Skidmore Undergraduate Research Conference
October 1, 2011

Abstracts of Student Research Projects

The abstracts are listed in alphabetical order by the last name of the lead student author

Thee Interferon-Stimulated Gene IFITM3 Decreases Reovirus Infection Efficiency in Hela Cells

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Reoviruses are double-stranded RNA viruses that infect the mammalian respiratory and gastrointestinal tract. In newborn mice, these viruses injure a variety of host tissues, including the brain, heart and liver. Reovirus infection elicits a number of host defense responses, including the production of interferons (IFNs), which trigger cellular antiviral pathways through the induction of interferon stimulated genes (ISGs). Although hundreds of ISGs have been identified, the functions of most of these genes are not known. Among the ISGs is a family of proteins of unknown function, called the interferon inducible transmembrane (IFITM) proteins. One member, IFITM3, has recently been shown to restrict influenza virus entry. As IFITM3 resides in late endosomes, where reoviruses undergo proteolytic disassembly, we sought to determine whether IFITM3 also restricts reovirus entry. Cells constitutively expressing IFITM3 (HeLa-IFITM3) or control cells (HeLa-Scr) were infected with reovirus at various multiplicities of infection (MOI). Efficiency of infection was assessed 18h post-infection by determining the percentage of infected cells via immunofluorescence microscopy. HeLa-IFITM3 cells were less susceptible to infection by reovirus, as they exhibited significantly lower percentages of infected cells in comparison to HeLa-Scr cells. However, this difference diminished at higher MOI. To control for factors associated with protein over-expression, we performed similar experiments in cells expressing an siRNA targeting IFITM3 (HeLa-shIFITM3) and control cells, which were either mock-treated or treated with human interferon-β for 4h prior to infection. Preliminary results suggest that HeLa-shIFITM3 cells exhibited a smaller decrease in infection in the presence of IFN than the control cells. These results suggest that IFITM3 restricts reovirus replication, likely at the cell entry stage. On-going research seeks to use confocal imaging to track labeled viral particles as they enter the endosomal compartments of both HeLa-IFITM3 and control cells.

Spatial Learning in Crayfish: Salience of Visual and Tactile Cues

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Several experiments were performed with crayfish, *Orconectes rusticus,* to examine the specific types of cues crayfish use when learning a new environment. Past research indicates that crayfish will initially spend time actively exploring a new area. Once they become familiar with the environment, this exploratory behavior decreases. A change to the environment can result in renewed exploration. We used these behaviors to determine if visual or tactile cues are most salient to crayfish as they learn spatial information. Animals were tested in arenas that were divided into an equal grid of squares and had movable panels that allowed for topographical and visual changes. In one experiment, crayfish were allowed to explore the arena for three hours a day, over a series of three days. On the fourth day animals experienced a probe test during which the arena was altered. One group experienced altered visual cues, one group experienced altered topography, and a control group experienced no change. Exploratory behavior was measured by the number of grid squares entered, the time spent moving, the time spent in contact with walls, and the time spent in contact with panels. In the second experiment, the same arena was used and animals were tested in a single day rather than over a series of days. Each animal spent five hours in the arena with exploratory behavior measured for the 1st and 5th hour. Crayfish were then removed from the arena for an hour while the arena was altered to have either novel visual or tactile cues. Animals were placed back in the now altered arena for an hour and exploratory behavior was recorded. In both experiments, crayfish habituated to the arena environment, displaying decreased time and distance walked in a single learning trial and across different days. Preliminary results indicate that, during the first 10-minute segments of the probe tests, crayfish crossed significantly more squares when topographical cues were altered relative to visual cues or the control condition. The crayfish in the topography-change group apparently recognized that the environment had changed and engaged in renewed exploration. These data suggest that, compared to visual cues alone, topographical features are more salient to crayfish as they learn about and remember new environments.

The Effects of Altered Core Temperature on Cardiovascular Strain, Thermal Strain and Performance

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Exercise in environmental extremes elicits physiological alterations in thermoregulatory, cardiovascular, and metabolic function in humans. **Purpose:** The purpose of this study was to examine cardiovascular, metabolic, and performance responses during maximal exercise performed at 3 different core temperatures:

normal, elevated, and depressed core temperature. **Methodology:** Ten healthy, highly-fit males were recruited to participate. On separate days, the normothemric condition was performed first followed by pre-cooling and pre-heating conditions in a randomized order. Participants were submerged in water up to their armpits at 23.1 and 38.9 °C in the pre-cooling and pre-heating conditions, respectively, followed by a brief transition period prior an incremental, maximal treadmill test. **Results:** Submersion resulted in significantly altered mean core temperature prior to exercise among the control (0.1 ± 0.2 °C), pre-cooling (-0.5 ± 0.2 °C), and pre-heating (+0.8 ± 0.2 °C) conditions. Core temperature remained significantly different throughout the exercise protocol and furthermore, the pre-cooling condition had a significant condition x time interaction versus the other two conditions. Mean and peak oxygen consumption was not significantly different among trials. Pre-cooling participants resulted in a 8-10 b·min-1 reduction versus pre-heating and control condition at any given time point during the exercise protocol including peak (pre-cooling 178.4 ± 9.3 b·min-1; pre-heating 186.7 ± 7.8 b·min-1; control 188.2 ± 5.8 b·min-1). Time to fatigue was significantly longer in the control condition (914.3 ± 97 sec) versus the pre-heating (879.9 ± 96.3 sec) and pre-cooling (889.2 ± 96.5 sec) conditions. **Conclusion:** Depressions (pre-cooling) in core temperature significantly reduced cardiovascular strain at any given workload and significantly changed participants' thermoregulatory response to exercise. Alterations in core temperature did not increase the metabolic strain placed on participants, however, pre-cooling and heating decreased time to fatigue. Early onset of fatigue without increased cardiovascular or metabolic strain can be attributed to central fatigue and depressed sympathetic activity for the pre-heating and pre-cooling conditions, respectively.

Phylogenetic Analysis of Nematodes Using Ribonuceloproteins

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As the most abundant and diverse roundworm in the phylum pseudocoelomates, with over 100 million undescribed species, nematodes are very difficult to classify morphologically because they are as small as 2.5mm long. Instead, their genomic data can be useful. Studies by De Ley and Blaxter (References) showed that small subunit ribosomal DNA (ssrDNA) was the best locus for molecular classification in nematodes. However, a fully conclusive phylogenetic tree has not been provided yet. Our research foci are to find new phylogenetic markers, design degenerate primers to amplify regions of interest from known and unknown nematode species, and reconstruct phylogenetic relationships among these nematode species based on the newly retrieved sequences.

A former Hamilton graduate, Suman Sarkar '11 sampled sequences from nine species across the animal kingdom: *Trichoplax adhaerens*, *Homo sapiens*, *Caenorhabditis*

briggsae, *Caenorhabditis elegans*, *Brugia malayi*, *Shistosoma mansoni*, *Giardia lamblia*, *Leishmania braziliensis*, and *Trypanosoma cruzi* and found that ribosomal proteins L10e, L12e, L15e and L19e were highly conserved. We aligned RPL19e and RPL8 sequences from 14 different nematode species in NCBI and KEGG databases and we designed degenerate primers targeting the most conserved regions. We then sequenced PCR products amplified from cDNA of five nematode species: *Cephalobus cubaensis*, *Acrobeloides uberrinus* and *Cephalobus sp.*, *Eucephalobus sp.*, and*Acrobeloides buetchlii.*

Our results showed that the primers designed specifically against RPL19e (~150aa) and RPL8 (~100aa) successfully amplified the region of interest. However, we still need to confirm whether or not the same primer combination would work on virtually all unknown nematode species, for which further testing of the primers is necessary. Because 100aa and 150aa provide little phylogenetic information, we are adding more markers into our study in the future.

The Effects of Facebook on Siena College Students

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Professor Dr. Paul Murray, Sociology Department, Skidmore College

This project looked at ways in which Facebook affects students. Some questions asked how students use Facebook, how much of a distraction Facebook is, and awareness of Facebook privacy policies. An electronic questionnaire was e-mailed to all current Siena students. There were 457 responses. The main reason Siena students use Facebook is to connect with distant friends. Underclassmen are more likely than upperclassmen to use Facebook for schoolwork-related reasons. There is some negative correlation between time spent on Facebook and GPA, but it is not significant. The majority of students do not believe Facebook is their biggest distraction. Female students are more likely than male students to have their profile set to private, to deny a friend request from a stranger, and to block someone who has made them feel uncomfortable. Most students are at least somewhat aware of Facebook's privacy policy.

Speaking of Smells: The Relationship Between the Verbal Description of Odors and Memory Recognition

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Smell is often associated with strong memories yet much remains to be discovered about the relationship between the two. Specifically of interest in the present study is the effect that the verbal description of an odor has on memory recognition. Intuitively, it is suspected that verbal description would improve subsequent memory

performance. However, the phenomenon of "verbal overshadowing" suggests verbalizing a perceptual experience may actually interfere with one's ability to accurately recall a memory. In the study, the subjects' ability to recognize specific odors after simply smelling them is compared to the recognition ability of subjects who verbally describe the odors. Subjects were randomly placed into one of three groups for Phase 1 where they were asked to either self-generate a description, choose a description, or solely smell each target odor. After initially smelling the odors, all subjects participated in an unrelated task before being presented with a set of 20 odorants, 8 being the target odors from Phase 1. Odorants from the 20-odor set were presented one at a time and subjects were asked to indicate if they recognized each particular odorant from the original set. Since describing the odorants reduced the ability to "remember" the smells as compared to the group that used no names at all, the results are consistent with the hypothesis that verbal overshadowing reduces the accuracy of olfactory memory.

Synthesis of Cyclotri (3,3''-para-terphenyldiyl ethynylene), a Novel Shape-Persistent Macrocyclic Carbon Single-Wall Nanotube Precursor.

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Shape-persistent phenylene ethynylene macrocycles have attracted attention because of their ease of synthesis and supramolecular properties. However, the reactivity of the alkyne moieties could allow conversion of the nominally planar ethynylene macrocycle into compounds with a dimensionality along the axis of the macrocycle; the result is a precursor structure for single-wall carbon nanotube segments. To incorporate the para-terphenylene units into the title compound, the synthesis of an ethynylterphenyl monomer was undertaken, which will be followed by statistical macrocyclization under highly dilute Sonogashira cross-coupling conditions.

Heat-Seeking Behavior in Bird Lice: Thermal Cues Mediate Host-Parasite Interactions

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Ectoparasites are often forced to choose between obtaining resources and escaping from host defenses. This decision is especially important for the feather-feeding wing lice of pigeons and doves. Wing lice feed on downy feathers only found on bird body regions. However, when in these resource-rich regions, lice are vulnerable to host preening. To escape preening, wing lice migrate away from their food source to hide in the barbs of wing and tail feathers. Here, we show louse thermo-orientation aids in their migration between the body and flight feathers. Lice were capable of orienting

on thermal gradients similar to those found on birds. Additionally, we show that food deprivation changes the temperature preference of lice; staved lice show greater preference for temperatures associated food-rich body regions whereas fed lice prefer temperatures associated with safer flight feathers. Studying thermo-orientation behavior can provide a clearer picture of how parasites use host resources and transmit between hosts.

Chemical Biology of cell wall-altering agents in *Penium margaritaceum*, a unicellular model system for anisotropic growth studies in plants

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The Charophycean Green Algae (CGA) represent some of the closest relatives to land plants and could provide a key to understanding their ancestry as well. *Penium margaritaceum* is a unicellular member of the CGA and recent analyses have demonstrated that this desmid produces a cell wall containing many of the polymers found in higher plant cell walls. Homogalacturonan (HG), rhamnogalacturonan-I (RG-I) and cellulose constitute the dominant wall macromolecules, and are organized in three distinct layers as visualized using transmission electron microscopy. Development of these polymers during wall expansion can be analyzed using live cell labeling with monoclonal antibodies raised against epitopes of similar polymers of land plants. The stable cylindrical phenotype of this alga also allows for quantitative assessment of new wall growth. In this study, we interrogated the wall synthesis mechanism and alterations to the cell wall using a variety of agents that disrupt wall development.

A Tale of Two Interglacials: A Stalagmite Stable Isotope Record Of Climate in Yucatán, Mexico Since 128,000 YBP

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Earth's glacial climate has been punctuated with warm interglacial periods lasting ~10,000 years each. Current anthropogenic greenhouse gas forcing is pushing climate towards a state that deviates from the established Quaternary patterns. In predicting future rapid climate two key analogs are the end of the last glacial, Termination 1 ~14,000 years ago, and the Eemian, which is the penultimate interglacial ~130-114,000 years ago. Speleothems, or cave formations, record changes in the isotopic composition of rainwater infiltrating the cave during these paleoclimate shifts. Stalagmite YAX-2 was deposited in Yucatán, Mexico within a ~40m deep cave lacking natural entrances from ~128,000 years ago to the most recent millennium,

therefore including both analogs. U/Th dating shows that YAX-2 grew most rapidly during interglacials. We present the YAX-2 record of stable carbon and oxygen isotope values as indicators of environmental change in Yucatán, Mexico and compare our results to published research on abrupt tropical climate change and interglacial dynamics.

Effects of MNTBAP and Co Treatment on Adiposity and Rev-Erb Dependent Expression

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PGC-1α is a master regulator of mitochondrial biogenesis and is regulated by the transcriptional repressor, Rev-ERB. Rev-ERB may be inhibited by carbon monoxide (CO), a byproduct of the degradation of Heme by the enzyme HO-1. MnTBAP is a heme-like compound that appears to turn-on mitochonadrialbiogenesis and cause weight loss in obese mice. We have investigated the effects of MnTBAP or CO treatment on Rev-ERB dependent gene expression. In obese mice treated withMnTBAP, we observed significant reductions in adiposity andan increase in PGC-1α and ApoCIII expression, two targets of Rev-ERB. CO treatment resulted in no changes in adiposity butApoCIII appears to increase. Therefore, preliminary data indicates that decreases in adiposity appear to be unrelated to changes in Rev-ERB dependent gene expression.

Chronic Cannabinoid Exposure During Adolescence Affects C-Fos Expression in Brain Areas That Mediate Sexual Motivation in Adult Female Rats

Samuel I. Brook
Professors Hassan H. Lopez, Ph.D., Alicia J. Saylor, Ph. D., Neuroscience Program, Skidmore College

The endocannabinoid system seems to play an important organizational role in the development and emergence of neuroendocrine systems that regulate female sexual behavior. In particular, chronic cannabinoid exposure during adolescence decreases behavioral measures of sexual motivation in adult female rats, and is associated with a decrease in CB1 receptor expression in the hypothalamus and amygdala. We investigated the effect of chronic cannabinoid exposure at the cellular level by assessing neuronal activity within several brain regions that are thought to mediate sexual motivation in female rats. The synthetic cannabinoid CP-55,940 was chronically administered to adolescent female rats once daily (0.4 mg/kg, i.p.) for 10 days (PND 35-45). Once sexual maturity was reached (PND 70), female rats determined to be either in estrous (sexually receptive) or non-estrous (sexually unreceptive) were exposed to a male target rat, using a paradigm specifically designed

to induce sexual motivation while preventing consumatory and/or copulatory behaviors. One hour after the "exposure test" we sacrificed animals in preparation for analysis of c-fos immunoreactivity in hypothalamus, amygdala and nucleus accumbens. We hypothesize that cannabinoid-treated animals will have reduced c-fos expression in sexual motivation-related brain areas and that this functional deficit will only occur during estrous.

Using Polarizers in Single Molecule Magnet Mn12 Acetate Terahertz Spectroscopy

Xinru Cheng, Chi Yung Fung
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As part of a continuous effort at Colgate to study the crystal Mn-12-acetate with terahertz spectroscopy, our project this summer aims at using polarizers to better control the polarization in measurements of transmission, in order to search for relationships between the disorders that cause individual molecules of Mn12-acetate to absorb different photon energies, and the disorders that cause them to exhibit quantum tunneling.

The research methodology mainly consists of probing the Mn12-acetate sample, which is aligned with a magnetic field of 7 Tesla and cooled to 4.2K in a cryostat, with THz pulse that goes through three linear polarizers. In order to conserve spin, the crystal sample only absorbs a portion of right circularly polarized (RCP) THz signal while transmitting the left circularly polarized light (LCP), causing the output from the sample to become elliptically polarized. We used wire-grid polarizers to measure the horizontal and vertical components of the sample's elliptical output. Then we programmed the computer to resolve the signal into transmission graphs for LCP and RCP using a mathematical relationship between linearly and elliptically polarized light. Thus we were able to obtain a more complete picture of the sample's absorption characteristics.

On the absorption versus frequency graphs obtained after Fourier Transform, we expected to see a sharp dip at 300GHz signifying the sample's absorption of the pulse. Our calculations also predicted the transmission graph of LCP to be significantly bigger than that of RCP. However, after running extensive checks and repeating processes like sample preparation to achieve the best results, we encountered a noise issue during the last week of the project. The noise size was big enough to affect the signal, and we could not account for its source at the moment. Work on this project will be continued in the coming semester by Chi Yung Fung.

Biomechanics of S-Looping

Kevin T. Chico

Professor Ashok Ramasubramanian, Mechanical Engineering Department, Union College,

1.3 million Americans have a congenital heart defect. Abnormal heart looping is a major cause. With the chick embryo as the experimental model, we are studying early s-looping, a stage of heart development when the primitive atria move superior to the primitive ventricle. Our aim is to test the effects of removing the splanchnopleure (SPL) and arresting heartbeat on s-looping.

Materials/Methods: Fertilized white Leghorn chicken eggs are incubated to HH Stage 12. For one group, the SPL membrane overlaying the heart is removed through dissection. Another group receives a 1ml solution of 0.8 µM verapamil to stop heartbeat. Both groups and a control group are cultured in an O2-rich environment.

Results: Please see Figure 1

Discussion: In c-looping, which directly precedes s-looping, the torsion of the heart tube is delayed by SPL removal, but not stopped. By contrast, the SPL seems to be necessary for early s-looping (Figure1 B,B'). An arrested heartbeat has no effect on c-looping. The same seems to be true for early s-looping (Figure 1 C,C').

Are the Catskills Streams Fast or Slug-Like at Retaining Phosphorous?

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Headwater streams are points of connection between terrestrial landscapes and larger aquatic ecosystems. Due to high physical complexity, shallow depths, and high rates of biological activity, headwater streams are known to have high nutrient processing rates. Nutrient processing is critical to maintaining downstream water quality. Therefore, what controls nutrient uptake in streams is a critical ecological question. We measured nutrient uptake in 14 streams in the Catskills Mountains, NY. At each site, we added a concentrated solution of phosphorous and a conservative tracer and tracked both at downstream location. Biological uptake results in phosphorous retention, but salt is only affected by dilution. Thus, the difference between the two allows us to measure phosphorous retention in the study reach. Ambient phosphorous concentrations ranged from 1-11 µg/L PO4-P. Phosphorous uptake lengths ranged from 15-110 m; indicating high rates of retention. Phosphorus uptake length increased with discharge. Ammonium uptake

and phosphorus uptake were highly correlated and this correlation indicates that biological processes are controlling uptake across these sites.

From Old Virginia to the Beautiful Blue Danube: Banjo Instruction Methods in Nineteenth-Century America

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Hamilton College

The banjo was brought to America in the mid-seventeenth century by West African slaves. However, during the early nineteenth century white musicians began to play banjos, particularly in minstrel shows. The first banjo tutor (musical instruction book), published in 1848, was aimed at these players, but soon authors sought to reach a wider audience, especially middle-class women who could increase the instrument's respectability; as a result, pedagogical methods, playing styles, and repertoire changed. Hamilton College recently acquired twenty-nine banjo tutors and thirteen other such banjo-related books from the nineteenth and early twentieth centuries. Many are rare; some are unique. All document the musical and social culture of the banjo in America. My paper assesses the various pedagogical methods used in each book, examines playing styles and their contexts, and studies repertoires (classical, minstrel, parlor song, folk).

The number of these banjo tutors meant that in-depth exploration of each book was impractical; however, I surveyed the overall collection, noting different pedagogical methods and amassing data (composer, instrumentation, and popularity of each tune) on the vast repertoire. Ichose five of the most significant books to examine fully.

I determined that the repertoire shifted from an emphasis on minstrel songs to popular European classical music such as "The Blue Danube Waltz" and excerpts from *Il trovatore*, partially effected by the shift in playing style from "stroke" to "guitar" style. Further, these tutors used different pedagogical methods in an attempt to provide instruction without a teacher, and I tested these approaches, learning banjo from their books. Finally, I clarified the different roles that each author played in shaping the reception and place of the banjo in American society during the nineteenth and early twentieth centuries.

***Taylor vs. New Rochelle*: Community Distress before the Public Trial**

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Taylor vs. New Rochelle is a little known 1961 school desegregation case oftentimes referred to as the "Little Rock of the North." Deeply dividing the community of New Rochelle, the case served as a reminder that the South was not the only region beset with the problem of segregation.

Since 1930 the concentration of African American pupils and allegations of poor educational standards at Lincoln School had brought accusations of racial segregation. The discontent of Lincoln School parents sparked a community crisis in 1960 following the refusal of the school board to allow Lincoln School students to transfer to other elementary schools within the district. After numerous protests and "stay-outs" encouraged by legal counsel Paul Zuber, the case appeared before Federal District Court Judge Irving Kaufman who ruled that Lincoln School had been deliberately segregated. *Taylor v. New Rochelle* was the first case in which a northern school district was ordered to desegregate.

The paper will address the question, "Why did the issue of segregation at Lincoln School become such a pronounced issue in 1960 as opposed to the decades before when controversy first materialized?" The paper will address events during 1960 that resulted in the case going to trial, and focus on how and when the issue of segregation at Lincoln School became prominent. This will involve analyzing various sources collected from the National Archives including the trial transcript, articles and letters to the editor from the New Rochelle *Standard Star*¸ as well as interviews with individuals who attended Lincoln School and remember the events that transpired.

This paper will explain how the landmark *Brown v. Board of Education* decision provided legal basis to argue that racial imbalance in Lincoln School was unconstitutionally created, a precedent that did not exist when the issue first was raised. The paper will also explain how the propaganda and publicized "stay outs" initiated by attorney Paul Zuber brought attention to the issue of northern segregation at a time when civil rights was a growing concern throughout the nation.

Linking the Distribution of a Noxious Exotic Plant, *Alliaria petiolata* (Garlic Mustard), and Candidate Dispersal Vectors.

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Riley Neugebauer, Sustainability Coordinator and Josh Ness, Biology Department and Environmental Studies Program, Skidmore College

Invasive species have been identified as a leading cause of habitat degradation worldwide. Garlic mustard, *Alliaria petiolata*, is recognized as a particularly problematic invader of temperate deciduous forests in the eastern United States and Canada. Unlike more benign exotics, this herbaceous plant is adept at colonizing undisturbed habitats. Once established in those sites, *A. petiolata* exerts a strong

competitive effect on other herbaceous plants and poisons the mycorhizal fungal associates so important to many plant species characteristic of temperate deciduous forests. As a result, *A. petiolata* is a *cause* of degradation rather than a *symptom*. Here, we map the distribution of >15,000 sexually mature *A. petiolata* plants within a forest on the campus of Skidmore College, and ask what factors might best describe the current distribution of the exotic within the forest. We conclude that 1) *A. petiolata* is currently confined to several large "super patches" within the forest, 2) these patches are exposed to high traffic (pedestrian, canine, and mechanical) but otherwise do not significantly differ in soil characteristics from non-invaded sites (i.e., these initially invaded sites are distinguished by an unusual degree of propagule pressure, rather than some intrinsic characteristic of the sites), 3) in the absence of further attention, these patches will continue to serve as a source of seed propagules to be transported by foot traffic (pedestrian and canine) deeper into the forest, and 4) that by collecting (killing) these 15,000 plants and mapping the current distribution of *A. petiolata* (including super patches and nascent "satellite" populations), we have taken a critical first step in protecting the forest from invasion.

Studies of Bifunctional Nanotether Influences on CdSe Nanoparticle Stability, Chromophore Distribution and Thin Film Morphology

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Professors Joanne D. Kehlbeck, Michael E. Hagerman, Chemistry Department, Union College

Solar energy can be harvested via numerous solar cell designs including dye sensitized solar cells and polymer photovoltaics. These third generation nanomaterials offer promises of lower cost and ease in manufacturing. A central focus of alternative energy research seeks to improve photocurrent efficiencies in these systems. Due to their high quantum yield with multiple exciton emissions, wide diameter range, and ability to tune various wavelengths of light emission, CdSe nanoparticles make for promising chromophores for solar cell light absorption and generation of current. The studies conducted this summer focused on generating novel quantum dots containing ligands capable of imparting useful properties to the nanoparticle. The specific ligand studied this summer was 4-aminobenzoic acid and its coordination to the CdSe surface. 1H NMR spectroscopy was used to monitor and quantify ligand exchange. Photophysical properties of the ligands and exchanged CdSe nanoparticles were examined by UV/VIS and fluorescence spectroscopy. Thin films cast with exchanged quantum dots from acidified solvents show promise for minimizing chromophore aggregation. Scanning electron microscopy (SEM) and atomic force microscopy (AFM) imaging were used to characterize thin film morphology. Energy dispersive x-ray spectroscopy confirmed location of CdSe nanoparticles by identifying elemental signa

Leaves of a Flower: A Latvian Woman's Tale

Philip Evangelista
Professor Elun Gabriel, History, St. Lawrence University

The purpose behind this project was to take the story of my grandmother, Ilga Rozitis, and compare it to other similar stories and put it in the context of history. My grandmother fled Latvia in 1944 and I grew up hearing these stories. The purpose of the project was to see if there were any trends in similar stories and also to put the stories in historical context as best I could. My research consisted of first reading background information on Latvia during World War II and after. Next I read memoirs by other Latvians who fled in the late stages of the war. I also interviewed my grandmother on three different occasions so that I could get the most accurate story that I could. After six weeks of research, I began to write my paper and still continue to work on it today. I anticipate by the finish of my project to have a thirty-page paper, hours of transcribed interviews, photocopied photos and primary documents.

Investigation of Invasive Plants in the Hamilton College Forests

Daniel Feinberg '12, Samuel Silverman '14, Mathew Combs '13, Ana Fernandez '13, Dilyana Mihaylova '12, Bethany O'Meara '12,
Professor William Pfitsch, Department of Biology, Hamilton

Several species of non-native invasive plants are prevalent in the forests surrounding Hamilton College in Clinton, NY. In July 2011, we measured the spatial distribution and abundance of five invasive plant species, *Alliaria petiolata* (garlic mustard);*Lonicera japonica* (Japanese honeysuckle); *Rhamnus cathartica* (common buckthorn); *Berberis thunbergii* (barberry); and *Rosa multiflora* (multiflora rose), in addition to those of the native *Allium tricoccum* (wild leek flower). We assigned abundance classes (ranging from 0 to 3) to each of the six species along 100 m x 25 m transects, and mapped the results using ArcGIS, Microsoft Excel, and Adobe PhotoShop.

We also began an investigation of soil conditioning by the invasive plants. Whereas many plants condition the soil microbial community to aid in their own growth, invasive plants can culture a microbial community to inhibit the growth of native plants. Using invasive *A. petiolata* and *L. japonica*, as well as native *Impatiens* (jewelweed) and *Symphyotrichum prenanthoides* (crookedstem aster), in a mixture of non-invaded forest soil mixed 2:1 with perlite, we transplanted multiple seedlings into 25 pots each and allowed them to grow for a period of 10 weeks. We also froze soil samples of the initial conditions for chemical and genetic analysis.

This study serves as the foundation for a project that, over the course of at least one

year, will assess the above- and below-ground effects of invasive plants on the native organisms and ecosystem processes of the Hamilton College forests.

Deletion of Genes Involved in Copper and Silver Resistance in *Cupriavidus metallidurans* CH34

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Isolated from a zinc decantation tank in 1976, *Cupriavidus metallidurans* CH34 harbors resistance to multiple metals, making it an ideal model organism for metal-microbe interactions. Genome sequencing and annotation identified several gene clusterswhich might be involved in coppers and silver resistance. Two of these clusters, *cop* and *sil* are located on one of CH34's megaplasmids, pMOL30. Using gene replacement, we aim to delete *silCBA*, *copF* and the 19 gen containing *cop* determinant in CH34 and predict an increased sensitivity of the resulting three mutant strains to copper and/or silver ions. The DNA fragments upstream and downstream of *copF* were successfully cloned into pCM184, flanking a kanamycin resistance cassette and the plasmid is currently transferred into *C. metallidurans* to replace *copF* with the antibiotic resistance. For the other two deletions, fragments downstream of *cop* and *silCBA* have been successfully cloned into pCM184 and the resulting plasmids are currently used to clone the respective upstream fragments. Once both fragments are in pCM184, the plasmids will be used to knock out the *sil* or *cop* determinant in CH34. The mutant strains will be tested for metal sensitivity giving insight into the involvement of these gene clusters in copper and silver resistance in *Cupriavidus metallidurans*.

Dragonfly TSDN Response Time to Simulated Looming Objects

Elon Gaffin-Cahn
Professor Robert Olberg, Biology Department, Union College

Dragonflies have high visual acuity, which, when combined with remarkably fast visual response, allows them to hunt with a high success rate. They do so by intercepting small flies in flight rather than by chasing from behind. Eight bilateral pairs of large Target Selective Descending Neurons (TSDNs) of the dragonfly ventral nerve cord respond to small, contrasting objects, which presumably represent potential prey. These interneurons are part of circuitry that triggers small changes in wing angle and position to control flight during prey interception. In flight, dragonflies extend their legs out to catch the prey about 20 ms before contact. The current research investigates the role of the TSDNs in prey contact. The dragonfly approaching the prey is simulated by generating a growing black circle on a screen. A dorsal approach is used to gain access to the ventral nerve cord. Neural responses of TSDNs are recorded with either tungsten microelectrodes or glass suction electrodes to test if the

interneurons can predict the time to contact of the looming stimuli. Anticipated conclusions are that selected TSDNs fire at a consistent interval before the calculated time to contact.

Expanding the Genetic Code of *E. coli* with Pyroglutamate

Sean Healton, Matt Walsh, and Madeline Frank
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Pyroglutamate is an amino acid formed from modification of glutamine in many proteins including beta-amyloid peptides associated with Alzheimer's disease and the anti-cancer agent, onconase. To facilitate studies of the role pyroglutamate plays in proteins, it would be useful to directly make peptides with pyroglumate. Our goal is to expand the genetic code of *E. coli* to incorporate pyroglutamate during translation in response to an amber stop codon. Our work this summer has centered on working towards testing our proposed system, both *in vitro* and *in vivo*. The necessary proteins and tRNA for *in vitro* testing have been isolated. We are developing a spectroscopic assay to test the system. We are also cloning relevant genes to test our system *in vivo*.

The All Too Brief History of KOM: Why Traditional Comics Failed During Perestroika

Kevin W Hoercher
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Comics in Russia stretch back to the seventeenth century. However, they did not share the same success in the early twentieth century as their counterparts in the US. Instead, they were discouraged by the government and largely left out of Russian culture. Traces of comics existed during Soviet history, but comics themselves had no niche in society. This trend would contiune until Gorbachev and Perestroika finally offered a legitimate chance for comics.

Perestroika and Glasnost meant two things for potential comics publishers. One, they now had the freedom to write and publish what they wanted. Two, they still had government subsidies to do so. This type of system was impractical and could not last forever, but it did give an opportunity for the Russian people to experiment with different mediums. Within this environment, Sergei Kapranov started Russia's first comics club: KOM. KOM would last five years and produce sixteen beautifully printed collections of comics, but would never gain widespread success or a successful following.

Why, when everything seemed right for a cultural flowering of comics in Russia, did KOM fail? This project seeks to answer this question. By examining the economic environment, the Russian people's perception of comics at the time, and the quality of

the comics themselves, one can begin to understand why comics in Russia evolved so differently from their counterparts in other countries.

This project found that the main reason for KOM's failure to gain a widespread following was due primarily to the Russian people's misconceived notions of comics. The economic environment was great for any publisher looking to experiment. The comics were printed in the best colors and on the best paper. And the stories themselves were often thought provoking and well executed. However, Soviet traditions made people wary of the combination of text and art.

Negotiating with the Enemy: Analyzing the Effectiveness of the United States' Foreign Policy Toward North Korea

Nicholas M. Hugh
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The issue of North Korea as a security concern, specifically in concerns to its nuclear weapons programs, remains a volatile and highly relevant international issue for the United States. This research analyzes how the U.S. has dealt with North Korea through the policies of the Clinton and Bush administrations, to determine how successful these administrations' policies have been toward effectively addressing and containing North Korea's nuclear ambitions. In order to do so, this research critically examines two diplomatic events in North Korean and U.S. relations, the 1994 Agreed Framework and the Six Party Talks. This was also done through analyzing past policy stances toward North Korea, toward greater coercive means or through diplomacy, and their consequences. Through this analysis, it was found that the U.S. has failed in the past diplomatically with North Korea due to a lack of enforcement measures to back up past diplomatic agreements. Due to ineffective U.S. action, North Korea was able to develop its nuclear weapons program (though of questionable reliability), which presents a potential security threat to U.S. interests in Northeast Asia as well as the possibility of nuclear weapons proliferation to rogue states or other third parties. From analysis of past U.S. policy toward North Korea and their consequences, multilateral diplomacy through the framework of the Six Party Talks, specifically in coordination with China, is the most practical and effective means for the U.S. to achieve North Korean nuclear disarmament and ultimately, greater regional stability.

Evolutionary Locomotion

Benjamin Humphreys
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Imagine if we had a robot whose structural nature allows it to easily be compressed, stored, and naturally reverts back to its original state when released. These traits may lead to interesting uses: the robot can be thrown over walls, dropped out of planes,

and stepped on, and it will naturally re-form once the abuse ends.

One technology which allows for these properties already exists: tensegrity structures are highly durable, malleable, and self-supporting structures created using struts, strings and springs. These structures maintain their shape via stressed equilibriums imposed by spring tension and strut compression [1]. Tensegrities are inherently dynamic; they want to move and naturally react to outside forces and stresses. However, no one has successfully created a complex tensegrity structure that moves dynamically.

Traditional engineering approaches suppress the natural motion of dynamic couplings. Dynamic couplings tend to produce unpredictable results that can severely alter operations [2]. Every section of tensegrity structures are dynamically coupled with every other section of the structure. Whenever an outside force is appled to any section of the structure, every other section will react. However, instead of suppressing the inherent dynamics to produce a quasi-static gait, we wish to exploit the dynamism of tensegrity structures to produce a highly dynamic and resonant gait. In other words, we will work with the natural motions of tensegrities instead of suppressing them before we attempt to achieve locomotion. Yet again we find that the problem is too complex to be solved by conventional engineering methods.

The final goal of this project is to generate a genetic algorithm which can discover a method of locomotion for a complex tensegrity structure, which has never been successfully implemented by use of traditional engineering methods. The complexity of the inherent dynamics of large tensegrity structures makes it impossible to generate useful results in simulation. Genetic algorithms exploit anything that can lead to better performance. The algorithms tend to take advantage of properties of the simulator that do not exist in reality, when simulating a problem with intricate dynamic couplings. This means that our only option to perform the embodied evolution on a physical robot.

Inside an Adirondack Arts Organization: The Depot Theatre, Westport, N.Y.

Katherine B. Imboden
Professor David Howson, Arthur Zankel Director of Arts Administration, Skidmore College

What is it really like to work inside a 33 year old professional theatre company in the heart of the Adirondacks? Kate Imboden and David Howson explore a variety of areas to learn what it really takes for this non-profit arts organization to survive year after year in this small rural community. By living and working side-by-side with the theater staff, their research aims to answer the following questions: Who are the stakeholders of the organization? What programs do they offer their community? What resources do they depend on for survival? By examining the theater's

organizational structure, board dynamics, artistic programming, operations, marketing and fundraising, they will gain rare perspective from within the organization.

Preparation and Characterization of Alumina-Based Aerogels for Applications in Green Automotive Catalysis

Stephen J. Juhl, Nicholas J. H. Dunn
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Aerogels are sol-gel materials that have unusually low densities and high surface areas. These properties render aerogels appealing for a variety of potential applications, including automotive catalysis. Aerogel catalyst materials have the potential to be produced via significantly greener processes than are used in the current catalytic converter technology. In this work, alumina and nickel-alumina aerogels were produced using an epoxide-assisted mechanism, followed by rapid supercritical extraction in a contained mold in a hydraulic hot press. Alumina sol gels were prepared by reacting an ethanol solution of aluminum chloride with propylene oxide, followed by solvent exchanges with ethanol and extraction in the hot press. Nickel-alumina (Ni-Al) aerogels were prepared by first making an alumina sol gel, then introducing nickel during one or more solvent exchange steps, before processing in the hot press. These aerogels were characterized by a battery of tests, including infrared spectroscopy (IR), crude bulk density measurements, helium pycnometry, BET surface area and BJH pore size distribution analysis, scanning electron microscopy (SEM), and energy-dispersive x-ray spectroscopy (EDX). These materials have physical properties that show promise for catalysis applications. Typical alumina aerogels have bulk densities of 0.044 g/mL, skeletal densities of 2 g/mL, surface areas above 670 m2/g and 25-nm average pore diameter. The nickel-alumina aerogels have bulk densities of 0.065 g/mL, skeletal densities of 2.3 g/mL, surface areas of 600 m2/g and 25-nm average pore diameter. EDX analysis shows that the nickel, aluminum and oxygen are co-located within the Ni-Al aerogel material. The somewhat higher bulk and skeletal densities and somewhat lower surface area are to be expected for the materials impregnated with nickel.

Excruciating or Liberating?: Gender and Company-Sponsored Sports in the Post-War US and UK

Tara E. Keough
Professor Karen W. Mahar, Ph.D., History & American Studies Departments, Siena College

This research is part of a larger project being undertaken by the faculty mentor on gender and corporate culture in the mid-20th century in the United States and Britain. The premise is that here, in the mid-twentieth century, normative ideals

regarding who can and should do higher-level white-collar work hardened. Corporate work culture in the 20th century was partly shaped by the methods of welfare capitalism. In the early 20th century, when unions and varieties of radicalism were increasingly powerful, companies on both sides of the Atlantic engaged in welfare capitalism. To keep workers from being attracted to unions, they improved physical conditions, such as rest rooms and cafeterias, and sponsored a range of recreational activities from retirement parties to sporting leagues. Sports became so important after World War II that it was estimated that American corporations spent more on sporting equipment than all the schools in the United States combined. This paper will consider how women's participation in company-sponsored sports reflected or challenged assumptions about women in the workforce. Women, for example, were expected to be physically weaker and baffled by technology, but enjoyed greater fine dexterity and had endurance for tedious tasks. Our evidence points both ways. In some settings, women's participation in sports was a mockery; in others, their achievements were taken seriously as a point of company pride. Did women's participation in sports further define them as inferior in the workplace, or did it offer a way to challenge assumptions about women under the purview of their co-workers and employers?

Kerouac's Sincere Pursuit of Authenticity in *On The Road*

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The purpose of this research paper is to determine whether Jack Kerouac achieves authenticity in *On The Road*. In addition to the novel, I read a selection of Kerouac's letters to friends and family in order to equate his narration as Sal Paradise to his real life voice and experience. To define authenticity, I referred to Lionel Trilling's *Sincerity and Authenticity*. This text allowed me a measure to determine whether Kerouac, in writing *On The Road*, acted on what he actually is and created something genuine from an undisputed origin. By researching the Beat Generation, I discovered that the Beats revered the authenticity of black otherness that jazz music embodied in the 1950s. Norman Mailer's *The White Negro* provided me with insight into the black experience of the time. Kerouac and Sal both believed that by adopting black music, they were adopting black otherness as well. They glorified the downtrodden, outcast and oppressed, romanticizing otherness without truly understanding its origins. Kerouac does not achieve authenticity in *On The Road* because he attempts to appropriate the authenticity of others by writing about them. Sal's outsider mentality can never be as genuine as the outsider mentality that comes from being oppressed and pushed to the outside of society for an entire lifetime. Both Kerouac and Sal misrepresent themselves when they adopt the lifestyle of otherness, so they cannot be authentic in their writing. They live lives of outsiders

by choice, a choice that a real outsider does not have. Despite Kerouac's failed attempt at authenticity in *On The Road*, the novel retains value due to the sincerity with which Kerouac seeks authenticity. The story is valuable due to Sal's eager desire to understand and experience the world and Kerouac's sincere pursuit of authenticity.

Use of Cell-Permeable Variants of Trehalose for the Cryopreservation of Mammalian Cells

Danielle M. Krieg
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The ability to store live mammalian cells, such as red blood cells or human stem cells, is important for the success of many research and clinical ventures. Many of these cells, however, are fragile and have a short storage shelf life at ambient temperature or in the refrigerator. Furthermore, the best available storage techniques, including freezing or drying, often kill a large number of these cells. Effective preservation of mammalian cells therefore must include methods that allow these cells to survive the freezing or drying steps. Traditional storage methods employ the use of cryoprotectants, which are generally cytotoxic and decrease cell viability when used at high concentrations, thus defeating the purpose of preservation. One promising new approach is to incorporate naturally occurring sugars, such as trehalose (Tre), into mammalian cells to prevent cell damage after cryopreservation. Unfortunately, mammalian cells do not naturally produce Tre, and cellular membranes are impermeable to hydrophilic sugars like Tre. To circumvent this difficulty, we have developed a pro-drug methodology to introduce Tre intracellularly. We are chemically synthesizing cell-permeable variants of Tre and assessing the ability of these Tre variants to protect mammalian cells from damage during cryopreservation. Currently, we are synthesizing one cell-permeable derivative of Tre. We are also evaluating the ability of another cell-permeable Tre variant to protect Jurkat cells from damage during freezing. Ultimately, our research will be used to protect mammlian cells during the freezing process, thus enabling cells to be stored for long periods of time with little reduction in viability.

Lolita-Chan in Taiko Land

Amanda L. Laven
Professor Jennifer Matsue, Department of Music, Union College

"Lolita-Chan in Taiko Land" rhythmically and visually explores the movement from traditional to modern Japan. Since the mid 1800s, outside influences, including the West, have been affecting the modernization of many aspects of Japanese life. Japan has integrated these foreign concepts without obscuring its cultural identity. Both *taiko* and Lolita fashion demonstrate this adaptability.

This composition is loosely structured in well-known *jo-ha-kyu* form.
The *jo* movement features a rhythm with accented offbeats, which creates an uneven feel reminiscent of traditional Japanese music. It is performed on the *chu-daiko*, a medium-sid barrel drum. The *ha* movement also features a Japanese-sounding rhythm on the *chu-daiko*, this time contrasted with a more Western rhythm featuring strong on-the-beat accents played on the *shime-daiko*, a small rope-tension drum.
The *kyu* movement incorporates rhythmic motives from both previous movements, gradually building to the conclusion of the piece.

The first movement is performed in *yukata*, a light summer kimono. Though *taiko* is rarely played in kimono, it is the article of clothing most associated with traditional Japan. The second movement is played in a handmade "Wa Lolita" (kimono Lolita) dress, which combines the long, wide sleeves and *obi* of kimono with the bell-shaped skirt of Lolita style clothing, a fashion that draws inspiration from Victorian clothing. The final movement features a handmade skirt with bows, ribbons, and frills characteristic of the "sweet" Lolita style, which emphasizes cuteness.

"Lolita Chan in Taiko Land" aims to demonstrate the way Japan has been able to incorporate outside influences in its modernization process without losing its identity. Many aspects of Japanese life have absorbed Western cultural concepts while remaining distinctively Japanese. *Taiko* and Lolita fashion combine in this performance to demonstrate that despite the movement from traditional Japan to globally conscious modern Japan, Japanese culture remains unique.

The Adaptive Significance of Female Mating Preferences in the Common Yellowthroat: Oxidative Stress, Sexual Ornamentation, and Offspring Quality

Katherine A. Littrell
Professor Corey R. Freeman-Gallant, Biology Department, Skidmore College

Female preference for male secondary sexual traits is adaptive if choosy females realize higher reproductive success than females who mate at random with respect to male traits. In common yellowthroats (*Geothlypis trichas*), males possess two plumage ornaments a scmelanin-based black facial mask important in male-male competition and a carotenoid-based yellow bib targeted by female choice. By preferring males with bright bibs, females select males with low oxidative stress and high survivorship. It is not clear, however, whether these preferred males increase female reproductive success by siring high quality young. In a three-year study, we used single cell gel electrophoresis to quantify the amount of oxidative damage to DNA sustained by 174 nestlings produced by 42 males. In preliminary analysis, oxidative damage was related to sampling date (timing of breeding) and brood size, but not to nestling gender. After controlling for sampling date and brood size in multivariate analysis, the offspring sired by bright males showed significantly less

oxidative damage to DNA than the offspring sired by dull males, suggesting that the females' preference for elaborate males is adaptive.

Amplification and Expression of a Putative Metacaspase from the Fungus Schizophyllum Commune

Ethan B. Loew, Kristin M. Fox, Zeliang Zheng
Professor Kristin M. Fox, Department of Chemistry, Union College

In animals, cysteine proteases called caspases are known to induce a form of programmed cell death called apoptosis. Recently, a family of enzymes has been discovered in plants and fungi that are homologous to caspases. Termed metacaspases, they share a cysteine-histidine catalytic dyad in their active site. However, caspases and metacaspases have different substrate specificity – caspases cleave after aspartic acid and metacaspases cleave after arginine/lysine. Like caspases, plant metacaspases are activated via cleavage into two subunits, called p10 and p20.

To learn more about the role of metacaspases, we are interested in expressing scp3, one of five putative metacaspases from the fungus Schizophyllum commune. Previous work in our lab has shown that the metacaspases are difficult to express in Escherichia coli. Of the 5 metacaspases in S. commune, three do not express protein at all when cloned into E. coli, and the one that does express (scp3) is found almost entirely in insoluble inclusion bodies. Because of similar difficulties with expression of active caspases, most are expressed as the individual p10 and p20 subunits, and then unfolded, combined, and refolded to produce active protein. To test this method with metacaspases, the p10 and p20 subunits of scp3 were amplified individually using polymerase chain reaction and cloned into pGEM® T-Easy (Promega). The p10 and p20 subunits were then subcloned into the expression vector pQE-80L (Qiagen) and expression was induced in E. coli M15 cells. The p20 subunit was successfully expressed, and work continues with the p10 subunit. Once both are successfully expressed, the cellular location will be examined and folding experiments completed.

Construction of PMMA Microfluidic Devices

Leland Martin
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Microfluidic devices can run chemical tests faster, are small and compact, and only require trace amounts of the liquid sample. Our goal is to be able to produce a chip made from PMMA, or Plexiglas material, which is cheap enough for use in underdeveloped countries. Using a CO2 laser etcher, we cut out micro-scale channels to control the fluid flow. The PMMA pieces are cleaned and fused through heat and pressure to make a whole chip. We then coat these channels with polyelectrolyte multilayers (PEMs) to see if PEMs can serve as a universal chip coating for all

materials used to make microfluidic devices. We measure the electroosmotic flow of these channels by placing positively charged ions at one end and seeing how long they take to flow to the other end when a current is applied through the channel. Repeated testing will give us a picture of how long these layers will last.

Starbursts Versus Stripping: Where is the Gas in Groups of Galaxies?
Christopher M. McGowan, Adina C. Micula, and Lyle A. Reed
Professor Mary Crone Odekon, Department of Physics, Skidmore College

Galaxies are often categorized as "early type" (elliptical in shape) or "late type" (spiral or disk-like in shape, like our own galaxy). A major problem in the study of galaxy formation is understanding the origin of these types. Previous studies have shown that late type galaxies have much more gas and tend to exist in more isolated environments early type galaxies. Therefore, it appears that the fate of loose gas is important in explaining the evolution of galaxies, and that the physical process causing the loss of gas in a galaxy is linked with its local environment. As part of a larger collaboration, we are testing the hypothesis that cool gas is missing in groups of galaxies because it has turned into stars, as opposed to being stripped out of the galaxies by tidal forces or a hot intragroup plasma. To do this, we are examining the properties of galaxies that have been observed using the Sloan Digital Sky Survey (SDSS), the ALFALFA radio survey, and the Spitzer Space Telescope. This combined data set allows us to estimate the amount of "missing" loose gas, the mass in stars, the total mass, and the current star formation rate in each galaxy. As part of this project, our team at Skidmore recently developed a procedure and accompanying Interactive Data Language (IDL) application to scan known or suspected groups of galaxies. The application reads from the Arecibo General Catalog, automatically queries the online SDSS catalog, selects galaxies for group membership, and calculates the local density near each galaxy.

Abundance of Invasive Plants in Hamilton College Forests
Dilyana Mihaylova '12, Daniel Feinberg '12, Bethany O'Meara '12, Ana Fernandez '13, Matthew Combs'13,
Professor William Pfitsch, Department of Biology, Hamilton

Invasive species are introduced organisms that can thrive in non-native ecosystems and have the potential to cause environmental and economic damage or threaten human health. This project determined for the first time the abundance of five invasive plant species, *Alliaria petiolata* (garlic mustard), *Lonicera japonica* (Japanese honeysuckle), *Rhamnus cathartica* (common buckthorn), *Berberis thunbergii* (barberry), *Rosa multiflora* (multiflora rose), as well as of one native

species, *Allium tricoccum* (wild leek flower), in the forests of Hamilton College in Clinton, New York. We used transect sampling in seven different locations to assign abundance categories for each of the six species in five by ten meter plots. Bar graphs created with Microsoft Excel showed the occurrence frequency of each category for every invasive and for every sampling site.

Overall, *Alliaria petiolata* was associated with the highest frequencies of the intermediate abundance classes ("few individuals" or "common") in all transects. However, only three locations had greatest occurrence of the highest category ("infestation") for garlic mustard. *Lonicera japonica*, *Rosa multiflora* and *Allium tricoccum* each exhibited the highest frequency of infestations in one transect. The "not present" category occurred most frequently for *Berberis thunbergii* in three of the sampling locations, for *Rosa multiflora* and *Allium tricoccum* in two sites and for *Rhamnus cathartica* in one. In addition, chi-square statistical analysis indicated significant difference ($p < 0.05$) in the distribution of the five invasive species within all transects as well as in the distribution of each of the species across the different sampling locations. These results imply that garlic mustard is highly adaptable and most successful in spreading over as well as infesting a diverse range of foreign habitats. Honey suckle, multiflora rose and wild leek flower are likely to form infestations in certain forest areas but appear to be less adaptable to a variety of environments. The other two species that we studied, barberry and buckthorn, seem to be the least abundant in the glens of Hamilton College.

Future research based on our study will examine the characteristics and mechanisms that allow garlic mustard and the other four invasive species to replace native vegetation as well as the impacts of these introduced plants on the forest ecosystem at Hamilton College.

Expression and Purification of Channelrhodopsin-2 Protein in *Pichia Pastoris*

Daniel L. Moss
Professors Patricia Hilleren, Brandy Sreenilayam, Departments of Neuroscience, Biology and Chemistry, Skidmore College

Optogenetics is a tool used by molecular biologists and neuroscientists to study the functions of neurons and neural circuits within the nervous systems of several model organisms. The method utilizes genes for light activated ion channels, known as channelrhodopsins, from the green algae *Chlamydomonas reinhardtii*. Channelrhodopsin proteins are nonspecific light activated ion channels and are permeable to positive ions, like sodium. Their properties allow them to depolarize neurons, causing them to activate neural pathways and elicit specific behaviors. Therefore these proteins are excellent candidates for genetic engineering to improve and impart desirable traits. However, there are no x-ray crystal structure data for

channelrhodopsin proteins, which are essential for engineering. The current study aims to purify channelrhodopsin-2 expressed in *Pichia pastoris*, a methylotrophic yeast, using a plasmid vector containing the gene for channelrhodopsin-2. Once purified attempts can be made to crystallize the protein and solve its structure using x-ray crystallographic techniques.

The Effects of Aging and Isoform Specific AKT Ablation on Insulin Sensitivity and Atrophy-Related Gene Expression

Lily Ng
Professor T.H. Reynolds, Department of Health and Exercise Sciences, Skidmore College,

AKT1 and AKT2 are signaling molecules that control muscle mass and insulin sensitivity. Because aging is associated with muscle atrophy and insulin resistance, we decided to examine insulin action and atrophy related gene expression in young (YG), aged (AG), AG-AKT1 and AG-AKT2 knockout mice. Glucose tolerance tests showed that insulin sensitivity was higher YG and AG-AKT1KO mice compared to AG and AG-AKT2KO mice. Gabarapl, Bnip3, and STARS, three atrophy related genes increased significantly in muscles of AG-AKT1KO and AG-AKT2KO mice compared to YG and AG mice. Taken together, these findings show that changes in atrophy related gene expression are not associated with insulin sensitivity.

Nup53, Nup59, and Mlps Are Necessary for Efficient Nuclear Protein Export.

Tinashe E Nyanhete
Professor Kenneth Belanger, Biology Department, Colgate University

Nuclear pore complexes (NPC) regulate the movement of RNAs and proteins between the nucleus and cytoplasm of eukaryotic cells. NPCs are composed of more than 30 different proteins called nucleoporins (Nups), some of which function directly in nucleocytoplasmic transport. However, exactly which Nups are responsible for transporting which substrate is unclear. Mlps are a type of Nup protein essential for the nuclear export of mRNAs, while FG-nucleoporins (FG-Nups) interact with transporter proteins to shuttle proteins and some RNAs in and out of the nucleus. We have undertaken experiments to investigate: (1) which FG-Nups are responsible for efficient protein export from the nucleus and (2) whether Mlps are required for nuclear export of proteins in addition to mRNAs. In our experiments, we transformed Crz1-GFP, a transcription factor tagged with GFP, into yeast cells that lacked either Mlps or specific FG-Nups. We allowed Crz1-GFP to accumulate in the nucleus, and then stimulated Crz1 export to the cytoplasm using the drug FK506. We observed the movement of Crz1-GFP after FK506 addition using fluorescence microscopy and recorded the number of cells exhibiting nuclear or cytoplasmic localization of Crz1-GFP in a 20minute period. Our results reveal that the export rate for cells lacking a

single Mlp were slower as compared to the wild-type cells, while a double mlp mutation resulted in an increased export rate. The Nups tested were Nup53 and Nup59. A loss of either resulted in a decreased export rate as compared to wild-type cells. The collected data showed that Nup53 and Nup59 are important for efficient nuclear export of Crz1-GFP and Mlps also take part in the export of proteins in addition to mRNAs. We are currently working on a new rapamycin-induced export assay that uses a small molecule-directed approach to control protein localization and examine nuclear export kinetics.

Investigation of the Binding of Perfluoroalkyl Acids to Human Serum Albumin Through 19F Nuclear Magnetic Resonance and Fluorescence Spectroscopy

Megan P. O'Connor and Laura A. MacManus-Spencer
Professor Laura A. MacManus-Spencer, Department of Chemistry, Union College

Perfluoroalkyl Acids (PFAAs) are used in the manufacture of a wide variety of consumer and household products, and their presence in the environment is a growing environmental and toxicological concern. PFAAs have been shown to bioaccumulate in the liver and blood stream of many organisms, as well as competing with endogenous ligands when binding to proteins. In this study, the binding of PFAAs to human serum albumin (HSA) over a range of pH values 6 to 9 and ionic strength values ranging from 0.2 to 0.5 M was investigated using two experimental approaches. Fluorescence spectroscopy and 19F nuclear magnetic resonance (19F NMR) spectroscopy were used to qualitatively and quantitatively describe the binding of PFAAs with varying chain length and ionic head group to HSA as a function of pH and ionic strength.19F NMR experiments were used to probe the binding of PFAAs to HSA by using the distinct signal arising from the fluorocarbon tails of the PFAAs. Fluorescence spectroscopy was used to monitor the native fluorescence of HSA as a function of PFAA binding, monitoring conformational changes in the protein and subsequent changes in the fluorescence spectrum. Fluorescence results indicate that ionic strength (over a physiologically relevant range) has little effect on the binding, while pH has a greater effect. Estimated binding constants from these studies are on the order of 104 M-1, varying with fluorocarbon chain length, ionic head group, and pH. The results of this study illustrate the relative effectiveness of these two complementary experimental approaches in estimating PFAA-HSA binding constants and contribute to a better understanding of the role of HSA in the bioaccumulation and pharmacokinetics of PFAAs.

Developing Cost-Effective Microfluidic Devices from Transparency Film

Brenda Olivo
Professor Kimberley Frederick, Chemistry Department, Skidmore College

Microfluidic devices are those which allow for the containment, manipulation, and analysis of nano-sized volumes of liquids. Microfluidic devices are often referred to as a "lab-on-a-chip" because of their potential chemical and medical applications. One problem in the use of microfluidic devices is the cost involved in making chips out of reliable materials which can withstand the constraints of testing conditions, such as high driving pressures. We have developed a way to make microfluidic chips from PET, the plastic component in transparency films, using a laser etcher and a laminator. The chips are cut out of sheets of transparency film by a laser etcher and are then heat-sealed using a laminator. Pressure testing is also done on the chips in order to determine the maximum pressure that can be applied within the chips before the lamination seal is broken.

Measurement and Modeling of Real-time Changes in Electroosmotic Flow under Dynamic Buffer Conditions

Aaron Osher
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The use of capillary electrophoresis (CE) as an analytical technique has so far been limited by the irreproducibility of data which is due to uncontrolled changes of the electroosmotic flow (EOF) in the capillary. In an attempt to understand these changes we examine the EOF when the solution in the capillary is exchanged with an almost identical solution, varying only by pH. The laser-based EOF measuring technique as well as the computer algorithms were developed in our lab. As every EOF exchange curve follows the same best fit function we can look at the coefficients of this function and compare them from run to run in an attempt of finding correlations between these variations in pH. This data is then compared to the models of EOF we developed in order to understand the observed behavior. If we can make this connect

Sculpting the Future: Creating Safer Schools by Increasing Teachers' Awareness of Bullying

Sophia Paljevic & Katherine DiFabio
Professor Christina Pfister, Ph. D, Teacher Education Department, College of St. Rose

Bullying is a prevalent issue in schools and, as pre-service teachers, we wanted to focus on middle school and the teachers that are faced with handling issues of bullying. Our research question was: How do staff members at one middle school define and perceive bullying and anti-bullying techniques in their school? The purpose of our research is to inform other educators and pre-service teachers about the different perceptions held by teachers regarding bullying and possible techniques that can be used when a bullying issue between students occurs. Although teachers know that bullying is occurring, there is little research that explains the teachers' perceptions of bullying and most of the current research is from the perspective of

students so we are adding to the knowledge base by asking teachers about their perceptions. We surveyed nine middle school teachers and asked what their definition of bullying is and how they handle situations of bullying. Some questions were open-ended and were analyzed qualitatively and other questions were on a closed scale and are reported in percentages of people responding. Results indicate that when considering their own school setting, teachers primarily understand bullying in two important ways. First, they define bullying as physical or emotional torment inflicted by one student on another. Secondly, they report that they believe bullying happens primarily (a) during the school day (rather than after school), and (b) it happens at non-instructional times such as lunch. When asked what type of anti-bullying techniques they replied with multiple ideas and actions they have used. One can conclude that the type of bullying and the location of the bullying effect how the teacher handles the situation. This is important for teachers and pre-service teachers because when they are well versed in handling bullying they can create a safe environment within the school.

Exoplanet Transit Observations at the Union College Observatory

Vaishali Parkash and Tokuei Higashino
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Modern studies of exoplanets generally rely on indirect detection methods. The transit method is an established detection method for exoplanets that permits determination of planet size and orbital inclination. Our aim was to characterize exoplanet properties by observing transits of known exoplanets. We used the telescope in the Union College Observatory and the attached CCD camera to take images of five stars known to have transiting planets. After image processing and photometry we confirmed several transits. For the the complete transit observation of WASP-3b on July 5, 2011, we obtained high quality data showing the characteristic inverted top-hat light profile. We computed 24 models of the system light curve using the program BinaryMaker. The best fit model is in good agreement with system parameters given by Pollocco et al. (2008).

Dirt Poor Or Rich With Nutrients? Soil Quality and Leaf Decomposition in Skidmore's North Woods

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Trees supply nitrogen and phosphorus to the soil when their leaves fall to the ground. In return, the soil provides these nutrients back to the roots of the trees. We examined the soil quality (organic matter content, nutrient concentrations, pH) and its

relationship to leaf decomposition rates in the North Woods. One square foot of leaf litter and two soil samples from below the leaves were taken from 60 randomly chosen locations within a predetermined grid. Decomposition was measured by determining the percent mass remaining from November to July. These data will be used to examine the relationship between leaf decomposition rates and soil quality in the context of land-use history of North Woods.

Calendar-Year Dating of Pre-Historic Hurricanes in Yucatan, Mexico Using Fluorescence Micro-Imaging of an Annually-Layered Stalagmite

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Hurricanes and tropical cyclones are among the most costly natural hazards and present significant risks to costal communities. Climate change may amplify the current risks by impacting the intensity, frequency, or tracks of tropical cyclones. However, hurricane-climate interactions are poorly understood. Stalagmites that are sensitive to environmental changes throughout their growth have the potential to provide an accurate and extensive record of past hurricanes, as well as the climatic conditions in which they were formed. Stalagmite CH-1, collected from a cave in Yucatan, Mexico, has established mud layers that record individual hurricane flooding events and can be used as a proxy for hurricanes over the last 2300 years. Epi-fluoresence imaging microcopy was used to obtain high resolution dating of CH-1 with calendar year precision. These images were analyzed to determine the calendar year of mud-layer deposition, which corresponds to hurricane flooding inside the cave. When the stalagmite dating is complete, the results will be compared to regional paelohurricane data and aid in assessing the long-term risks of hurricane strikes in Yucatan. The detection of paleohurricane events using stalagmite mud layers will contribute to an international effort to uncover long-term records of land falling hurricanes. The long-term objective of this research is to test theoretical and modeling predictions relevant to projecting the changing character of hurricane risk and hurricane-climate interactions.

Novel Application of Cerium Nanoparticles in the Treatment of Multiple Sclerosis

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There is clear evidence that oxidative stress is an important factor in the onset and progression of multiple sclerosis. Oxidative stress is caused by the accumulation of reactive oxygen species (ROS), which destabilize and destroy constituents of the cell. Nanoceria is capable of scavenging a wide array of biologically important free

radicals, suggesting it may have therapeutic value. It is the goal of the present study to test if cerium nanoparticles have the potential to reduce oxidative damage in a model of chronic progressive multiple sclerosis (MS) and relapse remitting multiple sclerosis. Multiple sclerosis was modeled in mouse subjects through the induction of Experimental Autoimmune Encephalitis (EAE), which mimics the key symptoms of MS. In each model, there were three treatment groups; preventative, delayed suppression, and control. Mice received injections of nanoceria according to dosing schedule, and were tested daily on the rotarod, hanging wire, and balance beam. These behavioral tests are commonly used to asses balance and strength in the hind limbs and forelimbs of the mouse.

We have found that in the relapse remitting model of multiple sclerosis, treatment with nanoceria does significantly increase performance in behavioral tests. This speaks to the potential of cerium nanoparticles as radical scavengers, and suggests that nanoceria may be a potential treatment for other illnesses in which radical oxygen species are central to disease progression. Next, we will be testing the effect of cerium nanoparticles on a mouse model of chronic progressive multiple sclerosis.

Ecology of Roadside Mosses

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The myriad of ways that humans have influenced the earth is wide ranging and affect all organisms, including moss. With 6.3 million km of public roads in the United States, roughly 1% of the land surface is directly impacted by the presence of roads. Few species of plants are capable of living in such highly disturbed areas that are found at the edge of a road, yet mosses represent a significant percentage of roadside species. Mosses are tiny non-vascular plants that can easily be found virtually everywhere, if you know what to look for. Due to their small size and the lack of a protective layer covering their leaves, mosses are incredibly sensitive to local environmental factors.

The purpose of this study is to determine the underlying casual effects about which roadside moss species grow where and why, focusing specifically on distance from the road, ground cover, and soil chemistry. To accomplish this I have collected data in Northern New York, Central Vermont, and Central New Hampshire. Throughout these three states I have sampled in 24 different locations, running a total of 72 transects with four sites up to 8 m away from the road edge. Through preliminary analysis of the data it is evident that total percent of ground cover for moss is higher at sites located farther away from a road. It is expected that this trend will also be evident for specific species of moss, splitting those that grow on more disturbed soils versus less disturbed soils found farther from the road edge. It is also expected that

the underlying soil chemistry will reveal further correlations, relating to the microhabitat of certain moss species.

A Model for Fetal Alcohol Spectrum Disorder in Zebrafish
Andrew Ross, Aaron Beck
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Fetal Alcohol Spectrum Disorder (FASD) encompasses the physical, behavioral and cognitive deficits exhibited in a child after alcoholic consumption during pregnancy. Due to similarities to the human nervous system, zebrafish are used as a model organism to elucidate the anatomical and molecular mechanisms of ethanol (EtOH) during embryonic development. At 3-4 hours post fertilization (hpf), embryos are collected and treated in a solution of EtOH. A control group develops in a non-EtOH solution simultaneously. At 24-36 hpf, the transparent embryos are labeled to visualize neurons and their projections under a fluorescent microscope. Neurons responsible for movement (motoneurons) and cognitive function (commissural neurons) are specifically disrupted in EtOH treated embryos, suggesting EtOH affects the guidance of neurons during embryonic development.

The Generational Constitution
Matt Rothenberg
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The project is based on the famous debate between Madison and Jefferson over the value of an enduring constitution. The two exchanged a series of letters while Jefferson was in Paris on the topic of whether each generation should scrap its existing Constitution, convene a new constitutional convention, and write an entirely new constitutional draft. Jefferson thought each generation (which he pegged at every 19 years) has a right to its own constitution. Madison, in contrast, thought that constitutions should endure over long periods of time to build up the necessary reverence to make them effective.

We know that Madison won that debate (our Constitution is now 224 years old), but what if Jefferson had prevailed? What if Americans scrapped their constitutions and allowed each generation to write its own? Our project is simple: we plan to imagine what those constitutions throughout American history would have looked like if Jefferson had won the debate. The project will culminate in us imagining a return to Philadelphia to draft a new constitution for the twenty-first century.

The unique bipolar mechanism of cell expansion in the unicellular green alga, *Penium margaritaceum*
Carly Sacks and Hannah Brechka

Professor David Domozych, Department of Biology and Skidmore Microscopy Imaging Center, Skidmore College

The green alga *Penium margaritaceum* serves as a valuable model organism for exploring anisotropic growth in plant cells because it is unicellular and has a cell wall constituency remarkably similarity to land plants. A major focal point of cell expansion is a central zone or isthmus, where new cellulose is produced, followed by secretion and synthesis of a calcium-complexed pectin lattice to form rigid outer wall. Moreover, Penium's endomembrane system consists of 100-150 Golgi bodies per cell, which are organized in a symmetrical network. The Golgi and Golgi-derived vesicles produce and carry various cell wall and EPS components to the cell surface via a poorly understood secretory mechanism. In this study, we measured the effects of cytochalasins and brefeldin A on the cell wall expansion mechanism and cytokinesis. We demonstrate that cell plate formation and cell expansion in this alga depends on the availability of a supply of wall precursor-carrying Golgi vesicles and an active actin-mediated cyclosis.

Women's Work: Examining the Indispensable Role of the Women of the Chipko Movement and the Niger Delta Protests in Combating Environmental Destruction

Fatima Sall
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The planet Earth today is faced with a plethora of challenges and issues that not only questions its future existence but also the future existence of all life form. A great majority of the issues faced, including climate change, deforestation, unprecedented carbon emissions, and decreased biodiversity, are the adverse effects of human activities, mostly for commercial purposes. And while they have had the least impact in creating these problems, people who exist in the periphery of the global market system bear the brunt of the current ecological crisis. Women, in particular, are the most affected by negative changes to the environment for reasons that can be explained using eco-feminist perspectives. From my analysis of two independent movements, the Chipko Movement of India and the Niger Delta Protests in Nigeria, heavily influenced by the presence and participation of women, I argue that the role the women of these movements play in preventing and/or correcting environmental issues that directly affect them and their livelihoods, has to potential to transform environmental policy, if their methods and ideologies are incorporated. I open this paper with an overview of the fundamental theories used for my argument: eco-feminism and David Harvey's theory of "accumulation by dispossession" under neo-liberalist ideals. I continue on with an in-depth analysis of each case study, with great

focus on agitating factors that prompted these women to take action and how eco-feminist perspectives and David Harvey's theory could be applied. Finally, to conclude, I give notice to analyze any possible connections in the methods of each movement to identify any characteristic that contribute to a movement's success in bringing about positive environmental change and how this can be utilized when addressing pressing environmental concerns to solve the ever-worsening state of environmental destruction on Earth.

Are Two Spaces Better Than One? The Effect of Spacing Following Periods and Commas During Reading

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There has been much debate on the topic of how many spaces should follow a punctuation mark at the end of a sentence. Many have argued that two spaces enhance the readability of a text, while others have argued that one space is more aesthetically pleasing. The most recent edition of the American Psychological Association (APA) Manual states that two spaces should follow the punctuation. This is in contrast to the one-space requirement from previous editions. However, to date, there has been no empirical support for either spacing convention. In the current study, participants performed (1) a typing task to assess spacing usage and (2) an eye-tracking experiment to assess the effects of spacing following punctuation on comprehension and reading performance. Participants read paragraphs that included either one or two spaces following periods and commas, for a total of four conditions. Although comprehension was not affected by punctuation spacing, reading times were shorter when the period was followed by two spaces, rather than only one, supporting the change made to the APA Manual. Additionally, local measures indicated that having two spaces following the comma facilitated reading. Individuals' typing usage also influenced these effects such that those who use two spaces following a period showed the greatest facilitation from reading in this condition and if anything those who use one space following a period show greatest facilitation in the one-space condition. The facilitating effects of two spaces may be attributed to an increase in ease of isolation of processing units or possibly a decrease in lateral interference.

Investigation of Laser Light in Color Reversal in Art Restoration

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When exposed to atmospheric pollutants - specifically hydro sulfur gas - lead white paint (basic lead carbonate), undergoes a chemical reaction to produce lead sulfide. This change in chemical composition causes the white pigment to appear black,

resulting in a loss of historical information. Currently, hydrogen peroxide is applied to the painting to undo this effect; however, using a liquid formula is imprecise and could bleed into neighboring areas. We investigated the use of laser light to effectively reverse this color change, transforming the black lead sulfide to lead sulfate, a white, stable compound.

We examined swatches of lead white paint exposed to hydro sulfur gas in April '09. We determined that at the radii of each of the lased spots, there was a threshold intensity at which the lead sulfide reacted to form lead sulfate. This affirmed that the reaction induced was purely photochemical. This threshold intensity varied by wavelength, as expected. We then mixed our own lead white paint, applied it to swatches, and exposed it to hydro sulfur gas, hoping to reproduce the results. However, the results found for the swatches prepared in April '09 were not repeatable. For our swatches, much higher intensities were needed to produce similar results. Also, when reintroduced to hydro sulfur gas, our lased spots blackened again, proving the reaction induced did not produce lead sulfate. Raman spectroscopy showed that the lead sulfide was instead transformed into a lead oxide.

Our inconsistent results showed that there might have been some dependence upon the thickness of the paint or the material to which the paint was applied. We are hoping to investigate paint thickness dependence using scanning electron microscopy. Further research into the subject is necessary for improvements to be made into the field of art conservation.

Star Formation and Nuclear Activity in the NGC 5846 Group of Galaxies

Wyatt C. Smith
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Star formation in galaxies produces radiation at specific wavelengths – for example the Balmer "Hα" hydrogen recombination line – due to the ionization of gas by ultraviolet photons. However, gas can also be ionized due to shocks from active galactic nuclei (AGNs, or black holes), making the classification of star forming regions by Hα emission alone impossible. Baldwin, Phillips & Terlevich (BPT) diagrams provide a way to compare ratios of several characteristic emission lines, allowing us to differentiate between ionization caused by star formation and by AGNs. I have developed several techniques for comparing and analyzing spectral data from the Sloan Digital Sky Survey (SDSS) and the Arecibo General Catalog (AGC) for the classification of star forming galaxies. With the resulting collated data, I was able to make both spatial distribution plots and BPT diagrams. Here I present my results on star formation versus AGN activity for the NGC 5846 group of galaxies.

Digital Image Source Identification

Adam M Steinberger
Professor Michael Eckmann, Mathematics and Computer Science Department, Skidmore College

Digital images contain information that goes beyond what we see. We wish to determine the source (e.g. camera) of a digital image, based on a set of attributes of the image. Digital cameras do, often proprietary, image processing between the light entering the sensors and the image being compressed and stored. Cameras use color filter arrays where each pixel has just one color (red, green or blue) sensor. Demosaicing is done by the camera to estimate the other two colors from the neighboring sensors. We attempt to create attributes related to the unknown demosaicing algorithm by computing statistics of how pixel colors relate to their neighbors. We create a classifier for a set of cameras from these attributes and report on initial results.

Neology in William Faulkner's *Light in August*

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The purpose of this project is to examine the function that neology, the practice of coining new words, serves within William Faulkner's *Light in August*. *Light in August* contains over 500 different neologisms, which serve to "defamiliarize" the reader with their preconceptions of the world through a unique aesthetic experience that would otherwise be unachievable through the use of standard words (Shklovsky). According to the phenomenological approach to the reading process, the novelty of using a neologism to signify a known or familiar concept forces the reader to pause and process this familiar concept in a new manner, which thereby challenges the reader's a-priori assumptions and preconceptions of the signified. Faulkner's neologisms within *Light In August*affect the reader by serving in three distinct functions. Their primary and most influential function is to subvert the gendered and racial binaries which Southern society was structured by during the late 19th and early 20th centuries. As the reader works to process these novel word coinages founded in the unstable language of binaries, male/female and white/black, the reader's own suppositions regarding those binaries are challenged. *Light in August* juxtaposes the three distinct narrative strands of Joe Christmas, Lena Grove and Gail Hightower. As a secondary function Faulkner's neologisms establish essential traits of these three primary characters throughout the novel, as well as the traits of many other minor characters. Faulkner's neologisms enhance the thematic unity of an otherwise non-linear narrative. The final function of *Light in August's* neologisms is to depict the scenery and landscape of Jefferson in a euphonic and melodic manner, which often

mirrors the emotional state of the characters depicted in that scene. Faulkner's abundant use of neologisms provides an insightful and vivid depiction of Jefferson society and landscape in a unique manner that could not be achieved by the use of a standard word.

Construction and Commissioning of a New Scattering Chamber at the Union College Ion Beam Analysis Laboratory

Colin Turley, Robert Moore, Christopher Johnson
Professors Maria Battaglia, Scott LaBrake, Michael Vineyard, Department of Physics and Astronomy, Union College

We have constructed a new scattering chamber in the Union College Ion Beam Analysis Laboratory to improve our experimental capabilities. The new chamber was constructed from a ten-inch, conflat, multi-way cross. We fitted the chamber with an eight-inch, Leybold turbomolecular pump so that it can be evacuated quickly. A target manipulator with stepper motors that provide x, y, and z-positioning of the target with micron precision is mounted atop the chamber. A target ladder was constructed for the manipulator that allows us to analyze multiple samples without breaking the vacuum. The chamber has a door with an O-ring seal mounted on one of the ten-inch ports that provides easy access to the interior of the chamber. An Amptek silicon-drift X-ray detector is mounted close to the target ladder, inside the vacuum so that low-energy X-rays can be detected. A new Faraday cup was also installed to provide more accurate current measurements. Finally, a new collimator system was developed and installed in the beam-line to the scattering chamber to provide a well-defined beam spot. A proton induced X-ray emission analysis of aerosol samples has been performed as the commissioning experiment for the chamber. Here, we report on the construction and commissioning of this new chamber.

Dual Pathways for Asn-tRNAAsn Formation in *S. aureus* and *B. bacteriovorus*

Brittany Ulrich, Kathryn Stein
Professor Kelly Sheppard, Chemistry Department, Skidmore College

Two routes have evolved for attaching the amino acid asparagine to its correct transfer RNA (tRNAAsn), an essential step in protein synthesis. In one pathway, asparagine is directly ligated to tRNAAsn catalyzed by the enzyme AsnRS. In the other pathway, a non-discriminating AspRS attaches Asp to tRNAAsn and GatCAB then converts Asp to Asn. The human pathogen *Staphylococccus aureus* and the predatory bacterium *Bdellovibrio bacteriovorus* encode the direct route in their genomes (i.e. AsnRS) and may also encode the second route as they code for GatCAB. The question is whether their AspRS is non-discriminating (*i.e.*, attaches Asp to tRNAAsn) or not. We are testing the *S. aureus* and *B. bacteriovorus* AspRS enzymes using *in vitro* and *in vivo*assays.

Progress Towards the Full Synthesis of Botryolide E.

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The purpose of this project was to begin the full synthesis of the natural product Botryolide E. This compound was discovered in a fungicolus fungi *Botryotrichum* and it was determined that it was possibly an antifungal agent. This was determined by using the information of previously known compounds within the fungus, and the fact that fungicolus species colonize and kill other fungi. The group that isolated Botryolide E also tested the mixture of all isolated compounds found from the organism, and found that some of the low concentration compounds must be having a significant antifungal effect because the effectiveness of the mix against fungus was more than what was expected from the previously discovered and tested compounds it contained. Because the fungus only makes Botryolide E in small quantity, it requires full synthesis to test, and a full synthesis also gives the opportunity to create similar molecules which could be used as a drug testing library. This synthesis was begun using a simple hydroxy-butyrate compound, which was then protected, reduced, run through a titanium mediated Evan's aldol reaction. This product is the furthest the synthesis made it, as the product seemed inactive to many different protections attempted on it. This research will continue during the upcoming year. During the course of this research another group finished the synthesis of Botryolide E in a convoluted synthesis, and tested it for activity and found it a potent antifungal, and effective antibacterial compound. The objective of this research has switched from being a new synthesis and testing, to a more economical and versatile synthesis, as this is a likely compound to start from when attempting to come up with a new antifungal.

The Design of a Honda Odyssey FL250 Rear Suspension and Drive Train for Rough Terrain

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The Honda 1981- 84 FL 250 Odyssey is a recreational ATV designed to go at higher speeds than the traditional go-kart and 3 wheeler of the early 80's. This model had improved stability and a front suspension; however there is no suspension in the rear where most of the vehicle and passenger weight are located. On rough trails, the Odyssey becomes very difficult to handle at higher speeds due to unstable bouncing. A Double A-Arm independent suspension and drive train has been designed to optimize the performance of this vehicle on rough terrain. The rear suspension was designed through a detailed process including research, concept drawings, sourcing parts and calculations. A Double A-Arm suspension offers great travel characteristics and strength. Concept drawings indicated this suspension style would adapt well to

the original Odyssey frame. After sourcing low cost independent axles, the geometry of the suspension was calculated based on desired travel characteristics. The detailed design of the rear suspension included the arms, arm carriers and mounting brackets. Each component was designed to handle the impact forces of rough trails and a dynamic stress analysis was done to ensure the suspension's strength. The specifications of the shocks were determined for a defined performance and incorporated in the suspension design. The drive train was then designed to accommodate the added rear suspension. A constant variable transmission was chosen for its ability to handle impacts and optimize the engine's power. These improvements provide a more controlled, safer ride on rough terrain. The suspension and drivetrain design will also be fabricated for a final test of the vehicle's improved performance.

Star Formation in the NGC 5846 Group of Galaxies

Lucas S. Viani
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Environmental interactions in groups and clusters of galaxies are thought to alter the evolution of member galaxies. The goal of this research was to analyze gas and star formation properties of galaxies in the NGC 5846 group. A sample of group galaxies was observed at CTIO (Cerro Tololo Inter-American Observatory in Chile) and KPNO (Kitt Peak National Observatory) using broadband red (R) and narrowband hydrogen emission line (Hα) filters. The images were reduced and analyzed to extract star formation rates and distributions. Neutral hydrogen data from the Arecibo Legacy Fast ALFA (ALFALFA) survey was used to measure the cold neutral gas content, which provides the raw material for star formation. The amounts and extents of the star formation regions in sample galaxies are compared as a function of cold gas content, galaxy type, and position in the group and compared to those of galaxies located in other

The Lost Voices of Kenyan Youth

Austin F. Walker
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Sponsor: The Levitt Center at Hamilton College

Like so many critical issues today, the debate over how to approach development in the world's economically impoverished regions has become polarized. While one camp urges the international community to pour billions of dollars in aid, technology and personnel into the developing world, the other calls for an end to overzealous development expenditures. Both camps back up their theories with years of practical experience, the support of noted academics and extensive field research. However, both sides of the debate leave out perhaps the most critical component in the debate: the voices and ideas of farmers, teachers, the unemployed, students and millions of

other individuals who carry out their daily lives in the developing world. In an effort to fill the gap, this research examines both sides of the existing development debate, while simultaneously asking, what solutions and methods Kenyan youth propose to help overcome their greatest challenges. Through the execution and examination of 138 interviews, carried out in four secondary schools in western Kenya, this project explores the solutions Kenyan youth propose to address their challenges as well as the level of involvement that they envision outside organizations playing in the development of their country. Their voices and ideas prove to be not only educated, but also realistic and innovative in ways that outsiders have failed to be. As youth comprise the greatest percent of Kenya's growing population, it is crucial to ensure their voices and ideas are included in the development debate. Most notably, youth have stated a need for youth groups geared towards discussing and seeking solutions to adolescents' challenges and access to advice from individuals who have come from similar backgrounds and succeeded. Perhaps such new and refreshing perspectives can breathe new life into the faltering and polarized area of development academia.

"Her Happiness Would Derive From Her Marriage With The Beast": Defining and Exploring the Subgenre of Animal-Human Transformation Fairy Tale

Jasmine Wallace
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Transformation from animal to human form has ensnared the imaginations of fairy tale writers and readers alike for centuries. A wide variety of tales, ranging from the French "Princess Camion" and "The Serpent and the Grape-Grower's Daughter" to the German "Little Brother and Little Sister" and the Italian "Maestro Lattantio and His Apprentice Dionigi," contain the motif of animal-human transformation. If this motif appears in such varied forms in tales that hail from all corners of the globe, does it possess an overarching meaning and significance? Also, what has lead to the overwhelming popularity of so fanciful and bizarre a motif? To answer these questions, I assembled and read a large collection of fairy tales that contain animal-human transformation and I used these tales to define a new subgenre of fairy tale literature. Based on my research, I divided the subgenre into two main subcategories: parent-induced transformation tales and romantic transformation tales. By analyzing and comparing examples from these subcategories, the broader meaning of the motif and subgenre can be determined. Basic plot structure, a double character development trajectory, similar casts of characters, and the importance of family and love are all defining characteristics of the subgenre. These characteristics come together to catalyze and support the personal development and coming of age that the animal-human transformation represents for the protagonists of each tale. Some fairy tales have grown outdated, particularly those involving children as the transformed victims

of evil stepmothers and witches. However, the ways in which courtship and marriage are conducted in contemporary western society are similar to the patterns depicted in many traditional tales, making this literature not only endearing but also worthy of continued study.

Why do Some Elders Show a Lack of Interest in Health Promotion Programs: The Case of the Albany Neighborhood Naturally Occurring Retirement Community

Simone Westerman
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Over 85% of the elderly want to remain living in their homes as opposed to living with another family member or in a nursing home (Bayer & Harper, 2000), but not all are able to safely do so (Alexander, 2006). Community-based programs, such as the Neighborhood Naturally Occurring Retirement Community(NNORC), have developed to provide the services needed for elders to "age in place" (e.g., case management, recreational programs, community nursing, support groups, and health promotion programs, Pine & Pine, 2002).

Past research has found that only about 25% of elderly residents of the Albany NNORC were interested in attending NNORC-sponsored health promotion programs (Dorr & Pulice, 2010). The purpose of the present study was to examine possible explanations for this relative lack of interest. Specifically, it was hypothesized that individuals who had a strong trust in their primary care physician, an external locus of control, a low sense of well-being, and a negative attitude toward the aging process would be less interested in attending health promotion programs. One hundred forty-four elderly Albany NNORC residents completed a survey designed to measure the aforementioned variables. Results showed that having an external locus of control was the most consistent predictor of reporting less interest in attending NNORC-sponsored health promotion programs. Other results showed that elders with a stronger perception that they had grown psychologically as they have aged were more likely to want to attend healthy lifestyle programs sponsored by the NNORC. No statistically significant correlations were found between scores on the well-being scale and interest in attending health promotion programs, or between reported trust in their primary care physician and interest in attending health promotion programs. Future research should examine ways to decrease seniors' external locus of control and see if this subsequently increases interest in health promotion programs.

Royal Appropriations of the Arthurian Myth at Glastonbury Abbey

Meghan H. Woolley
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This paper analyzes the political purposes of Henry II, Edward I, and Edward III in their involvement with the tomb of King Arthur at Glastonbury Abbey. Examining chronicle accounts of the royal visits to Glastonbury in the context of other evidence of royal appropriations of Arthur, I argue that these three kings used Arthurian legend to weaken the position of their adversaries and to bolster their own authority, political uses that reflect the efforts of a range of English kings to claim King Arthur for their own advantage.

According to Gerald of Wales, Henry II suggested to the abbot of Glastonbury that the monks should search for Arthur's body on their grounds. Although the exhumation was not completed until after Henry's death, the discovery Arthur's body would have been useful to Henry in rebuilding his relationship with the church after the murder of Thomas Becket. It also would have injured the morale of the rebellious Welsh, who were rallying around a legend that the immortal Arthur would return to lead them. Similarly, in 1278 Edward I attended a disinterment of Arthur's body before embarking on a campaign against the Welsh. The visit simultaneously bolstered Edward's morale and weakened the Welsh hope in the prophecy of Arthur's return. Finally, in 1331 Edward III visited Arthur's tomb at Glastonbury. His visit took place two years before he overturned the Treaty of Edinburgh-Northampton, when hostilities with the Scottish were rising, and it weakened Scottish connections to Arthur while strengthening his own.

I argue that these three visits to Glastonbury Abbey are representative of royal appropriations of Arthur between the 12th and 16th centuries as a whole. English kings strove to associate themselves with Arthur to strengthen their own position against domestic insecurities and to weaken foreign competition. Through their visits to Glastonbury Abbey and other appropriations of Arthurian myth, these kings strove to acquire the traits of Arthur himself, those of a strong leader and peerless conqueror.

The purification and crystallization of the LGN protein

Alexander T Zanetti
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The LGN protein is important for cellular division, playing a significant role in cell polarity and alignment of the mitotic spindles. LGN is found in high concentrations in certain cancer cells, and determining the structure may lead to the development of pharmacological treatments to slow the onset or spread. The immediate goal is to develop a purification scheme for LGN, with a long term goal of obtaining a crystal structure(s). For purification, LGN is expressed in *E. coli*, and is purified using various forms of chromatography, separating proteins based on tags, charge, and molecular weight. Purity is measured by running protein gels, followed by staining of all proteins. A Western blot will also be used to ensure that the correct protein has

been purified. The once the protein is found to be at least 95% purified it can then be set up for crystallization, which illustrates the three-dimensional structure of the protein.