mice and the 3 SH mice were photographed and the areas and diameters of the cells were measured using Image J. The mean diameter of the cardiomyocytes decreased by 16% following SH compared to the control cells. Although there appeared to be a similar decrease in area, a Student's T-test determined that the means of the control and treated groups were not different ($p=0.056$). Other cells, such as neurons, have been shown to decrease in size after SH but whether the mechanism is similar in cardiomyoctes is unknown.

THE EFFECT OF GLIMEPERIDE AND GLIPIZIDE ON MYOCARDIAL PROTECTION IN STEM CELLS. Jessice R. Themak & Kathryn E. Loesser-Casey, Dept. of Biol., Univ. of Mary Washington, Fredericksburg, VA, 22401 Sulfonylureas are hypoglycemic drugs often used to treat patients suffering from diabetes mellitus. They work by binding to and blocking ATP sensitive potassium channels in β-cells of the pancreas thus regulating the release of insulin. These K^+ ATP channels are also present on the membranes of cardiomyocytes and the opening of these channels can have a cardioprotective effect. However sulfonylureas may ameliorate the beneficial effects of K_{ATP} channels openers and thus prevent myocardial preconditioning, increase infarct size, and reduce time before ischemic contracture develops. A newer sulfonylurea, glimepiride may be more effective in treating diabetes mellitus due to its lower binding affinity for K_{ATP} channels in cardiac cells which suggests that ischemic preconditioning can be maintained with pre-treatment of this drug. To further investigate the effects of glimepiride on myocardial preconditioning, brown adipose tissue-derived stem cells were pretreated with glimepiride and glipizide and then exposed to hypoxia for a period of 18 hours. The mean number of surviving cells appeared to be greater in those cells pre-treated with glipizide when compared to the control. However, statistical analysis revealed that glipizide or glimepiride had no effect on myocardial preconditioning. Further study should be conducted to look at the effects of sulfonylureas on myocardial metabolism as well as action potentials which also seem to play an important role in preconditioning.

Biomedical and General Engineering

(No Abstracts Submitted)

Botany

PHYLOGENY OF THE LEGUME GENUS *ARACHIS* USING NUCLEAR AND PLASTID SEQUENCE INFORMATION. S.A. Friend[1], D. Quandt[2], & K.W. Hilu[1]. [1]Dept. of Biological Sciences, Virginia Tech., Blacksburg, VA 24061and [2]Rheinische Friedrich-Wilhelms-Universität, Nees-Institut für Biodiversität der Pflanzen, Meckenheimer Allee 170, D-53115, Bonn, Germany. The peanut genus *Arachis* L. (Fabaceae) contains 80 species and is native to South America. Krapovicaks and Gregory (1994) divided *Arachis* into nine sections based on morphology, geographic distribution and cytogenetics: *Arachis,Caulorrhizae, Erectoides, Extranervosae, Heteranthae, Procumbentes, Rhizomatosae, Trierectoides*, and *Triseminatae*. The largest of these, section *Arachis*, has been further subdivided into three genomes (A, B, and D) based on cytogentics. While this genus contains the crop peanut, a

comprehensive phylogeny for *Arachis* is lacking. Sequence information from plastid *trn*T-*trn*F and nuclear ITS from a total of 47 species representing all nine sections have been used to reconstruct the first molecular phylogeny for the entire genus, with *Chapmannia* and *Stylosanthes* as outgroup. Our results from ITS sequences show that the allotetraploid species *A. hypogaea* and *A. monticola* contain alleles that represent the proposed A and B genome progenitors, *A. duranensis* (A) and *A. ipanensis* (B). The sections *Caulorrhizae* and *Triseminata* are monophyletic, thus validating these sections. *Arachis macedoi* (section *Extranervosae*) is the first branching lineage, while the remaining species of this section are resolved in a terminal clade. Majority of the *Arachis* species are resolved in one of three main clades. The terminal clades (*Arachis* I and II) are comprised of section *Arachis* species and other sections placed within these.

STUDIES OF THE HEPATICAE AND ANTHOCEROTAE ALONG HAZEL RUN IN ALUM SPRING PARK, FREDERICKSBURG, VA – COMPARISON OF SAMPLING METHODS. Stephen W. Fuller & Emily Noordhuizen, Dept. of Biological Sciences, Univ. of Mary Washington, Fredericksburg, VA 22401. Initial sampling, carried out in the fall of 2008, used a complete sampling strategy to determine what liverworts and hornworts live in this habitat. To insure that the survey was as exhaustive as possible, it was repeated. In the spring of 2009 a stratified random sampling method was used on the same stretch of the stream to determine the comparative amount of labor involved and how efficacious this method would be in finding these species. The fall sampling was done to identify species which could be observed on botany field trips, whereas the spring sampling objective was to decrease the time and effort involved in sampling the entire course of the Hazel Run creek. Twelve species of liverworts and hornworts were found in the complete sampling, which required approximately 27 hours of field work. The random sampling technique revealed 8 species; it required about 8 man-hours to measure the strata, and about 20 man-hours of additional field work to locate the random collection sites and examine them for potential specimens. The stratified random sampling in the second survey proved to be less complete and just as time consuming as the complete sampling protocol; therefore, stratified random sampling would not seem to be a method of choice if one were interested in maximizing the number of liverwort and hornwort species found in this type of habitat, or in decreasing the effort involved in a survey of these plants.

A FLORISTIC SURVEY OF THE SMITH CREEK RESTORATION AREA IN ROCKINGHAM COUNTY, VIRGINIA. Karl V. Gorzelnik & Conley K. McMullen, Dept. of Biology, James Madison Univ., Harrisonburg, VA 22807. A floristic survey is being conducted as part of an ongoing collaborative project to monitor various aspects of a stream restoration project. The study area lies along part of Smith Creek in Rockingham County, Virginia. The intent of this project is to survey and catalogue vascular plants as a former pasture is being reclaimed. The results from the present survey will ultimately be compared with those obtained during later stages of the restoration, with the expectation of seeing an increase in diversity over the years. Plants are being collected and identified, and voucher specimens are being mounted

and stored at the James Madison University Herbarium (JMUH). From March 2008 through April 2009, 94 species have been collected and identified to species (32 families, 73 genera). Of these 94 species, 46 are native and 48 are introduced.

THE *FLORA OF VIRGINIA* PROJECT: A 2009-2009 UPDATE. Marion B. Lobstein, Dept. of Biology, Northern Virginia C.C., Manassas, VA 22205. Virginia, for its landmass, has the most diversity of vascular plant species of any state in the United States. It had the first flora, the *Flora Virginica* in 1739, yet does not have a modern *flora*. The Virginia Academy of Science for over eighty years has supported efforts to produce a modern *Flora of Virginia*. In 2001 the Foundation of the *Flora of Virginia*, Inc, was formed in 2001 and in May 2002 received 501(c) 3 status. Progress continues to be made on the efforts to develop a *Flora of Virginia* including fund-raising and public outreach efforts. Work on the content of the Flora of Virginia including the nearly 300 of the core illustrations have been commissioned, completed, and funded by VAS funds. A second Gwathmey Trust grant and one from the Robins Foundation have been awarded to the project this past year. The Academy, including the Fellows, continues to provide essential support including financial for this Project. Other progress includes completion of treatments of the dichotomous keys of 170 of the 201 vascular plant families in Virginia and the first step in developing species and genus descriptions has been completed. The second step of herbarium work on descriptions is 74% complete and the third and final step of species genus descriptions is 52% completed. The projected publication date is late 2012 or early 2013.

PLEOMORPHIC CHLOROPHYTES: A CHALLENGING PHENOMENON IN SPECIES SYSTEMATICS. Harold G. Marshall, Dept. Biological Sciences, Old Dominion Univ., Norfolk, VA, 23529-0266. The identification of chlorophytes is commonly based on standard keys that portray a representative figure and its dimensions. It is assumed that features given are stable and are major criteria used in identification. However, these illustrations commonly come from preserved field samples showing one stage in the species life cycle. Any deviation from these features has often led to establishing a new species, or varieties and forms of an existing species. Yet many of these taxa are pleomorphic, having multiple forms with morphological features that differ from the standard illustration in identification keys. To know these stages living specimens have to be studied. Unfortunately, little is known regarding the life cycle of many of these taxa, and life stages from a variety of chlorophytes have been mis-identified. These life cycle stages are under genetic control, with interaction from a variety of environmental factors (e.g. water temperature, nutrient concentrations and ratios, light intensity, predation, and other water quality variables) influencing the onset and duration of this development, indicating phenotypic plasticity is common among the chlorophytes. The study of living specimens and their life cycle is necessary to recognize this variability, plus the use of molecular genetic protocols to verify speciation among these taxa.

DARWIN'S GALÁPAGOS PLANT COLLECTIONS. Conley K. McMullen, Dept. of Biology, James Madison Univ., Harrisonburg, VA 22807. From 15 September to 20 October 1835, while serving as naturalist aboard HMS *Beagle*, Charles Darwin was

presented with an opportunity to collect plants from four islands within the Galápagos archipelago (Chatham, Charles, Albemarle, and James). Although not the first scientist to take plant specimens from the archipelago, Darwin nonetheless collected more specimens from more islands than his predecessors. It was these collections that Darwin sent to his botanical mentor John Stevens Henslow, who later passed them on to Joseph Dalton Hooker for study and publication in the first Flora of the Galápagos Islands. In fact, Darwin's collections comprised approximately 75% of Hooker's *An enumeration of the plants of the Galápagos Archipelago; with descriptions of those which are new*, which was published in 1847. Darwin's collections proved useful not only in the development of his theory on the formation of new species, but also in the relatively young discipline of plant geography.

PRELIMINARY STUDIES OF FLORAL ANATOMY OF *physalis* (SOLANACEAE). Paige E. Miller & W. John Hayden, Dept. of Biology, Univ. of Richmond, 23173. Near-anthesis flower buds of the tomatillo, *Physalis philadelphica* (syn.: *P. ixocarpa*), and a weedy relative, *P. pubescens*, were studied via light and scanning electron microscopy using standard techniques. Buds, flowers and fruits of *P. philadelphica* are larger than those of *P. pubescens*, but otherwise, the two species are structurally similar. Calyx consists of five fused sepals that are persistent and accrescent through fruit development. The rotate corolla consists of five fused petals each bearing a dark spot near the throat. Uniseriate trichomes, both glandular and eglandular, occur on surfaces of both perianth whorls. There are five stamens; basally, filaments are adnate to the corolla. Filaments are vascularized via a single amphicribral bundle. Anthers are tetrasporangiate, bilocular, and longitudinally dehiscent. The anther wall consists of a persistent epidermis, and a well-marked endothecial layer that varies from one to three cell layers thick; neither middle layers nor tapetum was observed in near-anthesis anther walls. The gynoecium consists of two fused carpels, the ovary region of which encloses two locules and large axile placentas bearing numerous ovules. The thickened base of the ovary wall functions as a nectar-secreting disk/nectary. Ovules are anatropous and unitegmic. Continuing studies will focus on the floral vascular system, as well as details of anther wall and ovule development.

THE POWER OF GENES IN UNDERSTANDING BIODIVERSITY: THE ROSIDS. Dipan H. Oza, Sunny S. Crawley, Chelsey M. Black & Khidir W. Hilu, Department of Biology, Virginia Tech, Blacksburg, VA 24060. We are assessing here the phylogenetic signal of genomic regions with different modes of evolution in resolving biological diversity using the “rosids” as a case study. The rosids are the largest lineage in flowering plants (angiosperms), comprised of about 70,000 species of diverse biological forms. Molecular phylogenetics brought the rosid families together from traditionally diverse angiosperm subclasses in a rather heterogeneous assemblage. We examine here the phylogenetic signal in two types of genomic regions that differ in rate of nucleotide substitution: 1) three rapidly evolving regions (*matK*, *trnK* intron , and *matR*), and 2) two slowly evolving genes (*atpB* and *rbcL*). When trees based on slowly and rapidly evolving genomic regions are compared, both displayed a similar amount of resolution but support for the nodes was significantly higher with the rapidly evolving regions. Using sequence information from all five genomic regions, the

support increases compared to the slowly evolving genomic regions alone, but quite similar to that obtained with the rapidly evolving genomic regions alone. Therefore, this study shows that rapidly evolving genomic regions provide more phylogenetic signal for resolving relationships among the rosids than the traditionally used slowly evolving regions.

HYDROPHILIC AND LIPOPHILIC ANTIOXIDANT CONTENT IN FIVE TROPICAL SPICES. Rachel E. Pence and Michael H. Renfroe, Dept. of Biology, James Madison Univ., Harrisonburg, VA 22807. Dietary sources of antioxidants are important as part of healthy diets because antioxidants are thought to help prevent various chronic diseases and provide multiple health benefits. We analyzed the antioxidant content of five tropical spices: allspice, cinnamon, cloves, ginger and nutmeg. Antioxidant content was measured using the ABTS/H_2O_2/HRP decoloration method, and means were compared using a one-way analysis of variance followed by Dunnett's T3 test for significance of differences of means. Cloves had the greatest hydrophilic antioxidant content but the least lipophilic antioxidant content. Lipophilic antioxidant content was greatest in allspice, while the hydrophilic antioxidant content of allspice was second only to cloves. Ginger was relatively low in antioxidants compared with the other spices. Total antioxidants was greatest in cloves. Studies of antioxidant content in spices can provide information helpful to planning healthy diets.

ISOLATION AND CHARACTERIZATION OF LEAF ENDOPHYTES IN BETULA UBER AND BETULA LENTA. Jessica D. Weaver & Kevin G. Jones, Univ. of Virginia's College at Wise, Wise VA 24293. Although originally described as a distinct species, *Betula uber* is now regarded as a variant of *Betula lenta*. A ubiquitous characteristic of angiosperms is that their healthy tissues show symptomless internal colonization by fungi called endophytes. The purpose of this research is to initiate a survey of the endophyte complement of *Betula uber* and *Betula lenta* and to investigate the effects of leaf shape on endophyte colonization since theses trees differ markedly only in leaf form. Surprisingly, gross morphology of the fungi revealed that there were no common endophytes between *Betula uber* and *Betula lenta*. There is great diversity in endophyte populations within and between these species; but, our results may simply reflect the natural diversity of endophytes. Because there is such diversity, no conclusions about the effects of leaf shape can be made at this time, and more samples need to be collected and analyzed. (Supported by the Virginia Academy of Science).

Chemistry

THE ENZYMATIC ACTIVITY OF MshA: A FUNDAMENTAL ENZYME IN MYCOTHIOL BIOSYNTHESIS. T. W. Boshers & M. Hernick, Dept. of Biochemistry, Virginia Tech, Blacksburg, VA 24061. Mycothiol is the primary reducing agent used by mycobacteria to prevent against oxidative damage. Consequently, enzymes involved in mycothiol biosynthesis are targets for antibiotic development. MshA is a glycosyltransferase that catalyzes the transfer of GlcNAc from UDP-GlcNAc to