hogs treated with enrofloxacin, and bacteria were cultured from the feces of swine both pre- and post-treatment with FQs. PCR screening will determine if samples contain common FQ resistance genes. DNA sequencing of the quinolone resistance-determining region (QRDR) of the *gyrA* gene in FQ-resistant strains will identify evolved resistance to FQ treatment. This research is important because it investigates the potential for the development of antibiotic resistance stemming from the use of antibiotics in livestock.

P146 **Benjamin Wildman[1], Leslie Courtad[1], Randy Beavers[2], L. Ann Foster[1]**

Use of hydrogen peroxide to reduce microbial load on arial parts of organic herbs grown for human consumption

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Organic herb producers who wish to use their plants in medicinal compounds must adhere to US Pharmacopeial Convention standards set for the maximum microbial load of 1 x 10^4 for 10 g of dried product. This strict standard is difficult to attain for plants grown in natural environments, which are subjected to contamination by rain, soil and animal activity. To reduce the microbial load of the dried product, we developed a washing procedure using water followed by a five minute soak in concentrations of hydrogen peroxide. Yellow dock (*Rumex crispus*) was used for our test plant and was wild harvested from the campus of Southern Adventist University , Collegedale, TN. Ten grams of leaves were used for each experiment and were either not washed (control), washed with tap water, or washed with tap water followed by a 5 minute soak in hydrogen peroxide. The leaves were then gently agitated with 100 ml PBS for 15 minutes, and a 1 ml sample was taken for serial dilutions and spread plated on tryptic soy agar. We found that exposure to hydrogen peroxide reduced the microbial load and is a viable sanitation solution for organic herb producers to use on their crops.

P147 **Suzanne G. Strait, Thomas Pauley, Joseph Hamden, Mark DeBlois**

Recuration of the West Virginia Biological Survey Museum

Department of Biological Sciences, Marshall University, Huntington WV

The West Virginia Biological Survey Museum (WVBSM) includes over 21,000 mammals, amphibians, and reptiles that have been amassed over 70 years of state-wide collecting. Almost every species that has been described in West Virginia is included in this collection, including taxa that are listed as federally endangered or at risk.The collections of mammals and herpetological specimens from West Virginia are greater here than at any other museum nationally. A National Science Foundation grant was recently received to provide new storage facilities and curation support to ensure this resource is available for years to come.The collection has been moved into new mobile cabinets, internal containers have been replaced, and specimens verification and georeferencing is underway. A low-temperature freezer is being purchased for tissue collections for genomic studies and therefore modernizing the research potential of this collection. Another important task of this project is archiving all data associated with this collection, including field notes, maps, and slides. This metadata is an integral part of the collection supporting the physical specimens and now it has all been digitally backed up for archival and accessibility reasons. Finally, a WVBSM web site is being developed which includes both collection data and public outreach components such as species accounts and keys.

P148 **Leah D. Starkey, Matthew J. Zdilla**

The role of gustin in zinc perception and nutriture: A double-blind pilot study

Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV

Although zinc is an essential mineral, aberrant zinc nutriture is common throughout the world. A method to effectively assess zinc levels has not been developed. One quick, noninvasive, although questionably valid, method for zinc analysis is the Bryce-Smith zinc taste test (ZTT). The ZTT measures the ability of an individual to taste a zinc sulfate solution. The ZTT may work through the presence and function of the salivary enzyme gustin. Although the involvement of gustin in the ZTT mechanism has never been directly tested, research has supported this enzyme's involvement in taste bud development. In our double-blind pilot study of college students (n = 36), gustin concentrations measured via sandwiched ELISA were compared to ZTT scores and a visual analog scale (VAS) developed by our laboratory. A strong, statistically significant correlation (r_s = 0.67; p = 0.02; n = 17)between the ZTT and gustin concentrations was identified. We discovered a strong correlation, however not statistically significant, between gustin concentrations and the VAS scores (r_s = 0.59; p = 0.06; n = 17). Our results suggest that the ZTT may be an indirect measure of gustin concentrations and, therefore, an indirect measurement of bioavailable zinc.

P149 **Starlene M. Loerch, Amber McCammon, Paul C. Sikkel**

Low susceptibility of invasive Indo-Pacific red lionfish (Pterois volitans) to a common Caribbean ectoparasite

Department of Biological Sciences, Arkansas State University, Jonesboro, AR

The enemy release hypothesis proposes that introduced species can become invasive by leaving behind natural enemies (predators, competitors and parasites) when they are introduced to a non-native habitat. Indo-Pacific red lionfish, *Pterois volitans*, are one of the most devastating species invasions to occur in the tropical Atlantic Ocean. We hypothesis that one reason the lionfish may be such a successful invader in the Caribbean is that it has escaped some of its parasites from its native range and is not susceptible to parasites in the introduced range. Specifically, the goal of this project was to test the susceptibility of red lionfish to a common Caribbean parasite, *Neobenedenia melleni,* (Monogenea: Capsalidea). Lionfish were placed in the overflow of an oceanarium containing large numbers of *N. melleni* larvae. Despite exposure to high concentrations of the parasite, only a single parasite was found on one lionfish. Our findings thus far suggest that *P. volitans* is highly resistant to infection by *N.melleni*.

P150 **Logan M. Griffith, Terrance J. Smith, Andrew J. Jajack**

An assembly pheromone in the brown dog tick in relation to a natural method of improving control of indoor infestations with the main component, guanine

Department of Biology, Wittenberg University, Springfield, OH

The brown dog tick *Rhipicephalus* sanguineus is an indoor tick that can transmit spotted fever rickettsia to humans and febrile, lameness and anemia associated diseases to dogs and livestock. To determine how this tick recognizes where to pack in walls and cracks where they defecate after feeding, we examined the behavioral responses to tick excreta in short range Petri dish bioassays by female ticks. After making contact with tick excreta, over 70% of ticks stopped crawling and remained motionless and form clusters. Ticks similarly arrested on guanine, but had a diminished response to uric acid. There was no dose-response to guanine, only the presence of guanine was needed to prompt a clustering response. The fastest and most intense clustering occurred under dry (33% RH) rather than moist (93% RH) conditions at 25°C and with *R. sanguineus* excreta but not other tick species. Based on high clustering response by ticks with different legs cut off but not for ticks having their palps removed, receptors for locating the excreta are likely on the palps. Guanine acts as an arrestant, inducing off-host clustering, and this has the highest speed of response in dry, warm comfort standards common in homes and kennels. This tick assembly pheromone functions to retain ticks within human homes and kennels. This leads to infestations of *R. sanguineus* and no other ticks, a species-specific response. We anticipate that pheromone trap baits can be made more effective using guanine to keep ticks on acaricide treated areas.

P151 **Duc Tran, Riccardo Fiorillo**

Helminth parasites of centrarchid fishes (Fm: Centrarchidae) from an urban creek in Gwinnett County, GA.

School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA

We examined the helminth parasites of several centrarchids from a small unnamed creek that runs through a large residential subdivision in Gwinnett Co. GA. The creek is a shallow, sinuous, and heavily silted waterway that receives outflow from a large neighborhood lake and run off from paved surfaces as well as residential lawns. In spring 2012, we collected with hook and line Bluegill (*Lepomis macrochirus)*, Redbreast Sunfish (*L. auritus)*, Green Sunfish (*L. cyanellus*), and Largemouth Bass (*Micropterus salmoides*). All fish were euthanized within 2 hours of capture and stored at -20 °C until necropsy. We examined the gastrointestinal tract, remaining visceral organs and gills for helminth parasites. We report data on species richness and diversity of the helminth community of these hosts and the prevalence and abundance of all helminth recovered.

P152 **Ashley Sholtis, Wayne Rossiter**

The energetic impacts of parasitism in freshwater sunfish (*Lepomis* spp.)

Department of Biology, Waynesburg University, Waynesburg, PA

The most common freshwater fish parasite, *Posthodiplostomum minimum*, is able to infect various members of the *Lepomis* spp., but there is relatively little known regarding its energetic impacts on infected fish. The metacercaria stage of the parasite forms white encystments on the heart and liver of infected fish (which act as 2nd intermediate hosts), and the purpose of this study was to determine if encysted metacercariae compromise host aerobic capacity or metabolism. Eighteen sunfish of varying size and infection intensity were run through an exhaustion trial that simulated a stream current in their natural habitat. The rate of oxygen consumption for each fish was also assessed in separate experiments, as a surrogate for metabolic rate. Fish were then dissected and examined to determine infection intensity. We found a strong and predictable correlation between fish mass and length, and statistical analyses showed that bigger fish exhausted faster than smaller fish. We also found evidence that the number of parasites on the heart and liver affected aerobic performance. However, we found no strong relationship between infection intensity and mass-specific metabolic rate. In general, this study supports the idea that *P. minimum* encystment on the heart and liver might compromise host physiology, which is thought to enhance the likelihood of the parasite being trophically transmitted to the predatory definitive host.

P153 **Harley Davidson, Wayne Rossiter**

Variation in parasite prevalence and intensity related to lake size

Department of Biology, Waynesburg University, Waynesburg, PA

While theory, along with some empirical studies, suggests that parasitism increases with increasing system size or diversity, few studies compare the prevalence or intensity of particular parasites in host populations across a spectrum of system sizes. Here we examine the parasite communities associated with sunfishes (Lepomis ssp.) across a gradient of lake sizes ranging from 5 acres to 6000 acres, all located in eastern Ohio. Specifically, we evaluate the prevalence and intensity of infections by the trematode Posthodiplostomum minimum, which utilizes sunfishes as 2nd intermediate hosts (as an encysted metacercaria). Additionally, infections by both encysting cestodes and cestode sparganum were recorded. Cursory statistics demonstrated that P. minimum intensity was significantly higher in smaller lakes, even when correcting for fish size. Subsequent use of Classification and Regression Tree (CART) analysis, with infection intensity as the response variable, revealed that site (lake) identity was the most powerful predictor. This was supported by a Multivariate Analysis of Variance (MANOVA), where site was the only significant correlate to infection intensity ($p = 0.0004$). We speculate that the increased edge habitat-to-volume ratios seen in smaller systems might increase both the density and contact rates of hosts in this parasite's life cycle, leading to increased infection loads.

P154 **Anthony Starks[1], Muhammad Mughal[1], Mario Giraldo[2], Paula C. Jackson[3]**

Sap flow for select tree species in a forest patch at Kennesaw State University, GA

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The purpose of this research was to test a method to determine sap flow and obtain preliminary data to compare water use in a broadleaf deciduous (*Liquidambar stryaciflua* L.) and an evergreen (*Pinus taeda* L.) tree throughout changes in seasonal climate. Sap flow was measured using the Granier sap flow method (Dynamax Probe 12 system) and weather conditions were monitored with a Dynamax Metpak Pro weather station. The study was located in a forest patch at Kennesaw State University in Kennesaw, Georgia within a prevailing ecological system known as the Southern Piedmont Dry Oak-(Pine) forest. We wanted to observe how sap flow is impacted by specific weather variables such as vapor pressure deficit (VPD) and radiation. Preliminary results suggest VPD plays a significant role in the daily sap flow rates of both tree species. Our early findings also suggest that sap flow was greater

among sweetgum (*Liquidambar stryaciflua*) when compared to the pine (*Pinus taeda*) during the peak seasonal flow (spring and summer).

P155 **Christopher K. Daniel, Sarah Grace Sapp, Mary Castro, Keilin R. Gamboa Salazar, Cathy H. Borer**

Evaluation of calcium sequestration as a mechanism for tolerance of aluminum toxicity in flowering dogwood (*Cornus florida* L.)

Berry College, Mt. Berry, GA

Calcium (Ca) is an essentialnutrient used by plants as a second messenger and for structural support of cellmembranes and walls. Aluminum (Al) can be absorbed by plant roots and accumulatein substantial amounts in the foliage of many trees. Although Al has no knownbeneficial effects, toxic effects are well documented. Plants capable of sequestering substantialamounts of calcium are also able to sequester aluminum, possibly reducing its toxicity (Borer et al. 2004). Flowering dogwoods (*Cornusflorida* L.) retain a large amount of labile calcium, unlike other speciessuch as oaks (*Quercus*), whichchemically sequester most of their foliar calcium (Borer et al. 2013). This may make dogwoods uniquely vulnerable to Al toxicity. In this experiment, we areevaluating foliar Ca sequestration and sensitivity to Al toxicity of floweringdogwood and oak. Seedlings of these species are being manipulated with twolevels of Al. Half the plants are being treated with aluminum levels in thehigh range of southeastern soils. The other half are being given no aluminum.Foliar Ca is being manipulated via artificial acid mist treatments (pH 3 and pH5). Measurements such as plant growth, health characteristics, foliar Ca and Alsequestration, and root to shoot ratios are being compared among treatments.Our goal is to extend our current knowledge of aluminum toxicity and itsrelation to calcium sequestration, providing new insight into plant mineralnutrition and health challenges for the flowering dogwood, which is declininggas a result of the fungal disease dogwood anthracnose.

P156 **Katherine Culatta, Jonathan Horton**

Physiological response of Southern Appalachian rock outcrop plants to cloud immersion

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Cloud immersion may decrease water stress experienced by rock outcrop plants by decreasing the leaf-to-air vapor pressure (VPD) deficit, decreasing transpirational water loss while maintaining carbon gain. Frequent cloud immersion may ameliorate water stress in these shallow-soil outcrop communities, increasing water use efficiency and growth. Current climate change predictions propose that frequency of cloud immersion will decrease, which may adversely affect rock outcrop plant populations. Field data and seeds were collected for three outcrop plants, *Phlox subulata*, *Saxifraga michauxii*, and *Viola hirsutula*. These plants differed in their response to VPD, suggesting different susceptibility to water stress and degree of reliance on cloud immersion for water conservation. For all three species, stomatal conductance decreased with increasing VPD, in attempt to limit water loss. However, transpiration increased significantly with increasing VPD in *V. hirsutula*, increased marginally in *P. subulata*, and did not increase in *S. michauxii*. The resultant decrease in water-use efficiency (carbon gained per water lost) in *V. hirsutula* may indicate greater susceptibility to water stress, and therefore greater reliance on cloud immersion to reduce VPD and conserve water. Photographic monitoring of cloud patterns over 81 days at one rock outcrop site showed cloud immersion during 28.7% of all daylight hours, and at least one hour of cloud immersion on 66.7% of days. Seeds collected from outcrop plants will be grown in microcosms to simulate cloud immersion at current levels, reduced by 50%, and absent to relate cloud immersion directly to gas exchange, water relations, and growth.

P157 **Rachel L. Craven[1], Morgan C. Fonvielle[2], J. Christopher Havran[2]**

Functional trait diversity of *Planchonella sandwicensis* (Sapotaceae), a Hawaiian endemic tree

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Planchonella sandwicensis is a variable plant endemic to the Hawaiian Islands. *Planchonella sandwicensis* has been divided into many different species based on morphological variations, but now is recognized as one species. Some characters like leaf size, used to previously subdivide the species, may be variable across different

ecosystems. No studies have been conducted to evaluate functional trait diversity in the species across its range. Standardized collections of the species were made from 39 trees across Kauai, Oahu, Molokai, Maui and Hawaii in summer 2012. Three fully expanded leaves were collected from one fully exposed branch from each tree. All leaves were scanned to measure leaf area. Two of the three leaves were dried for dry mass determination while additional leaves were preserved for stomatal measurements. Correlations between ecological parameters and functional traits were investigated. A positive correlation was shown between the amount of rainfall and specific leaf area ($p = 0.02434$) as well as stomatal density ($p = 0.03302$). The correlation suggests that the greater the amount of rainfall, the higher the specific leaf area and the greater the stomatal density. Our findings suggest that ecological parameters may explain morphological variation in the species. Future studies may find that additional functional traits may be correlated to environmental variables in *P. sandwicensis*.

P158 **Rachael Elkharash[1], James M LaCour[2], Kim Marie Tolson[1]**

Liver copper levels in Louisiana white-tailed deer

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White-tailed deer, *Odocoileus virginianus*, population management is essential to control the increasing number of herds across the state. In order to ascertain the health of a deer herd, biologists may conduct liver analyses to check for adequate mineral levels. Copper is a necessary mineral required for normal growth and metabolism. Copper deficiency in ruminants has been associated with poor growth weights and coats in calves, low body weights in adults, and low rate of pregnancy in herds. Micronutrient information such as copper levels, will allow biologists to determine areas that are low in copper, and in turn, adjust their management programs accordingly. The livers of 130 Louisiana white-tailed deer were collected from hunter or agency harvested animals between 2009 and 2012. Samples were analyzed to determine liver copper levels and this analysis revealed that 29% (38/130) of the deer were either marginal or deficient in liver copper levels. In the first year, 2009-2010, 63% (15/24) were marginal or deficient. In the second year, 2010-2011, 11% (2/19) were marginal or deficient, and in the third year, 2011-2012, 24% (21/87) were found to be marginal or deficient. Age, sex, and weight of the deer sampled were also recorded. Liver copper levels will be evaluated along with soil mapping data in order to develop a strategic plan for deer management in areas low in copper throughout the state.

P159 **Anastasia M. Woodard[1], Consuelo De Moraes[2], Mark Mescher[2], Travis D. Marsico[1]**

A pricklypear's cry decoded: characterization of plant volatiles released by *Opuntia humifusa* (Cactaceae) in response to native and newly-associated cactus boring moth herbivory (Lepidoptera: Pyralidae).

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Inducible defenses rely upon plant volatiles (PVs) as signaling mechanisms for initiating systemic defense throughout attacked plants and for signaling predators and parasitoids of insect herbivores as an indirect defense. Plant-plant signaling results in faster, more intense responses specifically tailored to threatening herbivores, and synthetic PVs are under investigation as environmentally-friendly pest management tools. *Cactoblastis cactorum* is one of many invasive pests for which new tools are needed. Recent findings indicate that defense signaling may be a viable method for controlling *C. cactorum* because it stimulates North American *Opuntia* to defend against *C. cactorum* the same way that these *Opuntia* spp.defend against native, co-evolved moth herbivores. In an effort to identify a chemical blend that could potentially mitigate the negative effects of *C. cactorum*, dynamic head space sampling with GC-FID and GC-MS analyses were used to characterize PVs released by *O. humifusa* in response to native and newly associated cactus boring moth herbivory. Significantly more compounds were emitted from plants infested with *M. prodenialis*, a co-evolved cactophagous moth ($F_{2,21}=6.23$, $P=0.008$). Eight compounds were emitted in significantly greater quantities from plants infested with *M. prodenialis* and six compounds were emitted in significantly greater quantities from defending plants regardless of treatment. Unlike other known plant-plant signals, the compounds of

interest, likely involved in the transference of defenses, are alkanes, fatty acid esters, and alkylbenzenes. These findings support that *O. humifusa* plants are signaling each other to defend via PVs and indicate that signaling PVs may be variable among plant lineages.

P160 **Megan Cordle, Mark Meade, Lori Tolley-Jordan**

Physiological status of the stream minnow, *Campostoma oligolepis,* inhabiting the historically impacted Snow creek, Calhoun County, Alabama

Department of Biology, Jacksonville State University, Jacksonville, AL

Snow creek is a perennial tributary of Choccolocco creek, Oxford, Alabama. In the 1970s, Snow creek was polluted by industrial heavy metals and PCBs. In those years, high concentrations of contaminants resulted in the death and/or migration of many aquatic organisms from the creek. Cleanup efforts began in the 1980s and the water conditions in the creek have improved. Nonetheless, mercury (Hg) and PCBs can still be measured in stream soils and in fish tissues. A diversity of aquatic organisms currently inhabit the creek, including many sensitive species. Oxygen consumption rates were determined for a common minnow species, *Campostoma oligolepis*, inhabiting Snow creek and inhabiting other un-impacted regional streams. Our goal was to determine if fish inhabiting Snow creek had altered metabolic rates, indicating potential stress. Fish examined from un-impacted streams included those inhabiting Shoal creek, a relatively pristine site in the Talladega National Forest, AL, and Mill creek, a relatively un-impacted site in Jacksonville, AL. Weight specific metabolic rates for fish inhabiting Snow, Shoal, and Mill creeks, respectively, range from 200-400 $mgO_2/kg*hr$. No significant differences were observed in oxygen consumption rates. Gill malformations are common in fish exposed to mercury and PCBs. Potential gill abnormalities were examined using SEM. Gill morphology of fish from Snow creek did not appear damaged in comparison to fish from other, un-impacted sites. We suggest that, although contaminants may linger, the physiological status of fish suggests the effects of contaminants currently may be minimal.

P161 **Jennifer Pauldurai**

The effects of selected drugs on the memory recall of sleep deprived mice

Biology and Allied Health Department, Southern Adventist University, Collegedale, TN

Memory in English white mice (*Mus musculus*) is influenced by the neurotransmission altering effects of the commonly used drugs: caffeine, ephedrine and ethanol. In humans, these drugs are often used with the belief that they improve mental capability while sleep deprived. Mice have been shown to exhibit similar cognitive changes when under the influence of both sleep deprivation and administration of these drugs. A sample of male English white mice was separated into three experimental groups (each group receiving a different drug) and one control group. After intraperitoneal drug injections and sleep deprivation, behavioral maze-testing demonstrated that the mice improved their overall time efficiency in maze completion with the ephedrine-fatigue combination. The caffeine-fatigue and ethanol-fatigue combinations did not have statistically significant changes in time efficiency. However, observational changes in gait, decision making, and accuracy of maze-running were evidenced in all three combinations. This suggests that sleep deprivation and selected drug use can improve memory recall of English white mice on maze testing, but with unwanted behavioral side effects.

P162 **H. Dawn Wilkins[1], Bradley A. Ray[2], Sue G. Byrd[3]**

Impact of avitourism on the conservation ethic and culture of women in the Ecuadorian Cloudforest

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Faculty from the University of Tennessee at Martin visited Ecuador to examine issues facing women, examining how ecotourism in Ecuador affects women of the region. Ecotourism, as defined by the International Ecotourism Society, is based on responsible travel that promotes conservation and improvement of local areas and people. Avitourism, the fastest growing form of ecotourism, is a type of ecotourism aimed at birdwatchers. We visited the Milpe Bird Sanctuary, operated by the Mindo

Cloudforest Foundation (MCF). MCF began in response to oil pipeline development that threatens the ecosystem integrity. The foundation continued to operate after a partially successful lobbying effort to move the pipeline with a goal to preserve and restore habitat for birds and promote avitourism as an alternate means of income for people in the area. Brian Krohnke, co-founder and current president of the MCF, and Karen and Gary Schlitz, Americans who have settled in the area and spend their time teaching women to make crafts that are sold to tourists were interviewed. Insight was gained into the lifestyle of women in the area and the importance of generating income for these women's families. We discussed how the craft group helps to build a sense of community for the women who participate in a culture where women are generally isolated in the home. Through these interviews and by touring the facilities and sanctuary, much was learned about planned expansions and renovations to enhance ecotourism efforts, as well as possible future involvement by University faculty and students.

P163 **David Tryon, Ben Thornton**

Modeling yeast population growth in the presence of density-dependent and density-independent limiting factors

Department of Biology and Allied Health, Southern Adventist University, Collegedale, TN

CANCELLED

P164 **Roger Jackson[1], Holly Huddleston[2]**

Lessons learned about student engagement in a linked cohort/learning community biology course

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Student engagement in the biological classroom is critical to student comprehension and learning of the course material. As a relatively new full-time instructor of General Biology for non-majors at Belmont University, a private liberal arts university, my experience thus far has been that students not in an allied health major or with a strong experience in Biology in high school readily disengage in the classroom and quickly loose interest in learning about the many ways biology impacts their everyday life. Herein I highlight techniques and lessons that I have learned thus far that have helped to re-engage my students in my classroom. Herein, I focus on the cross-disciplinary educational advantages of teaching a linked cohort of non-major students in paired classes—BIO-1010 *General Biology I* PED-1600 *Health & Fitness Concepts*—in contrast to my non-linked *General Biology* classes. The purpose of the *General Biology/ Health & Fitness Concepts* link or Learning Community Course (LCC) pairing is to illustrate both the unique and complementary ways in which the human body is studied in the fields of Biology and in Health and Physical Fitness. In *General Biology*, the students survey the fundamental basic concepts of the field of Biology, with particular emphasis on relating cellular biology and genetics to human anatomy, physiology, and diseases. In *Health & Fitness Concepts*, the students learn about health, nutrition, and different styles of physical fitness programs as a means to maintain life-long wellness and prevention of disease.

P165 **Nick Ragsdale**

Teaching traditional science courses with non-traditional resources

Department of Biology, Belmont University, Nashville, TN

Enrolling in a science course is often accompanied with the purchase of a large, bulky textbook with an even bulkier price tag. Students gain access to online materials, vibrant artwork and various study aids when these textbooks are purchased. However, it is proposed that students can acquire as much if not more information utilizing non-traditional science books accompanied by free materials from the internet. One can imagine the possibilities of these non-traditional resources by exploring the writings of James Kakalios, Paul Zehr and Takemura & Sakura. The utilization of some of these materials in an Honors Analytics course will be presented.

P166 **Valarie A. Burnett**

Evolution of a scientific literature research presentation from the classroom to a college-wide poster session.

Department of Science and Mathematics, Newberry College, Newberry, SC

Students at small College and University campuses often have little to no opportunity to do undergraduate primary research. However, most schools provide student access to multimedia and library and/or online resources that would enable students to research current scientific literature and present it to a group of peers. It is important for students to gain this experience, especially if they are planning to do further studies in a graduate or professional program. For the past seven years, I have required my biology and chemistry students to research a broad-themed topic, individually or as a group, and present their literature research in PowerPoint or Poster format. This began as an in-class assignment with an audience primarily composed of classmates, but it has evolved over the years to include an annual Earth Day Poster Session that is open to all science students and widely attended by students, staff, and faculty members. Most participants and attendees describe this event as a positive learning experience, and many report that the process has inspired them to do additional research into other areas of interest. This activity is also valuable preparation for developing research questions and primary research projects. Future plans for the Poster Session include inviting college mathematics students and local high school math and science students to participate in the event in an effort to promote collaboration between disciplines and establish a productive interaction between college professors and high school teachers, as well as provide high school students with insight into the college experience.

P167 **David G. Argent, William G. Kimmel**

Potential effects of thermal stress on brook trout (*Salvelinus fontinalis*) populations on Laurel Hill, Pennsylvania

Department of Biological and Environmental Sciences California University of Pennsylvania, California, PA

Acid deposition, habitat alteration, exotic species, and, more recently, climate change, have been identified as the primary factors threatening brook trout (*Salvelinus fontinalis*) populations inhabiting headwater streams. To evaluate the current viability of extant populations on Laurel Hill in southwestern Pennsylvania, we re-surveyed 20 streams previously assessed by Sharpe et al. (1987) in 1983. These streams were historically described as having healthy brook trout populations and represent one of the southernmost distributions within Pennsylvania. We installed temperature data loggers in three streams and their respective riparian borders on the northwest and southeast facing slopes respectively, and measured selected water quality parameters. Fish populations were sampled in the manner of Sharpe et al. (1987) along a 100 m reach of each stream by back-pack electrofishing; all fish collected were identified, measured, enumerated, and released in the field. Native brook trout were present in all sampled streams with 13 of the 20 harboring five year classes (Age 0 to IV+). Other species captured included blacknose (*Rhynichthys atratulus*) and longnose dace (*Rhynichthys cataractae*), white sucker (*Catostomus commersoni*), rainbow trout (*Onchorynchus mykiss*), brown trout (*Salmo trutta*), and mottled sculpin (*Cottus bairdi*). Values of specific conductance and total alkalinity were similar to historical data, while pH values were elevated. When compared with the data of Sharpe et al. (1987), we documented an overall 65% decline in the abundance of brook trout across all streams. Age 0 and Age I+ fish were the most severely impacted having experienced declines of 65% and 75%, respectively. Moreover, temperature sensor data revealed streams exhibited temperatures exceeding the upper thermal threshold for brook trout stress (>18C) during several periods in late summer. Thermal isolation in combination with other anthropogenic factors may be pushing these fragile populations toward extirpation.

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FIFTY-SIXTH ANNUAL MEETING

BETA BETA BETA
SOUTHEASTERN REGION

DISTRICTS 1 and 2

MEETING JOINTLY WITH THE
SEVENTY-FOURTH ANNUAL MEETING OF THE
ASSOCIATION OF SOUTHEASTERN
BIOLOGISTS

co-hosted by
Marshall University

Host Chapter: Mu Epsilon, Troy University

April 10-13, 2013
CHARLESTON, West Virginia

District I Brooks Award Session

Appelboom, Brittany & Holly Boettger-Tong. Sigma Lambda, Wesleyan College. Influence of vitamin A derivatives on prostate smooth muscle cell proliferation.

The human prostate is a small walnut sized gland that lies at the base of the bladder. It is extremely important for several functions including bladder control and production of seminal fluid. The prostate continuously grows as the male ages; this growth contributes to the process of benign prostatic hyperplasia, BPH, in men of advanced age. BPH is due, in part, to an overgrowth of the smooth muscle cells in the transition zone. Although Vitamin A has been tested as a treatment for prostate cancer, which primarily affects the prostatic epithelium, little is known about the role that Vitamin A, or its most potent metabolite, all-trans retinoic acid (ATRA) plays in prostate smooth muscle cell biology. Therefore, primary cultures of prostate smooth muscle cells were treated with three different doses, 10^-7M, 10^-9M and 10^-11M, of ATRA to determine the effect, if any, of this drug on cell proliferation. The data indicate a significant, dose-dependent decrease in the number of cells after a 7-day treatment. Qualitative differences in cell adhesiveness to the culture plate were also observed as a function of retinoid dosage. The data suggest that further examination of the role that ATRA plays in prostate smooth muscle cell biology is warranted.

Blankenship, Veronica. Eta Iota, Emory and Henry College. Potential Regulators of the Gibberellin Biosynthesis Pathway in Arabidopsis thaliana.

Gibberellins (GAs) are a group of regulators that control plant growth in terms of seed germination, stem elongation, flowering, and fruit development. The pathway in charge of producing GAs is called the GA biosynthesis pathway. Control of this pathway through mutation of its regulatory genes may produce crops with agricultural advantages. Our goal is to identify and characterize the regulatory genes of the GA biosynthesis pathway. Many candidate regulatory genes have already been identified. Currently, *HDG11* appears to be among the most promising candidates. Through the use of various characterization techniques, such as microarray, GUS staining, and qPCR, we have studied *HDG11* mutants in order to determine its role within the GA biosynthesis pathway. Due to about an 80% shared amino acid sequence with *HDG12*, we are also using similar techniques to determine its role within the pathway. Microarray analyses have shown several genes to be regulated by both *HDG11* and *HDG12*.

*Sloan, Tyler J. Sigma Psi, Florida Institute of Technology. Invariant feeding kinematics of two trophically distinct nonnative Florida fishes across environmental temperature regimes.

In the light of the predicted rise in environmental temperature wrought by global-climate change, it is imperative to investigate how organisms respond to environmental temperature fluctuations. It is particularly important to understand how climate-change-induced fluctuation in environmental temperature mediates the process of invasion by nonnative species. This study was designed to examine how feeding performance in two Florida nonnative fishes, *Belonesox belizanus* and *Cichlasoma urophthalmus*, responds to different environmental temperature regimes. Individuals of each species, collected from Florida populations, were filmed using high-speed video at three different water temperatures while feeding on live *Gambusia* sp. Two-Way Repeated Measures Multivariate Analysis of Covariance revealed that (1) at a given temperature, excursion and timing variables differed between species, (2) the kinematics of prey-capture did not vary across temperatures in both species, and (3) the Q_{10} values for muscle-dependent feeding performance metrics are less than the predicted physiological quotient, Q_{10} = 2.0

for the rate of contraction of skeletal muscles. This interspecific comparison raises the alarming notion that the feeding performance of nonnative fishes is resilient to environmental-temperature change, thus, making their spread more prevalent in the light of the global-warming scenario.

*Received First Place Distinction for Research

Pass, Thomas J., Robert C. Fuller, Brad Bailey & Melba D. Horton. Psi Rho, University of North Georgia. Stream Water Quality and the Surfacing Frequency of Red-eared Slider Turtles (Trachemys scripta elegans).

Polluted water has been shown to cause physiological distress in animals, including aquatic turtles that must surface to exchange gases. This response could therefore serve as a bio-indicator for environmental stress. The purpose of this study is to assess the frequency of turtle surfacing when held in water collected from eleven sites around Lake Lanier. Each water collection site was monitored for certain environmental parameters, such as temperature, pH, biological oxygen demand (BOD), chemical oxygen demand (COD), hardness, fecal coliform counts, and turbidity. Three turtles were tagged and placed in one aquarium that served as the experimental set-up (stream water) and three in a separate aquarium to serve as the control (tap water). The breathing frequency of the turtles was recorded using digital videography for one hour and viewed for analysis. Results of the t-test showed that the overall breathing frequencies between the experimental and control set-ups were significantly different from one another. Analysis of variance also revealed that environmental parameters between and among sites vary significantly ($p<0.05$). Using Pearson correlation and multiple regression analysis, it was observed that the water's COD and BOD significantly influenced the breathing frequency of the turtles ($F=7.5$, $p=0.001$).

Frazier, James. Sigma Phi, Guilford College. 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 shows 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°C 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.

Fletcher, Rochelle, and Holly Boettger-Tong. Sigma Lambda, Wesleyan College. The Effect of Lysophosphatidic Acid (LPA) on uterine smooth muscle proliferation.

Lysophosphatidic Acid (LPA) is a simple bioactive lipid which has only recently been appreciated for its diverse physiological effects. LPA is produced by a variety of cells and is also found in many biological fluids. This molecule exerts its functions through G-protein coupled receptors which produce a cascade of reactions via secondary messengers such

as adenylate cyclase and phospholipase C. These functions include cell proliferation, smooth muscle contraction, inhibition of connexin 43-based cell communication and tumor cell invasion. LPA has been linked to uterine endometrial receptivity and embryo spacing, but little is known about its influence on the myometrium. To determine if LPA influences uterine smooth muscle cell proliferation, cultured primary uterine smooth muscle cells were treated with a broad range of LPA concentrations for a period of up to seven days. The data indicate that LPA has a proliferative effect on uterine smooth muscle cells, with the highest influence in the 10μM range. Our results also indicate that sustained exposure to high levels of LPA is tolerated well by primary cultures of myometrial cells.

Glass, Andrew. Sigma Phi, 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 90-100% cover, two plots of 40-50% 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 χ^2 tests.

Meloro, Beth A and Dinene L. Crater. Phi Zeta, High Point University. Effectiveness of Fruit-Derived Compounds in Eliminating MRSA.

Methicillin-resistant *Staphylococcus aureus* (MRSA) results from an individual becoming infected with *Staphylococcus aureus* that cannot be killed by first line antibiotics. MRSA has evolved to become resistant to multiple beta-lactam antibiotics including methicillin, amoxicillin, penicillin, oxacillin, and others. Individuals infected with MRSA are now being treated with other antibiotics such as vancomycin and teicoplanin, but this provides MRSA with more opportunities to develop resistance. Previous studies by our laboratory identified several students on the High Point University campus as natural carriers of MRSA. The purpose of this study is to evaluate the effectiveness of natural compounds derived from various fruits in eliminating MRSA. Preliminary data has shown that *S. aureus* is sensitive to lime and lemon juices. Various fruit juices will be tested, and the pH and other characteristics of each juice will be analyzed in order to categorize which test products are most effective in reducing the growth of the bacteria. Test products will be analyzed for effectiveness on *Staphylococcus aureus, Staphylococcus epidermidis, Staphylococcus saprophyticus* and ultimately MRSA. The results of each test will determine the amount of inhibition of several *Staphylococcus* species for each fruit juice. Additional fruit products will be tested and analyzed in hoping to find a natural compound that can ultimately be used in future treatment options and preventative measures for decreasing the prevalence of MRSA. These natural compounds, with more research, can provide an alternative to antibiotic use and produce new disinfectants, therefore decreasing the degree of antibiotic resistance.

District II Brooks Award Session

Foye, Liberty. Mu Theta, Belmont University. Investigation of CED-1 Receptor in Gram-positive Bacterial Pathogen Recognition in Caenorhabditis elegans.

The CED-1 receptor is characterized as an apoptotic receptor in the organism *C. elegans*. It has also been implicated in the protection against gram-negative bacteria and fungal infection. We sought to determine whether this CED-1 receptor was necessary in an immunological response to a pathogenic gram-postive bacterium. We exposeded loss-of-function (CB3203), frameshift (MT1440), and wild-type (N2) worms (three days old) to *Staphylococcus aureus*. We treated worms with OP-50 as well. Test plates were checked 24 hours after infection to determine survival rates. A two-way ANOVA showed that there was no significant difference between survival rates of CB3203, MT1440, and N2 strains of *C. elegans*. It appears that the CED-1 receptor is not necessary for an immunological response to gram-positive bacteria; however, further studies using other types of gram-positive bacteria should be conducted.

Futrell, Robert, Mu Omicron, Columbus State University. Barcoding the Mississippi and Alabama Black Belt Prairie flora using the rbcL+matK gene regions.

Species identification is an often difficult, yet vitally important process for the study of biological systems. DNA barcoding is a recent molecular tool that can be used for plants to identify them to the species level. The recent agreement to use the rbcL-matK chloroplast gene regions as the standard DNA barcode for plants has resulted in numerous efforts to barcode local floras and establish plant DNA barcode databases for future ecological applications. We examined how effective these regions were for a complex flora with many polytypic genera. This study tested 190 samples from the threatened Black Belt prairies of Mississippi and Alabama. Both regions, rbcL and matK, were recovered in 92.6% of the samples. The identification success was lower than comparable studies at 56.4%. Monotypic genera in this study had a higher proportion of resolution (100%) than polytypic genera (66.7%). The study demonstrated a strong negative correlation between species per genera and resolution (Spearman's rho = -0.817, $P<0.001$). These results suggest that rbcL and matK have lower discriminatory rates in more complex floras.

Hawkins, Bellamy and J.H. Niedzwiecki, Mu Theta, Belmont University. Looking for Evidence of Behavioral Syndromes Using the Predator-Prey Interaction Between Pleurocera Snails and Orconectes Crayfish.

A behavioral syndrome is a correlation in behavior between contexts within an individual, such correlations, if caused by the same underlying mechanism, may prevent optimal behavior in conflicting situations. This has been phenomenon demonstrated in organisms that face different optima for traits such as boldness or activity across situations. We looked for correlations as evidence for syndromes in the activity of snails in the presence and absence of predation cues. We hypothesized that low predation risk environments would favor highly activity and high predation risk environments would favor low activity. Using three different water treatments, individual snail's' movements were measured, using ImageJ, as total distance moved. A significant predator effect, and a significant positive correlation would be consistent with a behavioral syndrome. Comparing control conditions to alarm cue, we found a significant treatment effect, but not a significant correlation, suggesting that snail did alter behavior to this cue, but there was not a significant correlation, indicating that all snails were able to slow to a similar level, and

therefore no evidence of a syndrome. It may be that the conflicting selection pressures in snails is not severe or activity in these two conditions can be decoupled in snails.

Silvis, Scott D., Mu Omicron, Mu Omicron, Columbus State University. Documenting the biodiversity of Fall Line Sandhill wetland flora using Plant DNA Barcodes.

The Sandhill flora of Southwest Georgia holds a vast number of rare and endangered plant species. For this reason many organizations are attempting to preserve and restore these fragile areas. DNA barcode libraries, while still relatively new, are fast becoming a necessity in such efforts, especially in floras where taxonomic complexity confounds identification of rare taxa based on morphology alone. Currently a number of wteland habitats associated with the Sandhill flora near Fort Benning, Ga are of conservation concern, although genetic confirmation of previously collected samples has not been accomplished. Here, I conducted DNA barcode sequencing using the *rbcL* gene region of chloroplast genome. Sequences were based-called and edited in Condon Code Aligner and alignments of contiguous sequences were visualized in Geneious Pro. Preliminary results based on all-to-all BLASTn analysis indicate that species resolution was 78% for this relatively diverse flora ~ 55% of the genera were monotypic. This study not only evaluates the effectiveness of using plant DNA barcodes in this locally, rare habitat but also contributes to the development of a DNA sequence library that will be of immediate use to conservation biologists working directly with this rare flora.

Steen, Janet and J.H. Niedzwiecki, Mu Theta, Belmont University. Using Microsatellites to Estimate Population Genetic Parameters in the Spotted Salamander, Ambystoma maculatum.

Population genetics can help explain parameters such as migration, selection or genetic drift. In light of recent amphibian decline, population genetics using microsatellite markers have provided insight of the population dynamics of amphibian species. In this study two unlinked microsatellite regions of spotted salamanders, *Ambystoma maculatum*, from two ponds close to each other to estimate population genetic parameters, to determine if they represented one or distinct populations. We isolated, extracted, and quantified DNA from *A. maculatum* larvae and amplified microsatellites using polymerase chain reaction (PCR) and recorded results using gel electrophoresis. We created a standard curve to assign alleles and analyzed the data using GenAlEx. Calculated allele frequency values showed primer Ama61 had a higher variation in alleles than primer AmaA. Also, heterozygosity calculations demonstrated a lower number of heterozygotes in one population. Although the Analysis of Molecular Variance (AMOVA) test showed a significant difference in populations, the sample size was not large enough to truly indicate a difference. This experiment demonstrates the feasibility of these primers and further expansion of this study, with a larger sample size and additional primers, could yield more definitive results.

Leflore, Taylor[1], Kristen Wendt[2], and Terry Hill[2], Omicron Pi, Tougaloo College[1], Rhodes College[2]. Southern blot analysis of Aspergillus nidulans mutants.

The long-term goal of research in the Hill laboratory is to contribute to our understanding of fungal cell development - especially the areas of tip growth and septation. Our principal current projects focus on the roles played by Protein Kinase C (PKC) and cytoskeletal proteins during polarized cell growth in the filamentous fungus *Aspergillus nidulans*. One aspect of the work involved replacement of septation genes by the nutritional marker gene RiboB, and another involved replacement of the native promoters of septation genes by the regulatable AlcA promoter. In the latter strategy, the AlcA promote r is accompanied

by the PyrG selective marker. The current project was focused on developing Southern blotting techniques that can be used to detect the presence of RiboB and PyrG selective markers in successfully transformed strains. Probes were designed and labeled and a convenient method for isolation of genomic DNA from transformed fungi was developed along with the refinement of methods for carrying out DNA digestion and hybridization to detect the selective markers. Using these techniques, we demonstrated the successful modification of three septation genes.

Martha Newell, Mu Omicron, Columbus State University. HPLC analysis of synephrine content in bitter orange dietary supplements.

Many Americans are currently taking, or have taken, non-prescription dietary supplements. These supplements claim to help prevent or relieve any number of ailments, but are not regulated by any governing body. One common use of dietary supplements is to aid in weight loss. Synephrine, the most abundant active component in bitter orange (*Citrus aurantium* L.) extract, became a regular ingredient in weight loss supplements after the 2004 ephedra ban. I am using reverse phase high performance liquid chromatography to determine the synephrine content of four dietary supplements and comparing my quantified concentrations with those reported on the supplement labels. Two of the supplements I am analyzing claim to be >98% pure synephrine, another reports 6% synephrine, and the last does not report synephrine content. To improve the precision of my quantitative analysis of synephrine content I am using 4-(dimethylamino)pyridine as my internal standard and all samples are being run in duplicate with ten replicates per supplement. Data will be analyzed using t-tests to compare my quantified synephrine content with the reported percentage to determine if the supplements are accurately labeled. I will also use one-way analysis of variance to compare synephrine content across supplements.

*Pearson, Mandy and Lori Tolley-Jordan. Mu Phi, Jacksonville State University. The effects of insect exclusion and animal size on temperature during four stages of decomposition.

In September 2012, we tested how insect barriers used on two sizes of rodents affected attraction of adult insects and larva during four stages of decomposition. Eight individuals of *Mus musculus* (17g-22g) and eight individuals of *Rattus norvegicus* (160g-220g), were randomly assigned to either insect exclusion or control with 1000g of pre-mixed soil. Insect exclusion containers were then covered with a spun-woven cotton mesh cover. For each size class of rodents, a control and exclusion container were placed into a stainless steel live animal trap (n=8) that was randomly assigned to one of the four decomposition stages. In a nearby field, each trap was buried with the rats flush with the ground surface in plots about 6 m apart. Upon reaching a set decomposition stage, each specimen was removed and frozen for further processing. Preliminary results showed that rodent size had little influence on temperature. However, regardless of size, the exclusion of insects significantly slowed decomposition in each of the four stages similarly for both mice and rats. These results suggest that insect access to carrion significantly facilitates the process of decomposition in terrestrial animals which is due in part to changes in temperature.

*Received First Place Distinction for Research

Graves, Courtney M. & Gregory R. Barth. Mu Iota, Northern Kentucky University. A Decade of Ichthyologic Demography: Meta-analysis of twelve years of biotic integrity analysis.

Gunpowder Creek at Camp Ernst in Boone County, Kentucky has a history of pollution and ethylene-glycol runoff from the Covington International Airport and other anthropogenic disturbances. In Pendleton County, a natural stream, Grassy Creek, has been free of major industrial pollution. Over the past twelve years, the Northern Kentucky University Vertebrate Zoology classes have sampled both Grassy Creek and Gunpowder Creek to collect data on the number of fish species located at each stream. A backpack electrofisher, kick seine, and pool seine were used by the classes at each location every other year since August of 2000. We have compiled this data to analyze the effects of the pollution over time with a Kentucky Index of Biotic Integrity (KIBI) analysis. We also compared the number of particular fish present at each site over time to see the changes in environmentally sensitive species present. Lastly, we demonstrated the effectiveness of various fishing techniques in response to the current debate over the quality of citizen scientist data in real world scientific analyses. Our study is geared toward the reproducibility of data from citizen scientists, as well as identifying possible long term results of ethylene-glycol exposure and other pollution on neighboring streams.

District I and II Combined Brooks Award Session

Zheng, Chenkang. Sigma Phi, Guilford College. 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 thionucloside is 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.

Adhikari, Pramisha & Wanda T. Schroeder. Sigma Lambda, Wesleyan College. The effect of exogenous estrogen on the expression of ERα in immature mouse vagina.

Studies have shown that endogenous estrogen has a major effect on the morphology of vaginal and uterine tissues *in vivo.* Although the molecular mechanisms leading to morphological changes are not completely understood, changes in estrogen-responsive tissues are associated with binding of estrogen to estrogen receptors with subsequent changes in gene expression. Two different receptors, ERα and ERβ, are expressed in rat uterus and vagina. Effects of estrogen on the expression of ERs have been studied in mature rat uterine and vaginal tissues; effect s have not been analyzed in these tissues in immature mice. In this study, the effect of exogenous estrogen on the expression of ERα in vaginal tissues of immature mice was analyzed. Tissues from immature mice (19-21 days old) sacrificed at 0, 3, 6, 18, 24 and 48 hours post-estradiol or vehicle injection, were

sectioned and analyzed for expression of ERα with a rabbit polyclonal anti-ERα IgG and FITC-conjugated goat anti-rabbit secondary antibody. Results indicated that ERα was expressed in vaginal tissue in sexually immature mice as early as 13 days of age. The results of this study will add to the body of knowledge pertaining to the mechanism of estrogen related changes in reproductive tissues.

Bartanus, Justin and Chin-Fu Chen. Sigma Gamma, Erskine College. Analysis of Methylation States of Relevant Genes for Development of an Epigenetic Screen for Autism.

Autism is a neurological disorder resulting from a combination of genetic and epigenetic factors. Correlation studies involving maternal vitamin D levels and the incidence of Autism in children and the prevalence of sleep problems in patients suggest that the vitamin D and circadian rhythm pathways play a role in the disease. The goal of the project was to investigate methylation patterns for specific genes within the vitamin D and the circadian rhythm pathways to lay the foundations for the development of a complete epigenetic screen for the disorder. The methylation states of various genes potentially related to Autism were analyzed in 39 people (20 patients, 19 controls). Methylation-Specific PCR was used to determine the degree of methylation and these results were then analyzed quantitatively to explore any significant differences. Of these genes, five (*Per1, Per2, CRY2, NPAS2*, and *DPYD*) differed in methylation between patients and controls by 100%, 75%, 250%, 28%, and 23.8% respectively. These findings lay a foundation for an epigenetic screen for Autism and from this information, treatments can be developed and preventative measures can be taken to help reduce the high rates of Autism.

Ghulam Jan, Lida & Darlene Panvini. Mu Theta, Belmont University. Biodiversity of Macroinvertebrates in Closed Canopy Riffles and Pools in the Little Harpeth River, Nashville, Tennessee.

The biodiversity of stream macroinvertebrates can be affected by the chemical and physical factors of pools and riffles. The presence of tree canopy cover can impact the physiochemical properties of streams by influencing stream temperature, erosion, light, and overall water quality. To examine the effect of tree canopy cover on streams, the occurrence of macroinvertebrates was determined in the Little Harpeth River, Nashville, TN using a rock-picking technique on rocks in riffles and dip net sweeps in pools in closed and open-canopied stream reaches. Diversity was determined using Simpson's, Shannon Weiner, and Equitability Indices. These were correlated with dissolved oxygen, pH, total dissolved solids, and temperature. Macroinvertebrate diversity did not differ between closed riffles and pools or between closed and open-canopied sites. While stream temperatures were lower in closed sites, this did not affect macroinvertebrate diversity. Shannon diversity tended to increase as dissolved oxygen increased in closed riffles. No correlation was found between overall water quality and macroinvertebrate diversity. In general, macroinvertebrate occurrence did not vary with the presence of tree canopy cover.

Ghulam Jan, Emma & Darlene Panvini. Mu Theta, Belmont University. Comparison of Stomatal Density and Photosynthesis Rates in Exotic and Native Vines in Middle Tennessee.

Exotic vines are prevalent throughout natural areas in Middle Tennessee and a primary threat to native biodiversity, resulting in ecological and economic consequences.

Examining the biophysical traits that enable exotic species to function as invaders can lead to understanding their competitive success. Leaf traits of two exotic vines (*Euonymus fortunei* and *Lonicera japonica*) and two native vines (*Parthenocissus quinoquefolia* and *Smilax rotundifolia*) were compared to determine the relationship between photosynthesis and stomatal density. Photosynthetic rates in relation to varying internal leaf CO_2 concentrations were measured in the field with a LI-6400XT. Stomatal density was determined using abaxial leaf epidermal impressions. Exotic vines had significantly higher stomatal density than native vines; however, their photosynthesis did not differ from the natives. Comparing the two exotics, *E. fortunei* had similar mean photosynthesis rates as *L. japonica* but a lower mean stomatal density. Comparing the two natives, *P. quinoquefolia* and *S. rotundifolia* both had similar mean photosynthesis rates and stomatal density. In general, the relationship between stomatal density and photosynthetic rates was not correlated for any species, suggesting that other factors may have a greater impact on photosynthesis.

Nneamaka Ezekwe. Omicron Pi, Tougaloo College. Genetic analysis of larval broods to assess paternity in speckled rockfish, sebastes ovalis.

Sebastes is a genus of marine fish in the family *Sebastidae*, commonly known as rockfish. The speckled rockfish is moderately important to the southern California commercial fishery, and as a shallow water inhabiting fish is important to the coastal ocean's ecosystem. To continue to sustain rockfish populations, one has to better understand the mating behavior of the rockfish which has the potential to influence the genetic diversity of a given population. Samples of *Sebastes ovalis*, a speckled rockfish commonly found along the California coast of the Pacific Ocean were collected from two locations off the California coast. Eleven broods of larvae, each from a different mother, were examined for the frequency of multiple matings with a genetic analysis of paternity. Eight microsatellite markers were used to test the frequency of multiple paternity. The *Colony2* software was able to determine paternity, using sibship reconstruction of a brood of larvae from known mother alleles and unknown father alleles. Analysis showed multiple paternity from broods within northern and southern California. The results indicate that there is multiple paternity within the rockfish species *Sebastes ovali; however, t*here were no visible regional trends or trends in relative contribution.

*Austin, Anna, Wes Tindell, Natalie Johnson, Megan Gibson, Marsena Morgan, Malcolm Harris, Christi Magrath, and Teresa Moore. Mu Epsilon, Troy University. Filamentation in yeast strains treated with antibiotics.

Previous analysis of water samples (from influent, effluent, upstream, and downstream locations near the Troy Wastewater Treatment Plant in Troy, Alabama) identified yeast deletion strains (Saccharomyces Genome Deletion Project) that displayed differential morphologies and growth phenotypes on the varying water sources. In that Saccharomyces strains with sensitivity to stimuli by chemicals and drugs (according to gene ontology analyses) displayed morphological differences during growth analysis on media prepared with various environmental water samples, analysis of the identified environmentally-sensitive strains was initiated utilizing exposure to butanol (filamentation inducer) and drugs as a model. The current project examines if the filamentation patterns of yeast can be altered by addition of drugs (primarily antibiotics) to growth media. Identifying the effects of different environmental water samples and drug response in initiating filamentous growth in a yeast deletion strain will allow determination of conditions that may allow antibiotics/drugs to alter filamentous activity.

*Received First Place Distinction for Research

Yang, Heekyung. Mu Chi, Midway College. Prevalence of Enterococcus species and Vancomycin Resistant Enterococcus in public restrooms in central Kentucky.

Vancomycin resistance *Enterococcus* species was isolated from 4 of 98 specimens (4.08%) of the samples collected in public restrooms in central Kentucky. Of the VRE positive samples, *Enterococcus fecalis* accounted for 100%. All four samples of VRE were found in hospital visitors' restroom that was also used by health care providers. The role of surface contamination in the transmission of *Enterococcus* species was the main focus in this research. This study measured the percentages of hotspots and public restrooms that were contaminated with *Enterococcus* species. Each of the collection locations was characterized and identified with a matching specimen. The specimens were documented based on such criteria: hygienic state, size, location, and male, female or both users. Restroom population based on gender showed that unisex restrooms had the higher positive number (50%) of *Enterococcus* species than male and female restrooms. There were 4 different areas in the restrooms where *Enterococcus* species were found; surface of door exiting each restroom, lock on the door, soap dispenser and feminine napkin dispenser.

Seilhamer Robert. Mu Iota, Northern Kentucky University. Population dynamics of rusty crayfish Orconectes rusticus in Northern Kentucky streams.

Much ecological attention has focused on rusty crayfish *Orconectes rusticus* as an invasive species in a several states from Wisconsin to New York and into southern Canada. I have studied the population dynamics of rusty crayfish in its native habitats in Northern Kentucky for the past two years. I used fishery stock assessment methods to estimate growth, maximum body size, natural mortality, and recruitment. I then used these parameters in a virtual population analysis (VPA). Modal progression analysis of catch length frequency suggested that the maximum length of rusty crayfish is around 45 mm carapace length (CL) for three year-olds. Young-of-the-year may hatch as early as February and become free juveniles by May. The VPA on 2 different types of stream habitat suggested that populations in deeper streams (less susceptible to drying) may hold populations that are three to four times larger than shallower streams that experience drought stress prior to fall. This corresponded to a conservative estimate of an annual population of 40,000 rusty crayfish in Gunpowder Creek, Boone County. I looked for movement patterns using data from mark-recapture experiments but could not identify strongly directed upstream or downstream movement during summer. My results and further analysis will help in our understanding of the conditions under which *O. rusticus* can become a successful invader.

District I Johnson Award (Poster) Session

Bartanus, Justin and Zhe Zhang. Sigma Phi, Guilford College. Modeling T164I nsSNP Influence on the β_2 Adrenergic Receptor and the Implications in Cardiovascular Disease.

Cardiovascular Disease (CD) is the leading cause of death in the world. In 2008, approximately 30 percent of worldwide deaths were attributed to CD. It has been observed that one significant genetic cause of CD has been linked to a nsSNP of the beta-2-adrenergic receptor (B_2AR), a member of the G-protein coupled receptor family. The B_2AR is usually the target of catecholamines and can regulate a variety of processes including, gluconeogenesis in the liver and controlling cardiac output in the heart. This project looked specifically at a nsSNP which substitutes a Threonine for an Isoleucine at residue 164 (T164I). In this project, web servers (Delphi, SDM, I-Mutant 2.0) and computational

equipment (JACKAL with Tinker) were used to calculate free energy of the minimized structures for the wild-type and mutant due. The substitution resulted in a localized decrease in stability; however an overall stabilizing effect on the protein was observed due to a reduction in solvent accessibility. Multiple sequence alignments (Clustal Omega, SIFT) indicated that the mutation was intolerant and 3D visualization software (PyMOL,JMOL) were used to better visualize the changes in the structure which led to destabilization and subsequently altered function in the protein.

*Bement, Brian J. Sigma Psi, Florida Institute of Technology. Temperature induced modulation of feeding kinematics in a nonnative Florida species (Pterois volitans/miles complex): A comparison of feeding profiles.

Efficacious species invasion relies upon physiological and behavioral traits appropriate to an invaded ecosystem, while environmental gradients, such as temperature, have been seen to influence performance when marine species are put under stress. By augmenting ecological gradients, the Indo-Pacific lionfish (*Pterois volitans/miles* complex) continues a trend of northerly invasion outside of the species' natural range. Though it is known that the capacity of a species to thrive is dependent on its ability to effectively capture prey, little is known about the integrated effects of body size and temperature across variations in the feeding-episodes of lionfish. Thirteen lionfish, divided into three size classes, were collected from a Florida population and fed live *Gambusia* spp. while being filmed using high-speed video. A frame-by-frame analysis of kinematic variables: gape, hyoid depression, cranial rotation, and jaw displacement were profiled through size and temperature regimes. A two way MANCOVAR was used to test the hypothesis: there is significant difference in feeding events across temperature regimes in size classes of lionfish. Examination into the breakdown of prey capture events gives insight into the occurrence of modulation and at what loci these changes are occurring. Manifestation of modulation could conceivably impact trophic communities where lionfish now reside.

*Received First Place Distinction for Research

Bonifer, Kyle S. Psi-Beta James Madison University. Anti-Microbial Analysis of a Novel Series of Amphiphiles.

Throughout the history of antibiotic use, drug resistance has made the development of novel and potent drugs a necessity. Our research is centered on the development of novel amphiphiles comprised of non-polar hydrocarbon tails varying in length, and multiple polar head groups. These series of amphiphiles were assayed for antimicrobial effectiveness against *Staphylococcus aureus*, *Enterococcus faecalis*, *Pseudomonas aeruginosa*, *Bacillus subtilis, Streptococcus agalactiae* and *Escherichia coli* by performing standardized minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) assays. MIC and MBC values for these amphiphiles were in the low micromolar range. Specifically, the compound M-P,12,12 (*meta*-pyridine, 12 carbon chain, 12 carbon chain) was most effective for all strains tested, with MIC and MBC values of 2μM for *S. aureus*, 2μM for *E. faecalis*, 4μM for *E. coli*, and 8μM for *P. aeruginosa*. In addition to being the most effective compound, the MIC values of M-P, 12, 12 were less than control compounds DTAB, CTAB, and Lysol.

Bondurant, Ashley and Dinene L. Crater. Phi Zeta, High Point University. Effects of Ultraviolet Light on the Presence of Staphylococcus aureus in a College Community.

Staphylococcus aureus is the leading cause of skin and soft tissue infections, and normally can be treated using a variety of antibiotics. Methicillin-resistant *Staphylococcus aureus* (MRSA) is a strain of *Staphylococcus aureus* that has become resistant to some of these antibiotic treatments, specifically beta-lactam antibiotics like penicillin and cephalosporins. MRSA is spread most commonly from hand to hand contact, and can generally be avoided by washing hands thoroughly. Community associated MRSA (CA-MRSA) typically affects younger, healthier individuals and can commonly be found on exercise equipment and other common surfaces that may not be regularly or meticulously cleaned. Many hospitals and other facilities that are prone to bacterial infections that can be transmitted to patients have begun testing the effects of ultraviolet lights on these microorganisms. Most studies have shown that ultraviolet lights with wavelengths shorter than 405 nm are capable of killing *Staphylococcus aureus* in as few as 5 seconds. I wanted to find out if there was a safer way to disinfect these surfaces without using chemical cleaners, possibly ultraviolet light. After determining where MRSA could be found on campus, I selected a common surface to test the UV light on. My findings show that long wave UV light (305 nm) had no effect on *S. aureus* at up to 15-minute exposure, but short wave UV light (256 nm) killed the bacteria as quickly as 15 seconds in some trials on nutrient agar plates. Future studies will be designed to manipulate the protocol in order to create a system that is safe for the college community.

Dehnart, Lauren M., Kevin Andres, and Virginia A. Young. Beta Omega, Mercer University. Efficacy of Protect 'N Shield antimicrobial coating in reducing microbial load on collegiate wrestling mats.

In this study, the ability of the organosilane quaternary amine Protect 'N Shield (3-(trihydroxysilyl) propydimethyloctadecylammonium chloride – 3.3%) to reduce microbial load on collegiate wrestling mats was tested. In a controlled laboratory setting, *Staphylococcus aureus* was swabbed onto Protect 'N Shield-treated and untreated mat samples. Mats sat at room temperature for 24 hours, and then mats were tested for the amount of viable *S. aureus* present. Subsequently, the disinfectants Maxima 128, Lysol, and Phenol were examined for efficacy in reducing the microbial load on the treated mats. Disinfected mats were tested for microbial load at ten-minute intervals via RODAC plates. The colony forming units (CFU) on plates taken from treated mat samples were then compared to the CFUs found on untreated mat samples at each time interval. The efficacy of Protect 'N Shield was also tested on wrestling mats used by the Mercer University wrestling team. Microbial load was assessed weekly via RODAC plates on treated and untreated mats both before and after mopping with the disinfectant Maxima 128. The results from the experiments carried out in the laboratory were compared to the samples taken from the wrestling mats in their environmental setting and examined for consistency.

Draghetti, Mary Christine. Sigma Psi, Florida Tech. Characterization of the diets of juvenile bonefish Albula sp. cf. vulpes in the Indian River Lagoon, Florida.

Bonefishes support very valuable recreational fisheries in the Florida Keys, Bahamas, Caribbean Islands, and around the Gulf of Mexico. Recent genetic research has shown that the well-known *Albula vulpes* is actually a multi-species complex, with at least 3 morphologically similar species of bonefishes co-occurring throughout the region. In fall 2012, large numbers of juvenile bonefish were found for the first time in the middle Indian River Lagoon, far north of their typical habitat. Genetic analysis identified these fish as the as-yet undescribed *Albula* sp. *cf. vulpes*. Little is known about the feeding habits, behavior, or ecology of any juvenile species of bonefish. Gut content analyses of the juvenile *Albula* sp. *cf. vulpes* from the Indian River Lagoon showed that these 29–105 mm juveniles fed primarily on benthic harpacticoid copepods and opportunistically on larger

invertebrates such as mysids, cumaceans and cirriped larvae. Unusual gill raker morphology appears to influence their ability to winnow their prey from sandy substrate. Hypotheses about the reason for the occurrence of juvenile bonefish outside their traditional habitat include natural recruitment variability, variation in thermal regimes, and loss of sea grass in the Indian River Lagoon.

Foor, Tracy A. & Brittany Ellington. Psi Rho, University of North Georgia. Distribution Patterns of Meiofauna on Sandy Beaches of Sapelo Island, Georgia.

Substantial abundance and diversity of meiofaunal intertidal invertebrates have been evidenced along two adjacent sandy beaches of Sapelo Island, Georgia. Meiofauna are small benthic, nearly ubiquitous, animals. They consume microbes and detritus, and in turn, are a food source for juvenile fish and ghost shrimp. Significant taxa differences of meiofauna were found within a small geographic region. In June, 2012, sand samples were collected from low, middle and high intertidal zones, and in depth ranges of 0-5 cm and 6-10 cm during low tide. Meiofauna were chemically and mechanically separated from the sand substrate and stained with Rose Bengal to visualize. On Nanny Goat and Cabretta beaches, a total of 23 meiofaunal clades were identified; Nematode worms were abundant in all zones and depths. A compelling increase in overall meiofauna abundance was found on Cabretta Beach, with twice as many Nematodes and 31 fold more Sipuncula worms observed, in comparison to Nanny Goat Beach. Indicators such as sand grain size, slope of the beach and weathering processes, such as deposition and erosion, may provide evidence for this meiofaunal variation. Surveying meiofauna on Sapelo Island could provide future insight into understanding metazoan food webs, beach disturbances and ecological contamination.

Goodison, Brianna. Sigma Phi, 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.

Hawsey, Sarah; Quinn, Kasi; & Fleet, Christine. Eta Iota, Emory & Henry College. Potential Regulators of the Gibberellin Biosynthesis Pathway in Arabidopsis thaliana.

Although the biosynthesis of the growth hormone Gibberellin (GA) in *Arabidopsis thaliana* is well understood, the regulation of the biosynthetic pathways is not. If the regulation of GA was understood, the growth of many crop plants could be manipulated to provide many agricultural benefits. In this project, potential regulators were identified and tested using microarray, the GUS staining method, and quantitative real time reverse transcription polymerase chain reaction (qPCR). A comparison of four microarray slides using a heat map showed five new potential regulators. The cryptochrome gene (*CRY 1*) has shown to be a regulator of the GA pathway through GUS staining. The swinger (*swn-4*) mutant was tested by qPCR, and has not shown to be a regulator based on preliminary

results. Preliminary results also suggest that the curly leaf (*clf*) mutants have down-regulated GA gene expression. Several other mutant plants--homeodomain glabrous 11 and 12, (*hdg 11* and *hdg12*)--are undergoing testing through PCR, GUS staining, and qPCR to characterize their role in GA regulation.

Leauge, R. Pulliam, K. Hee, R. Lloyd, S.A PhD., & Shanks, R.A PhD., University of North Georgia.The Effects of Methamphetamine on Phosphorylation Events in the Prefrontal Cortex of Male and Female C57Bl6/J Mice.

Methamphetamine (METH) is a psychostimulant drug, which over an extended period of time can cause neurological damage, changes in behavior, and acute toxicity. How METH affects the brain and downstream behavior differs between the sexes. However, there is little research regarding the sex-dependent cell signaling pathways effected by METH. To determine how METH affects cell signaling in the brain, as well as, sex-dependent differences, we initiated a broad scope experimental approach investigating the differences in phosphorylation of proteins within the prefrontal cortex (PFC) of male and female mice following an abuse dosing paradigm of METH. The PFC was analyzed because METH exposure causes dopaminergic activity in this region, leading to neurotoxicity. Using phosphoprotein immunoisolation followed by protein gel electrophoresis and coomassie staining, we will be able to detect differences in the phosphorylation state of proteins such as signaling proteins, receptors, transcription factors, and transport proteins. Side-by-side comparison of the phosphorylation state of proteins in the PFC will indicate differences between saline controls and METH exposed animals, as well as, sex-dependent differences. If a difference exists then further research may identify METH specific pathways and receptors, which could be therapeutically targeted.

Hensel, Linda, and Parth Patel. Beta Omega, Mercer University. Sequencing Allelic Series in Coding and Non-coding Regions of the Human Genome.

Single nucleotide polymorphisms (SNPS) in a coding region were compared to SNPS a non-coding region in the Human genome. The non-coding region we analyzed was TPA-25, an *Alu* fragment, found within the intron of the tissue plasminogen activator gene. This region was amplified and sequenced with commercially available oligonucleotides. For the coding region, oligonucleotides were designed to amplify a 900 base pair region of the large exon of the phenylalanine hydroxylase gene. The phenylalanine hydroxylase enzyme is crucial in metabolizing the amino acid phenylalanine to tyrosine, and we expect a high degree of conservation among various alleles. We will analyze the various SNPs to determine if a particular type of mutation e.g. transitions dominates that genomic region. We would like to compare the mutations in coding versus non-coding regions both qualitatively and quantitatively.

Horner, Kristen and Sadanani Manisha. Beta Omega, Mercer University. Psychostimulant withdrawal and Major Depression: The Role of Glutamate Receptors.

Psychostimulant addiction is a growing social and medical issue that does not have effective treatments. Studies have shown similarities in the effects of psychostimulant withdrawal and Multiple Depressive Disorder (MDD). Ketamine, a drug commonly used as an anesthetic, has become more prominent as an anti-depressant and has successfully been utilized in treating depression. Because MDD and psychostimulant withdrawal have symtomal similarities and since ketamine is an effective treatment for depression, it may have beneficial effects on psychostimulant withdrawal. However given the lack of studies

regarding ketamine as a treatment for withdrawal have not been completed.The goal of this project, focuses on determining if Ketamine is capable of reducing moods and side effects related to psychotimulant withdrawal by examining areas of the brain that deal with emotion.This study involved exposing rats to increasing levels of D-amphetamine followed by inducing a withdrawal period. Rats were then given Ketamine and observed for any effect the drug had on their withdrawal behavior. The rats were then sacrificed and changes in mRNA levels were examined using in situ hybridization. Results showed little to no effective change in withdrawal behavior symptoms following Ketamine dosage.

Hoang, Hoa. Sigma Phi, Guilford College. Can we find and culture the fresh water 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 *Planctomycetes* are normally found in fresh water and marine habitats. This study will focus on the potential collection and culturing of fresh water *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.

Morgan, Gregory P & Shanks, Ryan A & Lloyd, Steven A. Psi Rho. University of North Georgia. Effect of Dopamine on the Migration of BV-2 Microglia Cells.

Microglia are the dominant immune cell within the CNS, and they function in a protective role through cytokine signaling and phagocytosis. Microglia are activated by a variety of insults such as infection or neurotoxicity brought on by exposure to psychostimulants. After such stimulatory signals, ramified microglia (inactive) change morphologically (amoeboid (active) microglia) and functionally (i.e., they move to the site of injury). Microglia have receptors for dopamine, yet little is know about the direct effects of dopamine on microglia movement to a site of neurodegeneration following psychostimulant exposure. To gain additional insight into the movement of microglia driven by psychostimulant-induced activation, dopamine (DA), a neurotransmitter released in mass during psychostimulant exposure, was used in a wound-healing assay with a murine microglia cell line, BV-2. LPS, a known microglia migration activator was used as a positive control. Photos of the cell free area were taken every three hours after exposing the BV-2 microglia to different concentrations of dopamine or LPS. The number of cells that migrated into the wound were counted. Analysis of these results will provide insight into the direct effects of dopamine on microglia migration and activation after psychostimulant exposure.

Nichols, A. Elizabeth. Psi Beta, James Madison University. Do Rana muscosa Antimicrobial Peptides and the Cell-Free Supernatant of Pseudomonas fluorescens Have a Synergistic Effect on the Inhibition of the Zoospores of the Amphibian Fungal Pathogen Chytridiomycosis?

The fungal pathogen *Batrachochytrium dendrobatidis (Bd),* which causes the disease chytridiomycosis in amphibians, is implicated in the significant population declines and extinctions of amphibians around the world. However, some species and populations

coexist with the pathogen. Recent research has focused on how amphibian-produced antimicrobial peptides and bacterially-produced metabolites inhibit *Bd*. Synergy of antimicrobial peptides and the metabolite 2,4-diacetylphloroglucinol in killing *Bd* have been explored in a previous study. It was found that significantly lesser amounts of both peptides and the metabolite were needed when used in combination compared to the amounts needed when used individually. This study will investigate whether the synergistic effects occur when antimicrobial peptides are combined with the cell-free supernatant of *Pseudomonas fluorescens*. Cell-free supernatant is a more accurate representation of what is present on the amphibian skin because it contains multiple metabolites and bacterially produced antimicrobial peptides. The finding of synergy would support the general hypothesis that amphibians and their skin microbes are engaged in a mutualistic ecological relationship and may also explain why some amphibians are able to coexist with *Bd*.

Nguyen, Binh. Sigma Gamma, Erskine College. Understanding The Genetic Predispositions to Parkinson's Disease: a Computational Model of The Impact of L449S nsSNP in The Histamine H1 Receptor.

Parkinson's disease (PD) is the second most prevalent neurodegenerative disorder characterized by major motor malfunction, which is also accompanied with behavior disorders. Currently, about one million people in USA are living with this chronic, progressive, and incurable disease. A polymorphism in the Histamine Receptor H1 gene results in an amino acid substitution from Leucine to Serine on location 449 (Leu449Ser), which has been observed in PD patients (Martin, 2008). In order to understand the effect of this non-synonymous single nucleotide polymorphism (nsSNP) on the receptor structure and function, we propose a research protocol for computational modeling of the Histamine Receptor H1 (HRH1) and its mutant form on the basis of its recently determined crystal structure (Shimamura, 2011). We plan to investigate if this nsSNP interferes with HRH1's wild type signaling properties by comparing this mutated receptor with the wild type. GPCRs level of stability can be indicated by its protein folding energy. The most time-consuming computer calculations will be performed at the Clemson University Bioinformatics Lab using supercomputer clusters. The computer simulations will clarify the impact of the HRH1 gene mutation on Amber, Charmm, and OPLS force fields, and will possibly elucidate its relationship to Parkinson's disease through changes in potential energy in folded state. The calculations will provide atomic detail of binding and inversed agonistic activities, which can result in greater understanding of the mechanism of action of the native and mutated receptors. This, in turn, can lead to a new pathogenic pathway for treatment options, and possibly to a specific cure for Parkinson's disease.

Ross, Richard, James Rice, Guliano Mion, and Nancy Eufemia Dalman. Psi Rho, University of North Georgia-Dahlonega. Examining the mutagenic and toxi effects of shredded tree mulch leachate on the development of Xenopus laevis embryos.

Recycled tire mulch is a common material found in playgrounds and landscaping. Exposures to varying temperatures, UV radiation, and acid rain may release toxicants into soil and surface waters. Exposure to these chemicals may contribute to declining amphibian populations. *Xenopus laevis* is highly sensitive to environmental toxicants during early developmental stages. *Xenopus laevis* embryos were placed in an isotonic saline solution or varying concentrations of tire mulch leachate. To create leachate, shredded tire mulch was suspended in pH 5.6 isotonic saline and shaken at 200 rpm and 27°C for 48 hours. The final leachate solution was created by filtering out remaining particulates and bringing the solution's pH to 7.7. Tadpoles were observed daily for 96 hours and data regarding malformations and mortality were recorded. We found that

tadpoles exposed to increasing leachate concentrations had greater malformation and mortality numbers than those exposed to an isotonic solution. Further, leachate made from tire mulch weathered outdoors for one week caused notably increased larval mortality and malformation rates. Using mass spectroscopy, Triethyl Phosphate and 2-(3H)-benzothiazolone were isolated from the tire mulch residue. Further experiments will determine whether these chemicals are the primary leachate toxicants, and at what concentration they can be tolerated.

Schulz, Jordyn, Chris Tavares, Amanda Helton, Jordan Ross, Steven Lloyd, Ryan Shanks. Psi Rho, University of North Georgia. BDNF expression in adolescent mice after chronic methylphenidate exposure.

Alterations in BDNF or TrkB expression may be an underlying mechanism explaining sexually dimorphic differences in cross-sensitization to methamphetamine following adolescent exposure to methylphenidate (MPD). Previous research conducted in our lab found that mice exposed to MPD in adolescence showed drug and sex-specific behavioral sensitization after a challenge dose of methamphetamine in adulthood. Since BDNF and its receptor TrkB are highly involved in neuronal development and plasticity (especially in relation to addiction), this study investigated their expression after a10 day exposure to an abuse model of MPD (daily i.p. injections of 10mg/kg) or saline during adolescence (P22-31). Since MPD alters DA signaling and because BDNF is highly expressed in the dopamine terminals of the striatum and prefrontal cortex during development, these areas were specifically examined. The striatum and prefrontal cortex were microdissected and processed for RNA isolation and analyzed using RT-PCR (with BDNF specific primers). We expect to find increases in BDNF and TrkB levels after MPD exposure as well as differences between the 5 and 10 day mice. Elucidating the molecular mechanisms underlying previously noted behavioral alterations will uncover potential therapeutic targets as well as provide insight to the teratogenic nature of MPD in an adolescent population.

Tavares, Chris, Jordyn Schulz, Amanda Helton, Jordan Ross, Ryan Shanks, Steve Lloyd. Psi Rho, University of North Georgia. Does Adolescent Exposure to Methylphenidate Elicit Changes in ΔFosB expression: A Possible Underlying Mechanism of Cross-Sensitization.

Methylphenidate (MPD), a psychostimulant, blocks the dopamine (DA) transporter reuptake of DA, leading to increased amounts of extracellular DA. Preceding research in our lab provided evidence that early exposure to MPD (during adolescence) will produce drug and sex effects after exposure to methamphetamine in adulthood (~8 week aging period). Cross-sensitization is a phenomenon in which drug use leads to hyper-responsiveness to another drug. Cross-sensitization is a hallmark of addiction, so it is imperative to discover the complex role of gene expression in order to elucidate underlying mechanisms of cross-sensitization. Gene profiling and analysis has the potential to explain many behavior manifestations that have yet to have reasonable hypotheses. ΔFosB is associated with long-term neural plastic changes. ΔFosB is a transcription factor expressed in response to psychostimulants with key downstream targets. We expect increases in ΔFosB levels following adolescent MPD exposure, which is observable in both male and female C57BL6/J mice; however, we expect to find statistically higher levels in females compared to males. The PFC and striatum will be extracted and RNA will be isolated for real-time polymerase chain reaction analysis with ΔFosB specific primers. Increased ΔFosB expression indicates that drug exposure not only affects observable behavior but also causes changes in gene expression. The alterations to gene expression are a potential explanation as to why drugs cause long lasting behavioral changes.

Vincent, Jessica. Psi Rho, University of North Georgia. Interactions between Barrier-to-Autointegration Factor-Like (BAF-L) and Histones.

Barrier-to-Autointegration Factor (BAF) is a conserved DNA binding protein with cellular roles in nuclear assembly, regulation of chromatin structure, and gene expression. The regulation of chromatin structure by BAF is most likely mediated through its interactions with DNA and histones. BAF is regulated through phosphorylation, but there are other potential modifications of BAF that remain unknown. Barrier-to-Autointegration Factor-Like (BAF-L) is a protein that is 40% identical and 53% similar to BAF at the amino acid level. Recombinant BAF-L can form stable homodimers and can heterodimerize with BAF *in vitro* and *in vivo*. Although BAF-L does not significantly bind to DNA and other partners of BAF, it can interact with BAF in the presence of DNA. These distinct biochemical characteristics of BAF-L suggest that it might regulate BAF function through formation of BAF/BAF-L dimers. We hypothesize that binding of BAF-L may help regulate BAF interactions with histones and DNA. Preliminary data for our research group suggests that BAF-L can, like BAF, bind to histones H1 and H3. We will confirm this preliminary finding and extend it by testing BAF-L binding to histones through several methods: far westerns, immunoprecipitations, and chromatography.

Herdliska, A., C. Haygood, B. Phillips, R.A. Shanks, S.A. Lloyd. Psi Rho, University of North Georgia. An Assessment of Engagement and Higher Order Thinking in a Novel Laboratory Experience.

Conventional teaching styles in introductory biology classrooms rely heavily on lecture. Many students passively re-learn material previously covered. In order to create a dynamic experience, we applied an interactive approach. Students who engaged in the novel laboratory experience described here demonstrated significant increases in learning gains; specifically, gains in higher order thinking skills. The sample for this study was 241 freshmen undergraduate students in four courses taught over two semesters. Students in the experimental groups (n=114) followed an altered laboratory schedule, in which they completed a project that applied the scientific method to their experimental design. Aspects of this project included: hypothesis formation, an oral proposal and poster presentation. As an objective measurement, the Experimental Design Ability Test was used to test students understanding of the scientific method. As a subjective approach, the Student Assessment of Learning Gains, the Engaged Learning Index, and the Student Course Evaluation Questionnaire were also used. These self-report questionnaires allow educators to ensure that their students are fully engaged and are using critical thinking and analytical skills. Together, this study will demonstrate the effective use of undergraduate research experiences in the laboratory setting.

District II Johnson Award (Poster) Session

Bernal Mejia, Manuel, W.R. Bolus, T.A. Carver, M J. Kovach. Sigma, University of Tennessee at Chattanooga. An Analysis of Differentially Expressed Genes in the Context of Cochlear Malfunction in Charcot-Marie Tooth Syndrome.

Charcot-Marie Tooth Syndrome is characterized by improper nerve conduction in peripheral nerves affecting both motor and sensorineural functions. CMT1E represents a genetic variant of the disease distinguished by a deafness component attributed to a mutation within the Peripheral Myelin Protein-22. In non-neural tissue, it has an implicated role in cell proliferation. Neural versus non-neural tissue-specific expression patterns hint at a dual function of the PMP22 protein in normal hearing, that is supported by evidence of

neural and cochlear impairment in CMT1E patients. We hypothesize that a defect in PMP22 causes abnormal gene-expression central to proper development that causes the neuropathic phenotype and cochlear malfunction of CMT1E. To better understand the molecular nature of CMT1E, we aim to identify and characterize genes that are differentially expressed relative to functional levels of PMP22. Through Differential Display, 754 gene-transcripts were identified as differentially expressed in the TrJ mouse model for CMT. Thus far, 109 genes have been confirmed as expressed genes and characterized according to function. Approximately 52% of these genes cross-reference to the Human Cochlear EST database and represent potential candidate genes of the deafness phenotype. Promising candidates were further evaluated for temporal expression patterns using quantitative reverse-transcription PCR.

Brooks, Jacob, Mary McDaniel, and Lori Tolley-Jordan. Mu Phi, Jacksonville State University. The Effects of insect exclusion and animal size on diversity of adult and larval insects among four stages of decomposition.

In September 2012, we tested how insect barriers used on two sizes of rodents affected attraction of adult insects and larva during four stages of decomposition. Eight individuals of *Mus musculus* (17g-22g) and eight individuals of *Rattus norvegicus* (160g-220g), were randomly assigned to either insect exclusion or control with 1000g of pre-mixed soil. Insect exclusion containers were then covered with a spun-woven cotton mesh cover. For each size class of rodents, a control and exclusion container were placed into a stainless steel live animal trap (n=8) that was randomly assigned to one of the four decomposition stages. In a nearby flat, grassy field each trap was buried with specimens flush with the ground surface in plots about 6 m apart. Photographs of cages were made daily and recorded. In the lab, adult and larva insects found on the animal or in the soil were also recorded. Preliminary results suggest that more insects were associated with control mice and rats than excluded specimens. A more diverse assemblage and greater abundance of adult and larva insects were found on large versus small rodents. Regardless of carrion access, or animal size, the putrefaction stage attracted the largest numbers of larva and adult insects.

Brown, Janesha, Serena Bibbs, Amber Shaffer and Falicia Edwards. Omicron Pi, Tougaloo College. Effect of parathion and methyl parathion on antioxidant expression levels in human liver carcinoma ($Hepg_2$) cells.

Parathion and methyl parathion (MP) are organophosphate compounds that are widely used restricted-use agricultural insecticides. Published studies indicate that human exposure to these compounds may result in adverse effects on nervous, hematopoietic, cardiovascular, and reproductive systems. Both chemicals are among the class of organophosphates that are known for their ability to irreversibly inhibit acetylcholinesterase, leading to profound effects on the nervous system of exposed organisms. Studies link exposure of organophosphates to degenerative diseases such as Parkinson's, Alzheimer's, and amyotrophic lateral sclerosis (ALS). This linkage has been associated with increased oxidative stress (OS) damage. Although clinical manifestations associated with parathion and MP exposure are well documented, their molecular mechanisms of toxicity remain to be elucidated. Therefore, the aim of the present investigation is to use human liver carcinoma (HepG2) cells as a test model to assess cellular effects of parathion and MP. We hypothesize the OP exposure increase biomarkers of OS and ultimately cause cells to undergo apoptosis. To achieve this goal, we will perform catalase, superoxide dismutase, and total glutathione assays to measure antioxidant defense mechanisms.

Carlisle, Kristen T. Mu Phi, Jacksonville State University. Potential Problems with Cryoprotectants: Developmental Effects on Xenopus laevis Embryos.

In an effort to evaluate the feasibility of cryopreservation of *Xenopus laevis* embryos for education and research purposes, this project evaluated the effects cryoprotectants on embryos of *X. laevis*. Cryoprotectants are chemicals that are used to prevent damage due to ice crystal formation within the cells during the freezing and thawing process. Even though cryoprotectants are beneficial to the process, the extended exposure to these chemicals can cause developmental effects on the embryos, effecting survival, malformation, and growth. As part of a series of cryopreservation experiments, the effects of PVP, Galactose, DMSO, or a cryoprotectant cocktail upon the development of *X. laevis* embryos were studied using the Frog Embryo Teratogenesis Assay-Xenopus (FETAX) protocol. Early stage (≤ small cell blastula stage) *X. laevis* embryos were exposed to treatments for 96 hours (solutions statically renewed every 24 hours). At 96 hours, mortality, malformation, and length were recorded. The 96-hour LC50 (concentration to kill 50% of a population), 96-hour EC50 (concentration to cause malformations in 50% of a population), and the Teratogenic Index (TI=LC50/EC50) were calculated using Bonferroni's multiple comparison test via Systat 13. This study demonstrated that PVP, Galactose, and DMSO would not cause abnormalities or mortalities at levels used in cryopreservation.

Faulk, Jesse D., Alicia L. Darracott, & Lisa Ann Blankinship. Beta Zeta, University of North Alabama. An Investigation of Antibiotic Resistant Bacteria Found on Common Surfaces in Medical Facilities.

Bacteria are present everywhere including commonly touched surfaces within the community. By touching surfaces such as doors, phones, pens and magazines, bacteria are transferred from one person to another. During this study, common items such as sign in book or pen, plants, toys, water fountains, waiting room literature and chairs, or patient room countertops were sampled from six health care facilities. The six facilities chosen included two general care facilities, two pediatric care facilities, and two geriatric care facilities. The purpose of the study was 1) to determine what bacteria were present on commonly touched surfaces and 2) to determine the antibiotic resistance profile of each isolate collected. Samples were collected from each location using a sterile swab dipped in sterile water. Swabs were placed into nutrient broth and grown overnight before bacteria were isolated for identification using Biolog and antibiotic testing by the Kirby Bauer method. 79 isolates have been tested against the Biolog database resulting in 67 isolates identified, 11 isolates unidentified by Biolog, and one isolate that was no longer cultivable. Antibiotic testing showed that several isolates were resistant to antibiotics.

Guglielmi, Stefania & Alexus Rice. Mu Iota, Northern Kentucky University. Collection and identification of potentially toxic and allergenic cyanobacteria from the Greater Cincinnati area.

We report here on the recent occurrence of cyanobacterial blooms in the Greater Cincinnati area. Bloom samples were collected from several ponds in Ohio and Northern Kentucky in 2012. Many cyanobacteria produce liver and/or neurotoxins. Recent studies have suggested that there is also a correlation between exposure to cyanobacteria and their toxins and allergic reactions. Monitoring ponds near highly populated areas can be important to public health particularly since cyanobacterial blooms have become much more common in recent years. The most prevalent cyanobacteria in all our samples were *Microcystis*, which potentially produce Microcystins - liver toxins. We identified five

morpho-species: *M. aeruginosa, M. flos-aquae, M. viridis, M. wesenbergii* and *M. botrys*. We also found *Synechococcus aeruginosus*, a lipopolysacharide endotoxin producer. Samples also contained cyanobacteria in the genera *Anabaena, Oscillatoria, Planktothrix, Woronichinia Pseudoanabaena, Aphanizomenon, Merismopedia, Anacystis* and *Lyngbya*. Cyanobacteria from these collections are being cultured and analyzed for toxin production and for their potential as allergens at the U.S. Environmental Protection Agency in Cincinnati and at the University of Cincinnati Medical School.

Hofmann, Emily A. Mu Iota, Northern Kentucky University. The impact of stress on vaginal microflora dynamics.

Cyclic fluctuation of progesterone and oestrogen are key endogeneous factors affecting the vaginal microbiome of menarchel women. Bacterial load and colonization factors are dependent upon the environmental conditions such as; epithelial cell surface receptor expression, mucosal viscosity, glycogen levels, pH, and O_2 and CO_2 tension, and innate immune response. Exogenous influences like diet and stress levels are less well understood but show promising recent research. This study documents one menstral cycle with daily Gram stained wet mounts which were photographed for comparison and graded with a Nugent score. Weekly pH data and direct culture were also performed with qualitative identification of the most prevalent taxa. A detailed daily log of diet, exercise, sleep and relative health was maintained and a Likert score recorded of perceived stress per day. The correlation between the Linkers scores measuring stress and the Nugent scores indicating the microbial community dynamics is discussed.

Keeton, Symphony P., M. Lauren Bates, Vansh Shah, & Lisa Ann Blankinship. Beta Zeta, University of North Alabama. Identification of Hand and Cell Phone- Associated Bacteria and Their Antibiotic Resistance Profile.

Within the past decade the problem of antibiotic resistance has been brought to public attention. The medical community now faces a future limited to no or few antibiotics within the next 20 to 30 years. Antibiotic resistance is not a new problem. However when bacteria, such as members of the normal human flora or human pathogens, acquire antibiotic resistance genes then an increase in antibiotic resistance can become problematic. This study is part of a four year survey that looks at changes between cell phone and hand associated bacteria and the antibiotic resistance profile of bacteria isolated from hands and cell phones of participants. Data reported here are from year two of general population participants. In brief, hands and cell phones of participants were swabbed with a sterile cotton tipped applicator dipped into sterile nutrient broth to collect bacteria found on each surface. Bacteria were grown overnight in nutrient broth before serially diluting and plating. After isolation, bacteria were identified using Biolog Gen III database and tested for antibiotic resistance using the Kirby Bauer method. To date, 35 cultures have been tested against the Biolog database for identification with 15 isolates being identified at the genus species level. Several isolates need to be retested with Biolog using a different protocol (protocol B) and most likely represent members of the genus *Bacillus* or a closely related genus. Antibiotic resistance for 29 isolates against 19 antibiotics has been determined showing that several isolates are resistant to antibiotics.

Land, Lauren & Darlene Panvini. Mu Theta, Belmont University. Macroinvertebrate Biodiversity in Open Canopy Riffles and Pools in the Little Harpeth River, Nashville, TN.

Macroinvertebrate diversity is an indicator of the overall health of streams. One of the major factors affecting stream quality is the condition of the riparian zone, including the

presence of tree canopy cover. Canopy cover can impact stream temperature and light. Temperature differences related to levels of canopy cover can impact stream macroinvertebrate diversity. To determine the impact of canopy cover on diversity in Tennessee streams, macroinvertebrate occurrence was determined using rock picking and D-net sampling methods in six weekly sampling sessions in riffles and pools in open and closed canopy reaches in the Little Harpeth River, Nashville, TN. Simpson's, Shannon Weiner, and Equitability Indices of diversity were correlated with water quality variables (temperature, dissolved oxygen, total dissolved solids, and pH). Diversity did not vary between riffles and pools in the open canopy, or between open and closed canopied areas. Overall water quality did not differ between sites either, but temperatures were higher and dissolved oxygen levels lower in open canopy areas. In open riffles, diversity, determined by the Simpson's Index, was significantly correlated to overall water quality. This study reports on the relationship between macroinvertebrate diversity in open-canopied riffles and pools, in comparison to closed-canopied riffles and pools.

Bolivia Hurtado De Mendoza, Mu Omicron, Columbus State University. Characterization of bioreducible poly(β-amino ester) nanoparticles for siRNA delivery.

Glioblastoma multiforme (GBM) is a malignant brain tumor affecting adults. It is characterized by necrotic tissue and abnormal vasculature, making it highly resistant to cancer treatments. A promising alternative to standard cancer therapeutics is the use of drug delivery systems such as polymeric nanoparticles (NP) that deliver silencing RNA (siRNA) exclusively to tumor cells for gene knockdown. We hypothesized that the addition of disulfides to PBAE NPs would reduce cytotoxicity and increase siRNA transfection efficacy. In this study, we characterized the binding, physical, and siRNA delivery properties of reducible PBAE NP. Polymer-siRNA binding strength was analyzed by gel retardation and fluorescence competition assays. NP size and zeta potential were measured using NanoSight and zetasizer instruments. siRNA transfection efficiency was assessed by the amount of green fluorescent protein detected in GBM cells using a fluorescence plate reader. This study revealed that the addition of disulfides to PBAEs increased their siRNA binding strength, lowered cytotoxicity, and increased siRNA transfection efficiency. The best polymer showed 76% GFP knockdown while maintaining high cell viability twenty days following transfection. These novel polymers can serve as improved nonviral delivery vectors for a wide array of RNA interference (RNAi) targets, including those associated with malignant tumors.

Moeller, Katrina D.R. Mu Upsilon, University of Tennessee at Martin. Effectiveness of using silent counts and aural stimuli to detect Barred Owls in the area surrounding Reelfoot Lake, Tennessee.

Barred Owls are nocturnal predators commonly found in the area surrounding Reelfoot Lake in northwest Tennessee. Studies of Barred Owls have used a variety of censusing protocols. Our goals were to standardize census methods by comparing silent counts to post-playback counts and to determine if these methods vary in effectiveness by month. Ten points were established and sampled twice a month from October to January in 2011-2012 and 2012-2013. At each point, we conducted 5 and 10 minute silent counts followed by playback of Barred Owl territorial calls. We then conducted 5 and 10 minute post-playback counts. The 5 minute silent count detected significantly less owls than all other methods. In addition, the number of vocalizations counted during 10 minute post-playback counts was significantly higher than all other methods. Ten minute silent counts detected the same number of owls as 10 minute post-playback counts. Ten minute post-playback counts detected significantly more vocalizations than 10 minute silent counts during October and November, but not during December and January. The difference in the

number of vocalizations uttered in response to aural stimuli by month indicates a possible change in the level of responsiveness that may be related to breeding status.

Nichols, Zeke J. Glenn A. Marvin, and Paul G. Davison. Beta Zeta, University of North Alabama. Desiccation tolerance of arboreal microturbellarians.

Few free-living, freshwater micrometazoans are able to survive in habitats prone to prolonged drought and unpredictable periods of hydration provided by rainfall. Only nematodes, rotifers, and tardigrades are well known for their anhydrobiotic abilities and abundance in dry lichens and mosses. We investigated the desiccation tolerance of adult, undescribed, rhabdocoel microturbellarians (Platyhelminthes) collected from moss on trunks and limbs of eastern red cedar (*Juniperus virginiana)* in Lawrence County, Alabama. We devised a successful means for inducing worms to form drought-resistant cysts on glass slides (i.e., to encyst), and then compared the excystment success (survival) rate for worms that were taken down to 89, 75, and 33 percent relative humidities (rh). After 9 days, 5% survived 33% rh, 80% survived 75% rh, and 100% survived 89% rh. It appears lower relative humidity decreases the successfulness of excystment.

Parsons, Wesley and Mitch Mercer. Mu Iota, Northern Kentucky University. Diurnal Activities and Metabolism of the Lazarus Lizard (Podarcis muralis) as an Introduced Species.

A founder population (10 individuals) of Lazarus lizard (*Podarcis muralis*), introduced from Italy in 1952, has since grown exponentially throughout the Greater Cincinnati area where they thrive in urbanized saxicolous microhabitats. Our research evaluates the niche of these introduced lizards to determine if they 1) occupy a vacant urban niche, and 2) pose a threat to the local ecosystem. We study the foraging ecology of these lizards, as well as their time-activity budgets. An ontogenetic range of individuals within the species is currently being tested for differences in metabolic rates with a respirometry gas analysis system.

*Worthy, Sydney L., Mu Omicron, Columbus State University. Discriminating woody plant species in a warm-temperate flora using plant DNA barcodes.

The *rbcL+matK* gene region of the chloroplast genome has recently proven effective for the establishment of DNA barcode libraries and discerning species in a temperate flora typified by a high proportion of monotypic taxa of moderate phylogenetic dispersion. To date, the efficacy of this barcoding region in a warm-temperate flora typified by relatively higher proportions of invasive and more taxonomically complex taxa has not been tested. The goal of this study is to 1) establish a barcode library and 2) test the efficacy of the *rbcL+matK* barcode for species discrimination in the woody flora of Oxbow Meadows Environmental Learning Center, Columbus, Georgia. As a first step in this process, I collated, synthesized and analyzed previously collected *rbcL* barcode data for 62 woody plant samples to evaluate rates of species resolution. Of the 31 species analyzed, species resolution was 87% based on an all-to-all BLASTn analysis using this gene region. Furthermore there was a weak relation between the number of species per genus and % species resolution. Collectively, results indicate that species resolution is relatively high in warm-temperate floras that contain a high proportion of monotypic taxa, although rates for polytypic taxa are substantially lower.

*Received First Place Distinction for Research

Hall, Emma, Sigma, University of Tennessee at Chattanooga, A Continued Effort to Understand the Role of Peripheral Myelin Protein 22 (PMP22) and Other Genes of Interest in the Development of Sensorineural Deafness.

Charcot-Marie-Tooth disease (CMT) is a hereditary neuropathy affecting the peripheral nervous system. Duplication of the PMP22 gene accounts for most CMT cases; however a point mutation in PMP22 causes the rare genetic variant CMT1E, marked by sensorineural deafness. PMP22 contributes to myelin sheath formation and nerve conduction, but is also expressed in non-neural (cochlear) tissues, leading to the hypothesis that PMP22 serves a dual function in normal hearing. Additionally, audiological findings indicate neural *and* cochlear components to deafness in CMT1E patients. The potential role of PMP22 in cochlear development was investigated using the Trembler-J mouse model for CMT. Cochlea samples were taken from control (WT) and experimental (TrJ) mice throughout embryonic and postnatal development. Cochlea were examined for PMP22-associated changes, and characterized by immunofluorescence for localization of the *pmp22* alongside two proteins necessary for normal audition: insulin growth factor binding protein-4 (Igfbp4) (affects cochlear size and number of hair cells) and Synaptogyrin-1 (Syngr-1) (implicated in neural plasticity of auditory systems).Results show high expression of Igfbp4 in TrJ models compared to WT in hair cells and basilar membrane. Syngr-1 (localized in the cochlear nerve) changes staining intensity temporally—expression in day 1 is more pronounced than day 14, for example.

Harris, Tyler and Ashlie Rubrecht. Beta Omega, Mercer University. Isolation and Characterization of Mercury and Antibiotic Resistance Genes from Bacteria from the Artisanal Gold Mining Community of Tsetsera, Mozambique.

The process of artisanal gold mining makes use of mercury amalgamation for the purpose of gold extraction and isolation. Unfortunately, widespread mercury contamination due to the inappropriate disposal of mine tailings and other waste material often leads to human health problems and long-term environmental damage. Our lab is investigating the effect that mercury contamination, from artisanal gold mining, has on the bacterial population in the soil. Our hypothesis was that increased mercury levels in the soil will increase the prevalence of mercury resistant bacteria (Hg^R). However, our findings indicate that the percentage of Hg^R bacteria in a sample is independent of the mercury concentration in the soil. In addition, the development of bacterial resistance to mercury can correlate with increased bacterial resistance to multiple antibiotics. Therefore, we tested Hg^R strains from artisanal gold mine for ampicillin resistance by growing them on media supplemented with ampicillin. PCR is being used to amplify the *merA* gene coding for mercury resistance and the *bla* gene coding for ampicillin resistance. These sequences will be compared for genetic similarities between isolated strains. It is expected that areas with long-term mercury resistance will have more variation in resistance genes than locations with less exposure over time.

Cotton, Barbara and Christi Magrath. Mu Epsilon, Troy University. Antibiotics impact on the growth of yeast deletion strains grown in wastewater.

Analysis of *Saccharomyces* Genome Deletion Strains grown using the Troy (Alabama) Wastewater Treatment Plant (WWTP) and surrounding water bodies, including Walnut Creek, which has been classified as moderately impaired, indicated several noticeable ontological differences in impacted strains: increased or decreased drug response, increased or altered stress response, or "response to chemical stimulus". Based on these observations, the effects on antimicrobial sensitivity patterns in *S. cerevisiae* were

assessed. An inorganic chemical analysis was performed using environmental water samples collected from each location. The chemical analysis indicated minimal differences between the various water samples, with the exception of slight differences in the levels of calcium, iron, sodium, manganese, potassium, and magnesium. Growth analysis of selected wastewater-sensitive deletions strains (ΔOca1, ΔYap1, ΔGnd1, ΔYcf1, ΔUba4) in the presence of various antimicrobial agents (fluconazole, erythromycin, genticin, polymyxin B, and ampicillin) indicated that the growth response, as measured by doubling time, of these deletion strains is not usually altered (as compared to a wild type control) in distilled water, regardless of the presence of antimicrobial agent. However, in the environmental samples, differences were observable; ΔUba4 displayed altered growth patterns upon exposure to environmental water samples that varied based on the presence or absence of the antimicrobial agents. Additionally, morphological changes were evident in some samples, including the presence of filamentation, which is a result of an increased response to either chemical or environmental stress or some unknown form of stress. Therefore, sample collection and chemical analysis, followed by microarray analysis of antimicrobials in each of the water samples has assisted with environmental sensitivity mapping of the waters flowing into and through the WWTP with a thorough assessment of a simple biological community.

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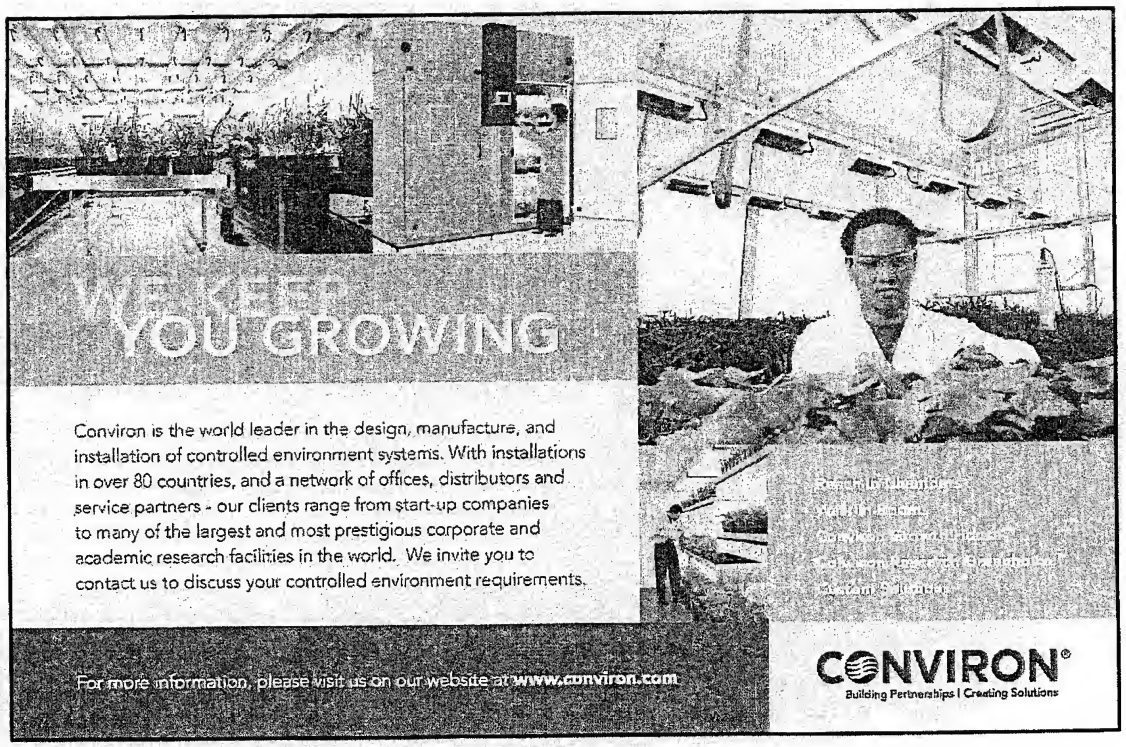
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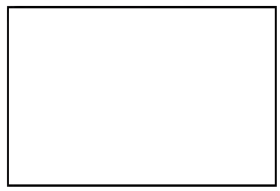

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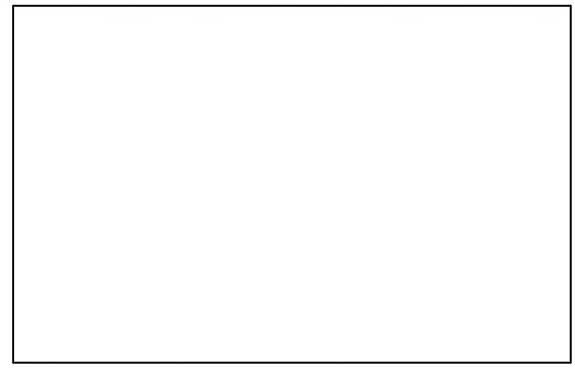

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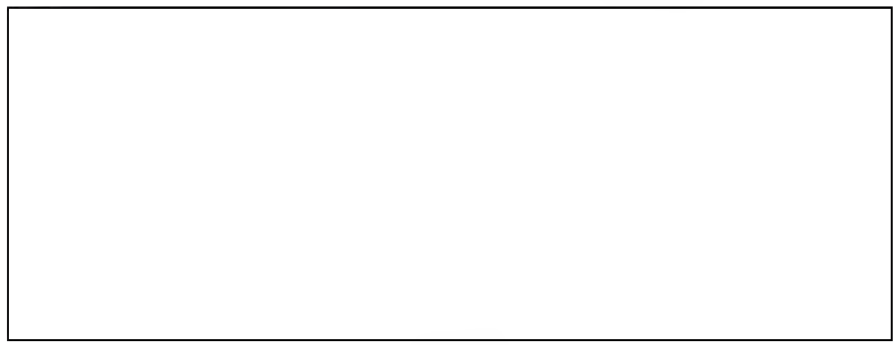

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OBITUARY

Wallace Douglas Dawson, Jr.
1932-2013

Wallace Douglas Dawson, Jr. died peacefully April 2, 2013 at Manor Grove in Kirkwood, Missouri. He was preceded in death by his parents Wallace Douglas Dawson, Sr. and Ida Belle Hiatt of Louisville, Kentucky, and by his younger brother Sam Jones Dawson, Montgomery, Alabama, and younger sister Anne Dawson Ford, Owensboro, Kentucky. He was lovingly married for 32 years to Dr. Victoria C. Hollowell, and they made their home in Columbia, South Carolina and then in Des Peres, Missouri. Wallace is survived by his daughter, Elizabeth Dawson Murphy (James R.) and son, W. Douglas Dawson, III (Elizabeth Crawford), and three grandchildren, John, Crawford, and Maggie.

Wallace served in the United Air Force 1955-1957. He received his B.S. in Biology from Western Kentucky University, Bowling Green, in 1954, his M.S. in Zoology from the University of Kentucky, Lexington, in 1959, and his Ph. D. in Genetics from Ohio State University, Columbus, in 1962. Shortly afterward, he joined the faculty in the Department of Biological Sciences at the University of South Carolina, Columbia where he achieved full professorship in 1971. Wallace served there as Department Chair (1974-1977), and then as the endowed George Bunch Chair Professor (1977-1980), retiring as Professor Emeritus (2003).

He was a Visiting Scientist at the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (1979), and Visiting Professor, University of South Carolina, Spartanburg (1980). Professor Dawson established the *Peromyscus* Genetic Stock Center at the University of South Carolina in 1985, continuously supported by the National Sciences Foundation (NSF) Biological Resources program since then, with funding from the National Institute of Health (NIH) grants (1998 on), user fees and institutional funds. The Stock Center has its antecedents from 1915 for its *Peromyscus* genetic research and stocks. *Peromyscus* or Deermice are experimentally invaluable as biological models for emerging diseases, particularly Lyme and hantavirus. Permanent wild-type stocks were developed by Prof. Dawson for the Deermouse species *P. californicus, P. eremicus, P. aztecus, P. leucopus*, with highly inbred lines established and maintained for *P. maniculatus* and *P. leucopus*. These deermice and their utility to biomedical and genetic research were the essential and devoted core to Prof. Dawson's career, over four decades. In recognition of this,

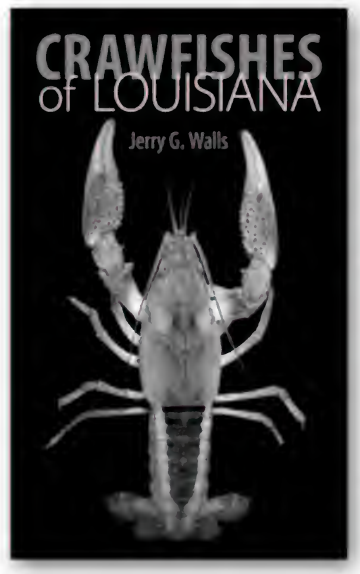
the University of South Carolina established the endowed Wallace D. Dawson *Peromyscus* Genetic Research Fund in 2013.

His research collaborations were national and international, with four Postdoctoral researchers (China, U. S.). Ten graduate students completed their M.S. and Ph.D. degrees under Wallace's oversight, with numerous undergraduates participating in *Peromyscus* Stock Center research. His collaboration with other faculty and colleagues resulted in numerous peer-reviewed publications. Prof. Dawson created the online Deermouse information database Perobase (http://wotan.cse.sc.edu/perobase/) and published, quarterly since 1986, The *Peromyscus* Newsletter, now online at http://stkctr.biol.sc.edu/newsletters/index.html.

Wallace Dawson was honored by the USC Honors Program Teaching Awards (1978, 1984), Sigma Xi (1959, 1964), the George Bunch Chair Professorship (1977), NSF Cooperative Graduate Fellowships (1960, 1961), and NSF Summer Graduate Fellowship (1959). He was an active member of various professional societies, including the American Association for the Advancement of Science, American Genetics Association, American Society of Mammalogists, Association of Southeastern Biologists; Genetics Society of American, Sigma Xi, Society for the Study of Evolution, and the South Carolina Academy of Science.

In lieu of flowers, donations may be directed to the "USC Educational Foundation" at the University of South Carolina. Please note in the "For" or "Memo" line that the donation should be directed to the "Wallace D. Dawson *Peromyscus* Genetic Research Fund." Mail to: The USC Educational Foundation, 1600 Hampton Street, Suite 738, Columbia, SC 29208. Burial will be private and plans for a memorial service in the Rutledge Chapel at the University of South Carolina are underway.

Submitted by John M. Herr, Jr., Department of Biological Sciences, University of South Carolina, Columbia, SC 29208.



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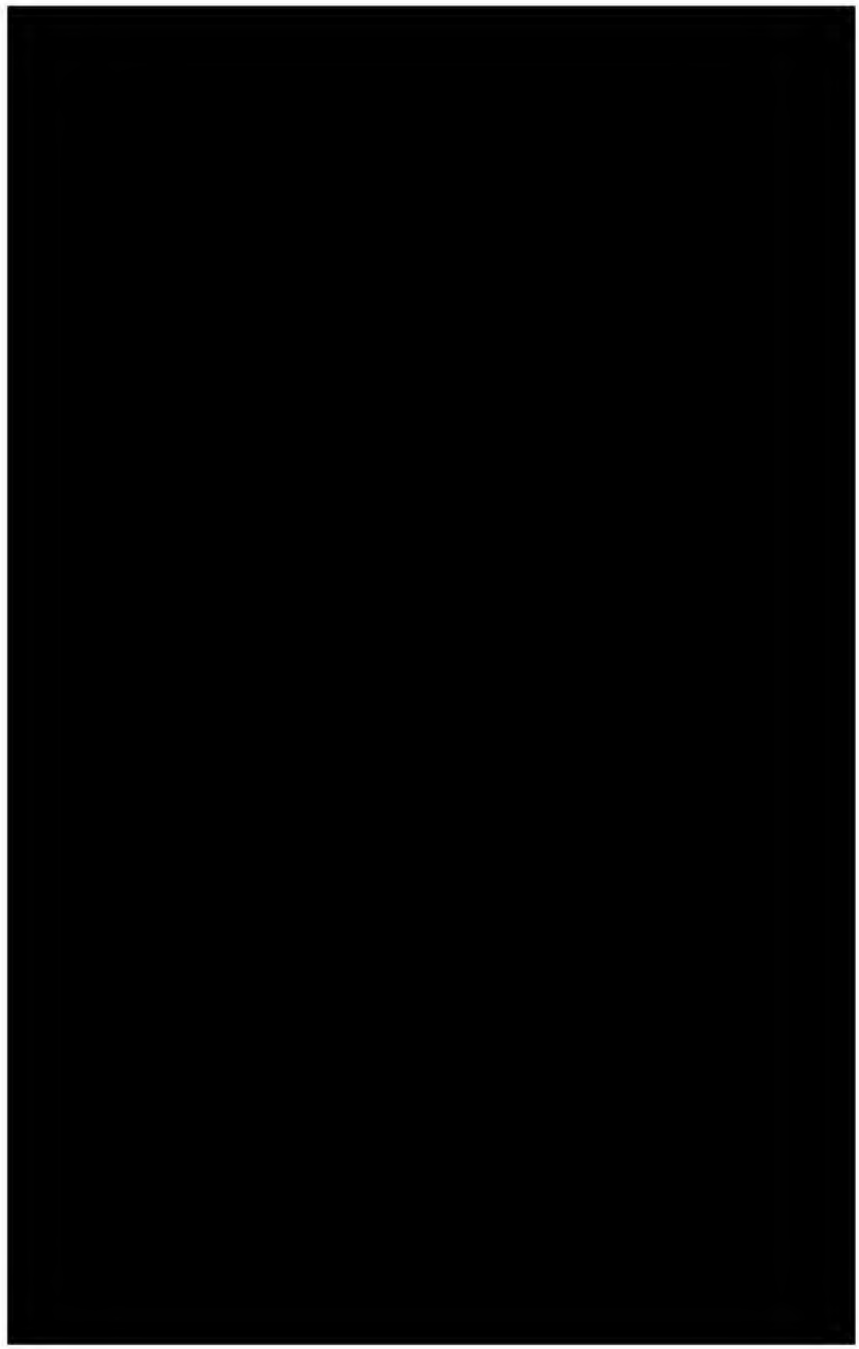

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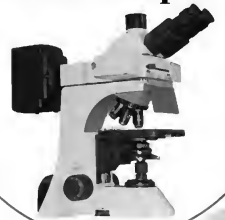

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